Department of Electrical and Electronic Engineering

B.Sc. in Electrical and Electronic Engineering

OBE CURRICULLAM

(Short Version)

Effective from Summer-2025 Session

Varendra University

Rajshahi

Preface

The Varendra University upholds the esteemed legacy of renowned historical learning centers in the Varendra region of Rajshahi Division. Over the years, this institution has played a significant role in national education, producing graduates who have achieved acclaim both domestically and internationally for their exceptional technical education. In recent times, VU has emerged as a leader in providing quality higher education, particularly in engineering disciplines. Since 2012, VU has offered many undergraduate programs like Electrical and Electronic Engineering (EEE), which is renowned for its innovation, creativity, and technical rigor.

The Department of EEE at Varendra University has recently revised and expanded its course offerings to incorporate the latest advancements in the field. New courses have been introduced to address emerging trends and technologies, ensuring that our students are well-prepared with contemporary practices. To enhance your academic experience, we have integrated additional learning resources, including state-of-the-art laboratories, industry case studies, and interactive learning tools. These resources are tailored to complement your coursework and offer practical insights into real-world applications.

Recognizing the importance of a holistic education, we have strengthened our interdisciplinary approach. This edition includes new opportunities for cross-departmental learning and projects that cultivate creative thinking and problem-solving across different fields of study. We have also enhanced soft skill development initiatives, but also life skills to thrive in real-life challenges. Our programs include hands-on activities, internships to help you gain valuable experience and confidence.

In response to feedback and the need for a more structured approach to learning outcomes, we've introduced Outcome-Based Education (OBE) activities across our courses. These activities are designed to align with specific learning outcomes, ensuring that students can apply their knowledge and skills effectively. Examples include capstone projects, case studies, simulations, peer assessments, collaborative assignments, and portfolio development.

We are committed to fostering a supportive and engaging learning environment. This edition outlines new initiatives for student mentoring, academic advising, and extracurricular activities that aim to build a strong sense of community and support your personal and professional growth. As you embark on this academic journey, we encourage you to take full advantage of the opportunities presented in this syllabus. Engage actively in your courses, seek out collaborative projects, and utilize the resources available to you. Our dedicated faculty and staff are here to guide and support you every step of the way.

We are excited to see the incredible achievements and contributions that you will make as part of our academic community. Together, let's strive for excellence, innovation, and lifelong learning. Thank you for being a part of our department. We look forward to a successful and rewarding academic year ahead.

Head

Department of Electrical and Electronic Engineering

Varendra University, Rajshahi

Members of Curriculum Committee

Serial No	Name	Designation
1	Prof. Dr. Kazi Khairul Islam	Professor and Head, Department of Electrical and Electronic Engineering, Varendra University
2	Dr. Tanvir Ahmed	Professor and Coordinator, Dept. of Electrical and Electronic Engineering, Varendra University
3	Dr. Ajay Krishna Sarker	Professor and External Academic Member, Dept. of Electrical and Electronic Engineering, Rajshahi University of Engineering and Technology
4	Dr. Md. Sohel Rana	Professor and External Academic Member, Dept. of Electrical and Electronic Engineering, Rajshahi University of Engineering and Technology
5	Engr. Shirin Yasmin	Chief Engineer (Purchase) & Project Director (Adl. Charge), NESCO, Rajshahi.
6	Dr. Mallika Mitra	Assosiate Professor, Department of Electrical and Electronic Engineering, Varendra University
7	Dr. Rezwana Sultana	Assosiate Professor, Department of Electrical and Electronic Engineering, Varendra University
8	Md. Anifuzzaman	Assistant Professor, Department of Electrical and Electronic Engineering, Varendra University
9	Mst. Tasnin Tania	Assistant Professor, Department of Electrical and Electronic Engineering, Varendra University
10	Jannatul Afroj Akhi	Lecturer, Department of Electrical and Electronic Engineering, Varendra University
11	Shamima Yasmin Sejuti	Lecturer, Department of Electrical and Electronic Engineering, Varendra University
12	Nasrullah Masud	Lecturer, Department of Electrical and Electronic Engineering, Varendra University
13	Md. Mahadi Hasan Sajib	Lecturer, Department of Electrical and Electronic Engineering, Varendra University
14	Asif Iqbal	Lecturer, Department of Electrical and Electronic Engineering, Varendra University
15	Partho Kumer Nonda	Lecturer, Department of Electrical and Electronic Engineering, Varendra University
16	Md. Rokonuzzzaman Mim	Lecturer (on probation), Department of Electrical and Electronic Engineering, Varendra University
17	Rakibul Hasan	Lecturer (on probation), Department of Electrical and Electronic Engineering, Varendra University

Table of Contents:

Part A

1. **Title of the Academic Program:** Undergraduate program in Electrical and Electronic Engineering (EEE)

2. **Name of the University: Varendra University**

3. **Vision of the University**

The vision of Varendra University is to be established as a top-ranking university nationally and internationally through continuous innovation in education, research, creativity, and entrepreneurship.

4. **Mission of the University**

The mission of the university is to contribute to national development by producing innovative, skilled, and technologically trained manpower. Ours is a knowledge-based society, and we hope to equip our students with knowledge and skill to face global challenges and become leaders of innovation in different fronts of practical life. The mission of VU also includes the promotion of humanism and peace through liberal education.

Mission 1	To contribute to national development by producing innovative, skilled, and technologically trained manpower.
Mission 2	To equip our students with knowledge and skill to face global challenges and become leaders of innovation in different fronts of practical life.
Mission 3	To include the promotion of humanism and peace through liberal education.

5. **Name of the Program Offering Entity:** Electrical and Electronic Engineering (EEE)

6. **Vision of the Program Offering Entity**

To become a dynamic, knowledgeable, and technological excellence center of Electrical and Electronic Engineering education in order to produce a knowledge-based economy and society for the betterment of humanity.

7. **Mission of the Program Offering Entity**

Mission 1	To offer advanced EEE allied technologies and knowledge-based services to meet the requirement of the society.
Mission 2	To provide excellence in teaching, research, and development activities in collaboration with academics and industry.
Mission 3	To inculcate moral and ethical values among the faculties and students for the betterment of humanity.

8. Objectives of the Program Offering Entity

The objectives of the department EEE is to produce human resources who will

- Practice electrical engineering as professionals in their chosen field of expertise in the areas of power system operation, power system protection, power system economics, advance power system design, advance electrical design, entrepreneurship, machine automation & process control, renewable energy resources studies and power electronics.
- Attain professional growth and advancement in their professional career.
- Engage in lifelong learning for continuous professional development.
- Produce innovations and new technologies that provide sustainable solutions to problems in the field of electrical engineering to improve community welfare

9. Name of the Degree: Bachelor of Science (B.Sc.)

10. Description of the Program

The Department of Electrical and Electronic Engineering at Varendra University (VU) will be offering a four-year undergraduate degree program in Electrical and Electronic Engineering. The bachelor degree program requires 153 credits and is spread over 8 semesters with 2 semesters per year.

11. Graduate Attributes:

- Subject specialists: They have deep knowledge, understanding, research skills, and other abilities related to their field, including working in teams with people from different disciplines or professions.
- Teamwork and Communication skills: Graduates convey ideas and information effectively to a range of audiences for a variety of purposes and contribute in a positive and collaborative manner to achieving common goals.
- Professionalism and leadership readiness: Graduates engage in professional behavior and have the potential to be entrepreneurial and take leadership roles in their chosen occupations or careers and communities.
- Adaptability: Ability to adapt to and manage change. They always look for opportunities to continue to learn, reflect and apply new knowledge and skills in a positive sustainable way with both local and world perspective.
- Intercultural and ethical competency: Graduates are responsible and effective global citizens whose personal values and practices are consistent with their roles as responsible members of society. They also Respect for and openness to global, cultural and societal diversity.

12. Program Educational Objectives (PEOs)

PEO 1	Exhibit engineering knowledge in ongoing learning and professional development through self-study, continuing education in Electrical and Electronic Engineering as well as in other allied fields.
PEO 2	Apply their engineering skills, exhibiting critical thinking and problem-solving skills in professional engineering practices, or tackle social, technical, and business challenges.
PEO 3	Adopt an ethical attitude and exhibit effective skills in communication, management, teamwork, and leadership qualities.

13. Program Learning Outcomes (PLOs)

SL No.	PLO Code	Program Learning Outcome
1	**PLO 1**	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	**PLO 2**	**Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems to reach substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**PLO 3**	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet specified needs, considering health, safety, society, and the environment.
4	**PLO 4**	**Investigation**: Conduct investigations of complex problems—design experiments, analyze and interpret data, and synthesize information to draw valid conclusions.
5	**PLO 5**	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools (including modeling and prediction) to complex engineering activities, understanding their limitations.
6	**PLO 6**	**The engineer and society**: Apply contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to professional engineering practice.
7	**PLO 7**	**Environment and sustainability**: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the need for sustainable development.
8	**PLO 8**	**Ethics**: Apply ethical principles and commit to professional ethics, responsibilities, and norms of engineering practice.
9	**PLO 9**	**Individual work and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams and multidisciplinary settings.

10	**PLO 10**	**Communication**: Communicate effectively on complex engineering activities with the engineering community and society, including writing reports, making presentations, and giving/receiving clear instructions.
11	**PLO 11**	**Project management and finance**: Demonstrate knowledge of engineering and management principles and apply them to one's work as a team member or leader to manage projects in multidisciplinary environments.
12	**PLO 12**	**Life-long learning**: Recognize the need for, and engage in, independent and life-long learning in the broadest context of technological change.

14. Mapping mission of the university with PEOs

PEOs	Mission 1	Mission 2	Mission 3
PEO 1	3	2	1
PEO 2	2	3	1
PEO 3	1	1	3

Correlation: 3- High, 2-Medium, 1-Low

15. Mapping PLOs with the PEOs

PLOs	**PEO 1**	**PEO 2**	**PEO 3**
PLO 1	√	√	
PLO 2	√	√	
PLO 3		√	
PLO 4		√	
PLO 5		√	
PLO 6			√
PLO 7			√
PLO 8			√
PLO 9	√		
PLO 10	√		
PLO 11	√		
PLO 12	√		

Part B

17. Structure of the Curriculum

a) Duration of the Program:

1. **Years:** 4 Years
2. **Semester:** 8 Semesters
3. There will be two semesters/academic sessions in each academic year. They are as follows:

Name of the Semester	Duration
Spring	January to June
Summer	July to December

Each semester spanning 6 months i.e., 26 weeks. The semester duration is distributed as follows:

i. Preparatory Leave: 02 weeks
ii. Examination: 05 weeks (Mid Term and Final)
iii. Result Processing: 02 weeks
iv. Scheduled vacation: 03 weeks
v. Conducting Class: 14 weeks

b) Admission Requirement

i. A minimum GPA of 3.00 in both SSC and HSC (or equivalent) examinations is required for admission into Honours Programs.
ii. Minimum five subjects from O-Level and two subjects from A-Level are required for the admission of new students. Out of seven subjects, students must have obtained B-grade or GPA 4.00 in four subjects and C grade or GPA 3.50 in other three subjects respectively.
iii. Total GPA of 5.00 in both SSC and HSC Examinations for the children of the Freedom Fighter.
iv. All diploma holders from the Govt. and the UGC or related Council approved Institutions/Institutes will be considered as HSC/Equivalent, and they will have to take usual admission test for any existing programs of this University.
v. Candidate must pass HSC/ equivalent examination from science group.
vi. Candidate must obtain HSC/equivalent examination with a minimum GPA 3.00 in Mathematics (in a scale of 5.00).

c) Total minimum credit requirement to complete the program:

The degree requirements of Bachelor of Science degree in Electrical and Electronic Engineering are:

1. Completion of 153 credit hour courses
2. Passing of all courses individually and maintaining a minimum CGPA of 2.00

d) Total class weeks in a Year/semester:

The procedure of Credit Hour Semester System which will be practiced in the academic program at the Varendra University involves 14 weeks duration. For all 3-credit theory and 1.50 credit lab courses, contact hour is 2 periods/week. Each class period of theory/Lab courses will have a minimum duration of 90 minutes.

e) Minimum CGPA requirements for Graduation

All required credits of the programs should be earned within the maximum length of period.

- **a.** Minimum CGPA should be 2.
- **b.** Students having 'F' grade(s) in any course(s) will not be eligible for the degree.

f) Maximum academic years of completion

A student must complete the program within 7 (seven) academic years.

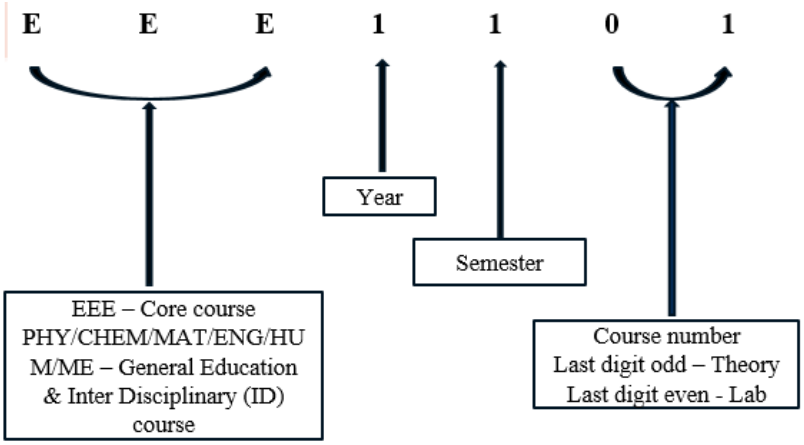
g) Courses Designation and Numbering System:

Each course is identified using a **three-letter code** followed by a **four-digit number**, based on the following structure:

a) The **first digit** indicates the **academic year** in which the course is typically taken.
b) The **second digit** denotes the **semester** (e.g., Spring or Summer) during which the course is usually offered.
c) The **third digit** represents the **course category**, such as Core Courses, Mathematics, Humanities, etc.
d) The **fourth digit** indicates the **course sequence**, where:
   i. **Odd numbers** represent **theory courses**
   ii. **Even numbers** represent **lab courses**

The course designation system is illustrated by one example as shown below:

Course Code: EEE 1101 (Electrical Circuits I)



h) Category of Courses:

Distribution of Courses

Course Type	Credits	% of Credits
Mathematics and Basic Sciences	**22**	**14.38%**
(a) Mathematics	15	
(b) Physics	4	
(c) Chemistry	3	
General Education	**12**	**7.84%**
(a) Economics and accountancy	3	
(b) Legal Issues and Management for Engineers	3	
(c) English Fundamentals	3	
(d) History of the Emergence of the Bangladesh	3	
Basic and Major Engineering	**119**	**77.78%**
(a) Theoretical	81	52.94%
(b) Laboratory	38	24.84%
Total	**153**	**100.00%**

i. Mathematics: (Have to take all the courses)

No. of Courses: 05 (Theory: 5, Lab: 0)

Total Credit: 15 (Theory: 15, Lab: 0)

Sl. No	Course Code	Course Title	Credit	Pre-requisite
1	MATH 1121	Differential and Integral Calculus	3.00	—
2	MATH 1221	Coordinate Geometry, Vector Analysis and Complex Variables	3.00	MATH 1121
3	MATH 2121	Differential Equations and Linear Algebra	3.00	MATH 1221
4	MATH 2221	Fourier and Laplace Analysis	3.00	MATH 1121
5	MATH 2223	Probability and Statistical Analysis	3.00	—

ii. Basic Sciences: (All the courses must be taken)

No. of Courses: 04 (Theory: 2, Lab: 2)

Total Credit: 07 (Theory: 5, Lab 2)

Sl. No	Course Code	Course Title	Credit	Pre-requisite
1	CHEM 1131	Chemistry	2.00	—
2	CHEM 1132	Chemistry Lab	1.00	—
3	PHY 1131	Physics	3.00	—
4	PHY 1132	Physics Lab	1.00	—

iii. General Education: (All the courses must be taken)

No. of Courses: 04 (Theory: 4, Lab: 0)

Total Credit: 12 (Theory:12, Lab:0)

Sl. No	Course Code	Course Title	Credit	Pre-requisite
1	ENG 1001	English Fundamentals	3.00	
2	HUM 2141	Economics and Accountancy	3.00	
3	BAN 1001	History of the Emergence of the Bangladesh	3.00	
4	HUM 3141	Legal Issues and Management for Engineers	3.00	

iv. EEE Core Courses: (All the courses must be taken)

No. of Courses: 40 (Theory: 22, Lab: 18)

Total credits: 92 (Theory: 66, Lab: 26)

Sl. No	Course Code	Course Title	Credit	Prerequisite
1	EEE 1101	Electrical Circuits I	3.00	—
2	EEE 1102	Electrical Circuits I Lab	1.50	—
3	EEE 1203	Electronics I	3.00	—
4	EEE 1204	Electronics I Lab	1.50	—
5	EEE 1201	Electrical Circuits II	3.00	EEE 1101
6	EEE 1202	Electrical Circuits II Lab	1.50	—
7	EEE 2101	Electronics II	3.00	EEE 1203
8	EEE 2102	Electronics II Lab	1.50	—
9	EEE 2103	Electrical Machines I	3.00	—
10	EEE 2104	Electrical Machines I Lab	1.50	—
11	EEE 2105	Numerical Techniques for Engineers	3.00	—
12	EEE 2106	Numerical Techniques for Engineers Lab	1.50	—
13	EEE 2201	Electrical Machines II	3.00	EEE 2103
14	EEE 2202	Electrical Machines II Lab	1.50	—
15	EEE 2203	Signals and Linear Systems	3.00	EEE 1101

16	EEE 2205	Digital Electronics	3.00	EEE 1203
17	EEE 2206	Digital Electronics Lab	1.50	—
18	EEE 2208	Electrical Services Design and CAD Lab	1.00	—
19	EEE 3101	Transmission & Distribution of Electrical Power	3.00	—
20	EEE 3103	Measurement and Instrumentation	3.00	—
21	EEE 3104	Measurement and Instrumentation Lab	1.50	—
22	EEE 3105	Electromagnetic Fields & Waves	3.00	—
23	EEE 3107	Communication Engineering I	3.00	—
24	EEE 3110	Independent Design Project	1.00	—
25	EEE 3201	Power System Analysis	3.00	—
26	EEE 3202	Power System Analysis Lab	1.50	—
27	EEE 3203	Industrial Electronics	3.00	EEE 1203
28	EEE 3204	Industrial Electronics Lab	1.50	—
29	EEE 3205	Digital Signal Processing	3.00	EEE 2203
30	EEE 3206	Digital Signal Processing Lab	1.50	—
31	EEE 3207	Communication Engineering II	3.00	EEE 3107
32	EEE 3208	Communication Engineering II Lab	1.50	—
33	EEE 3209	Power Plant Engineering, Environment and Ethics	3.00	—
34	EEE 4101	VLSI Circuits and Design	3.00	EEE 1203
35	EEE 4103	Control System	3.00	—
36	EEE 4104	Control System Lab	1.50	—
37	EEE 4105	Microprocessors and Embedded Systems	3.00	EEE 2205
38	EEE 4106	Microprocessors and Embedded Systems Lab	1.50	—
39	EEE 4201	Switch Gear & Protection	3.00	—
40	EEE 4202	Switch Gear & Protection Lab	1.00	—

v. Elective Theory Courses: (One course must be taken from each group)

No. of Courses: 4 (Theory: 3, Lab: 1)

Total Credits: 10.50 (Theory: 9, Lab: 1.50)

ELECTIVE COURSE I:

SL NO	Course Code	Course Title	Credits	Pre-requisite
1.	EEE 4141	High Voltage Engineering	3.00	
2.	EEE 4143	Power System Operation & Control	3.00	
3.	EEE 4145	Power System Protection	3.00	
4.	EEE 4147	Nuclear Power Engineering	3.00	
5.	EEE 4149	Smart Grids	3.00	
6.	EEE 4151	Electric Drives and Controls	3.00	
7.	EEE 4153	Industrial Automation System	3.00	

ELECTIVE COURSE II:

SL NO	Course Code	Course Title	Credits	Pre-requisite
1.	EEE 4251	Solid State Devices	3.00	
2.	EEE 4253	Wireless Communication	3.00	
3.	EEE 4255	Optoelectronics	3.00	
4.	EEE 4257	Biomedical Engineering	3.00	
5.	EEE 4259	Nanotechnology and Nanoelectronics	3.00	
6.	EEE 4261	Analog Integrated Circuit	3.00	

ELECTIVE COURSE III:

SL No	Course Code	Course Title	Credits	Pre-requisite
1	EEE 4261	Optical Fiber Communication	3.00	—
2	EEE 4262	Optical Fiber Communication Lab	1.50	—
3	EEE 4263	Data Communication & Computer Networks	3.00	—
4	EEE 4264	Data Communication & Computer Networks Lab	1.50	—
5	EEE 4265	Robotics and Automation	3.00	—
6	EEE 4266	Robotics and Automation Lab	1.50	—
7	EEE 4267	Artificial Intelligence and Advanced Machine Learning	3.00	—
8	EEE 4268	Artificial Intelligence and Advanced Machine Learning Lab	1.50	—
9	EEE 4271	Renewable Energy	3.00	—
10	EEE 4272	Renewable Energy Lab	1.50	—

vi. Inter-disciplinary Courses:

No. of Courses: 5 (Theory: 2, Lab: 3)

Total Credits: 10.50 (Theory: 6, Lab: 4.50)

SL No	Course Code	Course Title	Credits	Pre-requisite
1	CE 1182	Engineering Drawing Lab	1.00	—
2	CSE 1281	Computer Programming	3.00	—
3	CSE 1282	Computer Programming Lab	1.50	—
4	ME 3181	Basic Mechanical Engineering	3.00	—
5	ME 3182	Basic Mechanical Engineering Lab	1.50	—

vii. Capstone Project (EEE 4100 & EEE 4200, credit: 6)

All students will be required to undertake supervised study and research culminating in a dissertation in their field of specialization. The completed dissertation should be bound and printed in accordance with the regulation of the University.

18. Semester wise distribution of courses

SCHEME OF FIRST YEAR FIRST SEMESTER

SL NO	Course Code	Course Title	Credits
1.	MATH 1121	Differential and Integral Calculus	3.00
2.	ENG 1001	English Fundamentals	3.00
3.	CHEM 1131	Chemistry	2.00
4.	CHEM 1132	Chemistry Lab	1.00
5.	EEE 1101	Electrical Circuits I	3.00
6.	EEE 1102	Electrical Circuits I Lab	1.50
7.	CE 1182	Engineering Drawing Lab	1.00
8.	PHY 1131	Physics	3.00
9.	PHY 1132	Physics Lab	1.00
Total			**18.50**

SCHEME OF FIRST YEAR SECOND SEMESTER

SL NO	Course Code	Course Title	Credits
1.	MATH 1221	Coordinate Geometry, Vector Analysis and Complex Variables	3.00
2.	EEE 1203	Electronics I	3.00
3.	EEE 1204	Electronics I Lab	1.50
4.	EEE 1201	Electrical Circuits II	3.00
5.	EEE 1202	Electrical Circuits II Lab	1.50
6.	CSE 1281	Computer Programming	3.00
7.	CSE 1282	Computer Programming Lab	1.50
8.	BAN 1001	History of the Emergence of Bangladesh	3.00
Total			**19.50**

SCHEME OF SECOND YEAR FIRST SEMESTER

SL NO	Course Code	Course Title	Credits
1.	MATH 2121	Differential Equations and Linear Algebra	3.00
2.	EEE 2101	Electronics II	3.00
3.	EEE 2102	Electronics II Lab	1.50
4.	EEE 2103	Electrical Machines I	3.00
5.	EEE 2104	Electrical Machines I Lab	1.50
6.	EEE 2105	Numerical Techniques for Engineers	3.00
7.	EEE 2106	Numerical Techniques for Engineers Lab	1.50
8.	HUM 2141	Economics and Accountancy	3.00
Total			**19.50**

SCHEME OF SECOND YEAR SECOND SEMESTER

SL NO	Course Code	Course Title	Credits
1.	MATH 2221	Fourier and Laplace Analysis	3.00
2.	MATH 2223	Probability and Statistical Analysis	3.00
3.	EEE 2201	Electrical Machines II	3.00
4.	EEE 2202	Electrical Machines II Lab	1.50
5.	HUM 3141	Legal Issues and Management for Engineers	3.00
6.	EEE 2203	Signals and Linear Systems	3.00
7.	EEE 2205	Digital Electronics	3.00
8.	EEE 2206	Digital Electronics Lab	1.50
9.	EEE 2208	Electrical Services Design and CAD Lab	1.00
Total			**22.00**

SCHEME OF THIRD YEAR FIRST SEMESTER

SL NO	Course Code	Course Title	Credits
1.	ME 3181	Basic Mechanical Engineering	3.00
2.	ME 3182	Basic Mechanical Engineering Lab	1.50
3.	EEE 3101	Transmission & Distribution of Electrical Power	3.00
4.	EEE 3103	Electrical & Electronic Measurement	3.00
5.	EEE 3104	Electrical & Electronic Measurement Lab	1.50
6.	EEE 3105	Electromagnetic Fields & Waves	3.00
7.	EEE 3107	Communication Engineering I	3.00
8.	EEE 3110	Independent Design Project	1.00
Total			**19.00**

SCHEME OF THIRD YEAR SECOND SEMESTER

SL NO	Course Code	Course Title	Credits
1.	EEE 3203	Power Electronics	3.00
2.	EEE 3204	Power Electronics Lab	1.50
3.	EEE 3205	Digital Signal Processing	3.00
4.	EEE 3206	Digital Signal Processing Lab	1.50
5.	EEE 3201	Power System Analysis	3.00
6.	EEE 3202	Power System Analysis Lab	1.50
7.	EEE 3207	Communication Engineering II	3.00
8.	EEE 3208	Communication Engineering Lab	1.50
9.	EEE 3209	Power Plant Engineering, Environment and Ethics	3.00
Total			**21.00**

SCHEME OF FOURTH YEAR FIRST SEMESTER

SL NO	Course Code	Course Title	Credits
1.		Elective Course I	3.00
2.	EEE 4101	VLSI Circuits and Design	3.00
3.	EEE 4103	Control System	3.00
4.	EEE 4104	Control System Lab	1.50
5.	EEE 4105	Microprocessors and Embedded Systems	3.00
6.	EEE 4106	Microprocessors and Embedded Systems Lab	1.50
7.	EEE 4100	Capstone Project Part I	3.00
Total			**18.00**

SCHEME OF FOURTH YEAR SECOND SEMESTER

SL NO	Course Code	Course Title	Credits
1.	EEE 4201	Switch Gear & Protection	3.00
2.	EEE 4202	Switch Gear & Protection Lab	1.00
3.		Elective Course II	3.00
4.		Elective Course III	3.00
5.		Elective Course III Lab	1.50
6.	EEE 4204	Industrial Attachment	1.00
7.	EEE 4200	Capstone Project Part II	3.00
Total			**15.50**

ELECTIVE COURSE I

SL NO	Course Code	Course Title	Credits
1.	EEE 4141	High Voltage Engineering	3.00
2.	EEE 4143	Power System Operation & Control	3.00
3.	EEE 4145	Power System Protection	3.00
4.	EEE 4147	Nuclear Power Engineering	3.00
5.	EEE 4149	Smart Grids	3.00
6.	EEE 4151	Electric Drives and Controls	3.00
7.	EEE 4153	Industrial Automation System	3.00

ELECTIVE COURSE II

SL NO	Course Code	Course Title	Credits
1.	EEE 4251	Solid State Devices	3.00
2.	EEE 4253	Wireless Communication	3.00
3.	EEE 4255	Optoelectronics	3.00
4.	EEE 4257	Biomedical Engineering	3.00
5.	EEE 4259	Nanotechnology and Nanoelectronics	3.00
6.	EEE 4261	Analog Integrated Circuit	3.00

ELECTIVE COURSE III

SL NO	Course Code	Course Title	Credits
1.	EEE 4261	Optical Fiber Communication	3.00
2.	EEE 4262	Optical Fiber Communication Lab	1.50
3.	EEE 4263	Data Communication & Computer Networks	3.00
4.	EEE 4264	Data Communication & Computer Networks Lab	1.50
5.	EEE 4265	Robotics and Automation	3.00
6.	EEE 4266	Robotics and Automation Lab	1.50
7.	EEE 4267	Artificial Intelligence and Advance machine Learning	3.00
8.	EEE 4268	Artificial Intelligence and Advance machine Learning Lab	1.50
9.	EEE 4271	Renewable Energy	3.00
10.	EEE 4272	Renewable Energy Lab	1.50

Part C

19. Description of All Courses

Course Code: MATH 1121 **Course Title: Differential & Integral Calculus** **Credits: 3.00**

Rationale of the Course: One of the basic requirements for the students in Electrical and Electronic Engineering to develop the understanding and solution skill for various engineering problems regarding differentiation and integration.

Course Content:

Review of Functions and Differentiation: Overview of various types of functions and their properties. Differentiation techniques including Rolle's Theorem, Mean Value Theorem, Taylor's and Maclaurin's Theorems (both finite and infinite forms).
Series and Partial Differentiation: Study of convergence and divergence of series. Partial differentiation including Euler's Theorem. Concepts of tangent, normal, curvature, and determination of maxima and minima with applications.
Integration Techniques: Review of indefinite and definite integration for various functions. Application of definite integration in summing series. Wallis' formulae and improper integrals. Beta and Gamma functions.
Applications of Integration: Calculation of area under curves and between two curves (both Cartesian and polar forms). Determination of volume and surface area of solids of revolution.

Text Books:

1. Das & Mukharjee -Differential Calculus
2. Das & Mukharjee - Integral Calculus

Reference Books:

1. H. K. DAS- Engineering Mathematics

Course Code: ENG 1001 **Course Title: English Fundamentals** **Credits: 3.00**

Rationale of the Course: One of the basic requirements for the students in Electrical and Electronic Engineering to develop their communication skill and writing skill in English.

Course Content:

Parts of Speech and Sentence Structure: Parts of speech, types of phrases, types of clauses and sentences, verb and phrasal verb, preposition and conjunction.
Grammar and Usage: Transitional words and phrases, subject-verb agreement, tense, voice, question formation (wh-questions, yes/no questions, tag questions, embedded questions).

Reading Comprehension and Vocabulary: Techniques for reading for gist and detail, reference and inference, finding factual information, understanding author's purpose, and high-frequency academic vocabulary.
Writing Skills: Paragraph and essay writing techniques, resume writing, cover letter preparation, email writing, précis writing, report writing.
Spoken Discourse: Common spoken discourse in formal and informal contexts.

Text Books:

1. Baker, S.: *The Practical Stylist* (7th ed.), HarperCollins College Div
2. Barnet, S., Stubbs, M., Bellanca, P., & Stimpson, P. G.: *Practical Guide to Writing with Readings and Handbook* (8th ed.), Prentice Hall Canada
3. Eastwood, J.: *Oxford Practice Grammar Intermediate* (Paperback edition), Oxford University Press
4. Imhoof, M., & Hudson, H.: *From Paragraph to Essay: Developing Composition Writing* (7th ed.), Longman

Course Code: CHEM 1131 Course Title: Chemistry Credits: 2.00

Rationale of the Course: It is important for the students in Electrical and Electronic Engineering to achieve the knowledge of the basic concepts of chemical property along with different chemical reactions.

Course Content:

Chemical Bonds and Properties: Different types of chemical bonds and their characteristics. Modern concepts of acids and bases. Problems involving acid-base titration. Properties and uses of noble gases.
Electrochemistry: Mechanism of electrolytic conduction, transport number, Kohlrausch's law. Ionization of water and the concept of pH. Electrochemical cells, cell emf, single electrode potentials (determination and application). Secondary cells including lead-acid and alkaline accumulators.
Solutions and Properties: Classification of solutions, factors affecting solubility, gas solubility in liquids. Colligative properties of dilute solutions. Le Chatelier's Principle and its industrial applications.
Thermochemistry and Kinetics: Basic concepts of thermochemistry and chemical kinetics.

Text Books:

1. Principles of Physical Chemistry – Haque & Nawab
2. Essentials of Physical Chemistry- B.S. Bahl & G.D. Tuli
3. Introduction to Modern Inorganic Chemistry – S.Z. Haide

Reference Book:

1. Modern Inorganic Chemistry – R. D. Madan
2. Advanced Inorganic Chemistry – F. Albert Cotton & Geoffey Wilkinson

Course Code: CHEM 1132 Course Title: Chemistry Lab Credits: 1.00

Rationale of the Course: Students in Electrical and Electronic Engineering needs to demonstrate their knowledge acquired in CHEM 1131 course.

Course Content:

Sessional based on the theory course of CHEM 1131.

Text Book: Lab Manual

Course Code: EEE 1101 Course Title: Electrical Circuit I Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill for analyzing different Direct Current (DC) and Alternating Current (AC) related problems.

Course Content:

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 and 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 signals; Voltage and current of inductor, capacitor, and resistor; Phasor algebra and representation; Reactance, Susceptance, Impedance, Admittance; Kirchhoff's laws in phasor domain; Phasor diagrams.
Circuit Reduction Techniques: Combining impedance in series, parallel, series-parallel; Voltage and current divider rules; Circuit equivalence; Y-Δ transformation; Source transformation; Voltage regulation.
Circuit Analysis Techniques: Solving AC and DC circuits using mesh current and node voltage methods.
Circuit Theorems: Tellegen's theorem, Superposition principle, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Millman's theorem, Substitution theorem, Reciprocity theorem.
Powers in AC Circuits: Instantaneous power, Real, reactive, and complex power; Power factor; Conservation of AC power; Power factor correction; Maximum average power transfer theorem.

Text Books:

1. Fundamentals of Electric Circuits: Charles K. Alexander and Mathew N. O. Sadiku

Reference Book:

1. Introductory Circuit Analysis: Robert L. Boylestad

Course Code: EEE 1102 Course Title: Electrical Circuit I Lab Credits: 1.50

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the practical skill for analyzing, designing and experimenting different types of Basic electrical circuits and theorems taught in the course EEE 1101- Electrical Circuits I.

Course Content:

Sessional based on the theory course of EEE 1101.

Text Books: Lab Manual

Course Code: CE 1182 Course Title: Engineering Drawing Lab Credits: 1.00

Rationale of the Course: This lab provides students with a basic understanding of civil engineering. In practice, CE, EEE, and ME are all related to each other. So, each engineer in these must have some knowledge about others.

Course Content:

Introduction to Engineering Letters: Covers conventions and formats for professional engineering correspondence, focusing on clarity and effective communication.
Introduction to Drawing Tools: Familiarizes students with instruments like rulers, protractors, compasses, and drafting software essential for precise technical drawings.
Orthographic Projection and Dimensioning: Teaches techniques for representing 3D objects in 2D views with accurate size and shape depiction.
Isometric Projection and Dimensioning: Provides methods for visualizing objects in 3D space with equal scales along all axes.
Drawing Reinforcement Details of Typical Columns: Illustrates placement and specifications of steel bars in concrete columns per engineering standards.
Sectional Views of a Building: Involves interpreting architectural plans to visualize internal structures from different perspectives.
AutoCAD Drawing: Introduces computer-aided design software to create detailed technical drawings including floor plans and cross-sections.
Ground Floor Plan Designing Using AutoCAD: Applies drafting techniques to develop scaled layouts of foundations and interior spaces with architectural elements.

Open Lab Sessions: Offers hands-on practice with engineering drawing concepts and software tools to enhance proficiency and creativity in technical design.

Text Books: Lab manual

Course Code: PHY 1131 Course Title: Physics Credits: 3.00

Rationale of the Course: One of the elementary requirements for the students in Electrical and Electronic Engineering to understand the fundamental principles that describe and govern all physical aspects of the universe and solution skill for various engineering problems.

Course Content:

Electricity and Magnetism: Electric charge and Coulomb's law, Electric field, concept of electric flux and the Gauss's law – some applications of Gauss's law, Gauss's law in vector form, Electric potential, relation between electric field and electric potential, capacitance and dielectrics, gradient, Laplace's and Poisson's equations, current, current density, resistivity, the magnetic field, Ampere's law, Biot-Savart law and their applications, Laws of electromagnetic induction, Maxwell's equations.
Waves: Periodic Motion, Simple Harmonic Oscillation, Types of waves, Equation of waves, Velocity and energy, complex waves, Standing waves, Resonance and Beats, Sound waves, Doppler effect.
Fundamentals of Light: Basic properties and theories of light, Electromagnetic spectrum and visible range, Refractive index, optical path, Dispersion, Wave theory and Huygens principle, Photoelectric effect, Quantum theory of light, Wave-particle duality, Photons.
Interference: Interference phenomenon, Young's double slit experiment, Displacement of fringes and its uses, Fresnel's bi-prism, Interference in thin films, Newton's rings, Interferometers.
Polarization: Production and analysis of polarized light, Brewster's law, Malus law, Polarization by reflection and refraction, Nicol prism, Optical activity, Polarimeters.
Diffraction: Fresnel and Fraunhofer Diffraction, Diffraction by single slit, Diffraction from a circular aperture, resolving power of optical instruments, Diffraction at double slit and N-slits, Diffraction grating.

Text Books

1. Halliday and Resnick, Fundamentals of Physics, John Wiley & Sons, Inc.

Reference book

1. F A Jenkins and H E White, Textbook of optics.
2. Brij Lal, M. N. Avadhanulu, and N. Subrahmanyam, A Textbook of Optics.

Course Code: PHY 1132 **Course Title: Physics Lab** **Credits: 1.00**

Rationale of the Course: This subject is classified under the Basic Technology group and intended to give the students hands on experience on operation of various electronic devices related to their use and working in electronic systems and applications.

Course Content: Sessional based on the theory course of PHY 1131.

Text Books: Lab Manual

Course Code: MATH 1221 **Course Title: Coordinate Geometry, Vector Analysis and Complex Variables** **Credits: 3.00**

Rationale of the Course: One of the core requirements for the students in Electrical and Electronic Engineering to develop the understanding and solution skill for various engineering problems regarding geometry and vector analysis.

Course Content:

2D Coordinate Geometry: Transformation of coordinates; Pair of straight lines; Circle, System of circles. General equation of second degree.
3D Coordinate Geometry: System of coordinates; Distance between two points, Section formula, Projection, Direction Cosines; Equations of planes and lines.
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 dependence and independence of vectors.
Vector Calculus: Differentiation and integration of vectors together with elementary applications. Definition of line, surface, and volume integrals; Gradient, Divergence and Curl of point functions, various formulae. Gauss's theorem, Stokes' theorem, Green's theorem.
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. Complex integration and Cauchy's theorem. Infinite series, Taylor's and Laurent series, Residue, The residue theorem, Contour integration.

Text Books:

1. M. R. Spiegel, Schaum's Outline of Complex Variables.
2. S. I. Loney: Analytical Co-Ordinate Geometry
3. M. R. Spiegel, Schaum's Outline of Vector Analysis.

Reference Books:

1. Rahman & Bhattacharjee: A text book on Coordinate Geometry with Vector Analysis
2. H. K. Dass: Advanced Engineering Mathematics

Course Code: EEE 1201 Course Title: Electrical Circuit II Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill for analyzing filter and two port related problems.

Course Content:

Analysis and Synthesis of Polyphase Balanced and Unbalanced Circuits: Introduction to poly-phase system, 3-4 power generation, Phase, Line, Neutral quantities and phase sequence. Balanced polyphase circuits analysis: Y-Y, Y-Δ, Δ-Δ, and Δ-Y. Three-phase power measurement, Comparison of copper losses among phases, Unbalanced system, Phase sequence effect, and checking. Unbalanced polyphase circuits analysis: Y-Y, Y-Δ using Conventional Method and Millman's theorem, three-phase power calculation and vector power factor.
Resonance in AC Circuits: Series and parallel resonance. Q-value and Bandwidth.
Filters: Introduction to filters, classification of filters, key terms related to filters, passive filters, different types of filter prototypes, double tuned filter, crossover circuit, constant-k filter, m-derived filter, conventional analog filters analysis and design.
Conductively and Magnetically Coupled Circuits: Terminology, concept of mutual coupling, coefficients of coupling with associated self and mutual parameters, mutual inductance in series and parallel branches, polarity test, concept 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 of 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, networks with controlled sources.

Text Books:

1. Fundamentals of Electric Circuits: Charles K. Alexander and Mathew N. O. Sadiku
2. “Introduction to Circuit Analysis” by Robert L. Boylestad

Course Code: EEE 1202 Course Title: Electrical Circuit II Lab Credits: 1.50

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill of practicing, designing and analyzing theoretical knowledge acquired in EEE 1201.

Course Content:

Sessional based on the theory course of EEE 1201.

Text Books: Lab Manual

Course Code: EEE 1203 Course Title: Electronics I Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill for analyzing and designing BJT, FET, and MOSFET circuits for industrial applications. This course provides the student about the basic working principle of diode. It includes basic concepts of rectifier, clipper and clamper circuit.

Course Content:

Overview of Semiconductor: Conductor, insulator, semiconductor; intrinsic/extrinsic materials; N & P type semiconductors; Diode operation (P-N diode, no bias, forward, reverse bias).
V-I Characteristics of Semiconductor Diode: Ideal vs Practical; Resistance levels; Reverse recovery time.
Load-Line Analysis: Series diode configurations; Parallel and series–parallel configurations.
Rectification: Sinusoidal inputs; Half-wave rectification; Full-wave rectification.
Clippers and Clampers: Series and parallel clippers, with and without biasing; Clampers: Series and parallel, with/without bias.
Zener Diodes: Vi and R fixed, fixed Vi, variable RL, fixed RL, variable Vi.
Voltage-Multiplier Circuits: Voltage doubler, tripler, quadrupler.
Transistor Construction and Operation: Common-base, common-emitter, and common-collector configurations.
DC Biasing of BJTs: Fixed bias, emitter bias, voltage-divider bias, collector feedback, emitter follower, common-base.
BJT AC Analysis: Small-signal models (hybrid-π, T-model), voltage/current gain, input/output impedance, common emitter/base/collector configurations.
FET AC Analysis: Small-signal models of JFET/MOSFET, transconductance, voltage gain, input/output impedance, common source/gate/drain configurations.
Field-Effect Transistors: Construction and characteristics of JFETs, depletion-type and enhancement-type MOSFETs.
Optoelectronic Devices: Photodiode, phototransistor, solar cell, photoconductive cell.

Text Books:

1. "Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky
2. "Microelectronic Circuits" by Adel S. Sedra and Kenneth C. Smith

Course Code: EEE 1204 Course Title: Electronics I Lab Credits: 1.50

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill for practicing, analyzing and designing the concept gained in course EEE 1203.

Course Content: Sessional based on the theory course of EEE 1203.

Text Book: Lab Manual

Course Code: CSE 1281 Course Title: Computer Programming Credits: 3.00

Rationale of the Course: This course is one of the core or optional requirements for students majoring in Electrical and Electronic Engineering, Electronic and Telecommunication Engineering, and Computer Science and Engineering. It is designed to help students develop the skills necessary for analyzing and designing computer algorithms. As a structured programming language, C is introduced so that students can understand the fundamental logic of programming, enabling them to design and analyze algorithms to solve specific problems effectively.

Course Content:

Introduction to C Programming: Programming concepts; structured programming language: Data types, operators, expressions, control structures.
Variable Length Argument List: Command line parameters; error handling.
Conditional Logic and Loop.
Introduction to Function: Functions and program structures: Function basics, parameter passing conventions, scope rules and storage classes, recursion; header files.
Preprocessor; Arrays and Pointers: User-defined data types: Structures, unions, enumeration; input and output: Standard input and output, formatted input and output, file access.
Object-Oriented Programming Using C++: Introduction, classes and objects; polymorphism; function and operator overloading; inheritance.

Text Books:

1. Programming with C: Byron Gottfried

Reference Books:

1. C How to Program: Harvey M. Deitel and Paul J. Deitel
2. Teach Yourself C: H. Schield

Course Code: CSE 1282 Course Title: Computer Programming Lab Credits: 1.5

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the practical skill for analyzing, designing and experimenting different types of circuit and electronic programming and theorems taught in the main course Computer Programming

Course Content: Sessional based on the theory course of CSE 1281.

Text Books: Lab Manual

Course Code: BAN 1001 Course Title: History of the Emergence of Bangladesh Credits: 3.00

Rationale of the Course: This course aims to provide students with a comprehensive understanding of the historical roots of Bangladesh as an independent state. It explores in depth the political, social, and cultural vicissitudes that led to the demand for provincial autonomy and ultimately to independence. The course highlights the key developments and the heroic contributions of political and student leaders leading up to independence, culminating in the valiant efforts of the Freedom Fighters during the Liberation War of 1971. By the end of the course, students will be able to grasp the deeper significance of Bangladesh's emergence as a sovereign nation. Ultimately, this course seeks to instill in students a sense of appreciation for the birth of Bangladesh and foster patriotic values.

Course Content:

Partition of India in 1947: Lahore conference; United Bangla plan; Two nation theory; Creation of Pakistan and India; Displacement crisis.
Language Movement of 1952: Primary discussion on Bangla and Urdu language; early stage of movement; Agitation of 1948; 21 February of 1952; Constitutional status of Bangla language.
Disparity between Two Wings of Pakistan: Economic disparity; Administrative disparity; Political disparity.
Military Rule of Ayub Khan and Six Point Movement: Commander-in-Chief of the Pakistan Army; President of Pakistan; Constitutional and legal reforms; Background of Six-point movement; Six-point movement; Result of six-point movement.
Mass Upsurge of 1969 and Yahya Khan, General Election of 1970: Shorbodolio Chatro Shongram Porishad (All Party Student Action Committee); Democratic Action Committee. Withdrawal of Agartala conspiracy case; Election campaign in East Pakistan, Political condition of West Pakistan.
Result of the Election and Aftermath Condition of Election. Historic Speech of 7 March, Non-cooperation Movement.

Genocide of 25 March, Declaration of Independence and Proclamation of Independence. Mujibnagar Government.
Contribution of Different Countries to Independence, 14th December Tragedy, 16th December Victory.
Government of Bangabandhu Sheikh Mujibur Rahman. 4th November and 15th August Tragedy.
Liberation War: Expectation and Achievement: A Study.

Text Books:

1. K. B. Sayeed – *Political System of Pakistan*
2. ডা. মোঃ মাহবুবর রহমান – *বাংলাদেশের ইতিহাস, ১৯৪৭–১৯৭১*
3. বশির আল হেলাল – *ভাষা আন্দোলনের ইতিহাস*
4. আতিউর রহমান – *মুক্তিযুদ্ধের প্রস্তুতি পর্ব: অসহযোগের দিনগুলি*
5. আবুল মাল আব্দুল মুহিত – *বাংলাদেশ: জাতিরাষ্ট্রের উদ্ভব*
6. William van Schendel – *A History of Bangladesh*

Course Code: MATH 2121 Course Title: Differential Equations and Linear Algebra Credits: 3.00

Rationale of the Course: This course is designed to equip students of Electrical and Electronic Engineering with essential mathematical tools to analyze and solve real-world engineering problems. Differential equations are fundamental in modeling dynamic systems such as circuits, control systems, and signal processing, while linear algebra is crucial for understanding system behaviors, transformations, and complex computations. Together, these topics provide a strong analytical foundation, enabling students to approach technical challenges methodically and efficiently in both academic and professional settings.

Course Content:

Ordinary Differential Equations: Degree and order of ODE, formation of differential equations, solution of first order differential equations by various methods, solution of first order but higher degree ODE.
Ordinary Differential Equations: Solution of general linear equations of second and higher order with constant coefficients, solution of homogeneous linear equations and its applications.
Ordinary Differential Equations: Solutions of differential equations of higher order when dependent and independent variables are absent, solution of differential equations by the method based on factorization of operators.
Partial Differential Equations: Lagrange's method of solving PDE of first order, integral surfaces passing through a given curve, nonlinear PDE of first order (complete, particular, singular, and general integrals).
Partial Differential Equations: Partial differential equations: Standard forms f(p,q)=0, z=px+qy+f(p,q), f(p,q,z) = 0, f1 (x,p)= f2(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.
Partial Differential Equations: Series solution: solution of differential equations in series by the method of Frobenius, Bessel's functions, Legendre's polynomials and their properties.
Linear Algebra: Definition of matrix, different types of matrices, algebra of matrices, adjoint and inverse of a matrix, elementary transformations of matrix, matrix polynomials, Cayley-Hamilton theorem with uses of rank and nullity.
Normal and Canonical Forms: Solution of linear equations, eigenvalues and eigenvectors. Application of linear algebra to electric networks.

Text Books:

1. L. S. Ross: Differential Equations
2. Schamum's Outline Series: Partial Differential Equations
3. P. N. Chatterjee: Matrices

Reference Books:

1. H. K. Dass: Advanced Engineering Mathematics
2. Frank Ayres. Jr: Theory and Problems of Matrices

Course Code: EEE 2101 **Course Title: Electronics II** **Credits: 3.00**

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill for analyzing small signal BJT and FET analysis and to know about Op amp and to design oscillator circuits using crystals.

Course Content:

Operational Amplifier: Difference amplifier, CMMR, ideal operational amplifier, inverting amplifier, non-inverting amplifier, general purpose IC operational amplifier, integrator, differentiator, linear and non-linear applications of operational amplifier, comparator and converter.
Oscillators: Positive feedback, condition of oscillation, RC phase shift oscillator, Wein bridge oscillator, resonant circuit oscillators, crystal oscillator and waveform generators. Square wave generator, triangular wave generator and sawtooth wave generator.
Timing Circuits: Basics of IC 555, bi-stable, mono-stable and astable multivibrators using IC 555, Schmitt Trigger, and application of OP-Amp in timing circuits.
Negative Resistance Devices and Switching Circuits: General characteristics of negative resistance devices, tunnel diode, two terminal and three terminal negative resistance devices, negative resistance switching circuits.
Feedback: Concept of feedback: negative feedback, positive feedback, voltage feedback, current feedback, effect of feedback on impedance, gain, bandwidth, distortion & stabilization.

Frequency Response of Amplifiers: Poles, zeros and Bode plots. Amplifier transfer function, techniques of determining 3 dB frequency of amplifier circuits, frequency response of single stage and cascade amplifiers, frequency response of differential amplifiers.
Power Amplifiers: Classification of power amplifiers, collector efficiency, transformer coupled class-A amplifier; class-B push-pull amplifier, class-C amplifier, tuned amplifier, class D, E & S amplifier.

Text Books:

1. Robert Boylestad: Electronic Devices and Circuit theory.

Reference Books:

1. Robert F. Coughlin: Operational Amplifier and Linear
2. Allen Mottershead: Electronic Devices and Circuits
3. David A. Bell: Electronic Devices and Circuits

Course Code: EEE 2102 Course Title: Electronics II Lab Credits: 1.50

Rationale of the Course: This subject is classified under the Basic Technology group and intended to give the students hands on experience on operation of various electronic circuits and devices related to their use and working in electronic systems and applications.

Course Content: Sessional based on the theory course of EEE 2101.

Text Book: Lab Manual

Course Code: EEE 2103 Course Title: Electrical Machines I Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill about dc generator, dc motor and transformer.

Course Content:

D.C. Generator: Principles, construction, classification, armature windings, voltage build-up, armature reactions and commutation, performance and testing, compounding of DC generator, generator characteristics, voltage regulation, losses and efficiency, parallel operation.
D.C. Motor: Operation, types, back EMF, torque equations, motor characteristics, speed-torque characteristics, speed regulation, losses and efficiency, methods of speed control, methods of braking, starters.
Single Phase Transformer: Principles, types, equivalent circuits, performance and testing, regulation, losses and efficiency, parallel operation, auto-transformer, instrument transformers.

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

Text Books:

1. A text book of Electrical Technology Volume II: B. L. Theraja and A. K. Theraja
2. Direct and Alternating Current Machinery - Jack Rosenblatt, M. Harold Friedman

Reference Books:

1. Electric Machinery Fundamentals 4th: By Stephen J. Chapman

Course Code: EEE 2104 Course Title: Electrical Machines I Lab Credits: 1.50

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill for analyzing the operation and controlling of electrical machines. Controlling the speed of DC machinery and analyzing the generating process of DC machinery are the key aim of this course. After learning this course, a student will be able to start & control of DC machinery along with the basic operating concept of transformer.

Course Content: Sessional based on the theory course of EEE 2103.

Text Books: Lab manual

Course Code: EEE 2105 Course Title: Numerical Techniques for Engineers Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to study different methods regarding mathematical problems and provide faster method to solve engineering problems.

Course Content:

Introduction: Motivation and errors in numerical techniques, Taylor series.
Finite Difference Calculus: Forward, backward, divided and central difference of a polynomial.
Interpolation and Extrapolation: Newton's formula and Lagrange's formula, spline, Chebyshev and inverse, extrapolation.
Nonlinear Equations: Iteration, Bisection, False position, Raphson, Secant and Muller's method.
Simultaneous Linear Algebraic Equations: Cramer's Rule, Gauss Elimination method, Gauss–Jordan method, Gauss-Seidel Iteration method.

Curve Fitting: Linear and polynomial regression, fitting power, exponential and trigonometric functions.
Numerical Solution of Ordinary Differential Equations: Introduction; solution by Taylor's series, Euler's method, modified Euler's method, Runge-Kutta method.
Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule, 3/8 rule, Romberg integration, and related rules.

Text Books:

1. Introductory Methods of numerical Engineering (5^{th} Edition)-S.Sastry

Reference Books:

1. Computer Oriented Numerical Methods- V. Rajaraman

Course Code: EEE 2106 Course Title: Numerical Techniques for Engineers Lab Credits: 1.50

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering, to develop the skill for analyzing Numerical techniques, Non-linear equations and to learn how to solve an equation using different numerical methods.

Course Content: Sessional based on the theory course of EEE 2105.

Text Books: Lab manual

Course Code: HUM 2141 Course Title: Economics and Accountancy Credits: 3.00

Rationale of the Course: The aims of this course are to equip Electrical and Electronic Engineering (EEE) students with a foundational understanding of economic principles and accounting practices relevant to their future careers. It recognizes that while EEE graduates primarily focus on technical skills, a strong grasp of financial and business concepts is crucial for successful project management, industry participation, and entrepreneurship within the electrical engineering field.

Course Content:

Economics: Definition, scope and methods. Demand, supply and their elasticities; equilibrium analysis—partial and general; consumer behavior, marginal utility; indifference curve, consumer's surplus; producer behavior; iso-quant, iso-cost line.
Factors of Production: Production function; production possibility curve; fixed cost and variable cost; short run and long run costs, total, average and marginal cost; laws of returns; internal and external economies and diseconomies; market and market forms; perfect and imperfect competition; price-output determination.

Introductory Macroeconomics: GNP, GDP, per capita income, interest, rent, saving, investment, inflation; project approval, NPV, IRR and their application; cost-benefit analysis.
Accountancy: Definition, advantages, objectives; nature of transactions; double-entry system of bookkeeping; classification of accounts.
Accounting Cycle: Journal, ledger, trial balance, final accounts including adjustments. Final accounts: Trading & manufacturing accounts, profit and loss accounts, and balance sheet. Depreciation: Methods of depreciation.
Costing: Concept of cost, classification of costs, cost-sheet, distribution of overheads to various cost centers/departments, calculation of departmental overhead rate and machine hour rate; job costing: preparation of job cost-sheet & quotation. Marginal costing & profit volume/ratio, operating cost.

Text Books:

1. Economics: Samuelson & Naurdhaus.
2. Principle of Accounting: Needles & Anderson

Reference Books:

1. Macro Economics: Shaum's
2. Financial Accounting: Weggandt & Kieso

Course Code: MATH 2221 Course Title: Fourier and Laplace Analysis Credits: 3.00

Rationale of the Course: One of the basic requirements for the students in Electrical and Electronic Engineering to develop the understanding and solution skill for various engineering problems regarding Fourier and Laplace analysis.

Course Content:

Fourier Series: Fourier series; Fourier coefficients; even and odd functions; properties of Fourier series; convergence of Fourier series; extension of interval Fourier series.
Fourier Integrals and Transformations: Fourier integrals; Fourier transformation; finite & infinite Fourier transform and their uses in solving boundary problems.
Fourier Transforms: Fourier transforms and their uses in solving boundary value problems of wave equations.
Laplace Transforms: Laplace transforms of some elementary functions; properties of Laplace transform; inverse Laplace transform and its properties; convolution theorem; Laplace transforms of derivatives.
Applications of Laplace Transform: Applications to solve differential equations related to linear circuits and partial differential equations.

Text Books:

1. M. R. Spiegel: Laplace Transforms
2. Schamum's Outline Series: Fourier-Analysis

Reference Books:

1. H. K. Dass: Advanced Engineering Mathematics
2. Matrices B. D Gupta: Mathematical Methods

Course Code: MATH 2223 Course Title: Probability & Statistical Analysis Credits: 3.00

Rationale of the Course: One of the basic requirements for the students in Electrical and Electronic Engineering to understand mathematical logic and develop the solution skill for various engineering problems.

Course Content:

Frequency Distribution and Measures of Central Tendency: Frequency distribution; mean, median, mode and other measures of central tendency; standard deviation and other measures of dispersion.

Moments, Skewness, and Kurtosis.

Elementary Probability Theory: Basic concepts and discontinuous probability distributions (Binomial, Poisson, and Negative Binomial).

Characteristics of Distributions.

Elementary Sampling Theory: Principles of sampling theory; different sampling methods and their uses.

Estimation: Estimation techniques, practical significance, point and interval estimation.

Hypothesis Testing: Fundamentals of hypothesis testing; conducting tests, interpreting results, and making informed decisions.

Regression Analysis: Use in modeling relationships between variables; performing regression analysis on datasets.

Text Books:

1. M. R. Spiegel: Schamum's Outline Outlines of Statistics
2. P. Hoel: Introductory Statistics, Wiley and sons, N.Y

Reference Books:

1. A H M Rahamatullah Imon, Introductory Statistics.
2. Mr. Nurul Islam: Statistics and Probability
3. HK DAS- Engineering Mathematics

Course Code: EEE 2201 Course Title: Electrical Machines II Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill for analyzing AC machines, alternator, synchronous motor, induction motor, performance of AC machines.

Course Content:

Single Phase Induction Motor: Theory of operation, equivalent circuit, starting techniques, no load test and blocked rotor tests.
Polyphase Induction Motor: Principle of operation, constructional details, classifications, equivalent circuits, starting torque and maximum torque, speed-torque relations, losses and efficiency, circle diagram, starters, methods of speed control, methods of braking and plugging, induction generator.
Synchronous Motor: Principle of operation, starting, effect of loading under different excitation, effect of changing excitation, synchronous condenser, V-curve and inverted V-curve, applications.
Alternators: Basic principle of operation and operational characteristics, vector diagrams at different loads, synchronous impedance, synchronous reactance methods of predicting voltage regulation and its limitations. Parallel operation of alternators: necessary conditions, synchronizing, circulating current.
Special Machines: Universal motor, repulsion motor, reluctance motor, electrostatic motor, permanent magnet motor, hysteresis motor, stepper motor, power modulators, power rectifiers, frequency multipliers, BLDC motor.

Text Books:

1. "Electric Machinery Fundamentals by Stephen Chapman
2. B.L. THERAJA: Electrical Technology (Volume II)
3. Direct and Alternating Current Machinery - Jack Rosenblatt, M. Harold Friedman

Reference Books:

1. CI Hubert: Electrical Machine

Course Code: EEE 2202 Course Title: Electrical Machines II Lab Credits: 1.5

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill for practicing and analyzing the performance of AC machines.

Course Content: Sessional based on the theory course of EEE 2201.

Text Books: Lab Manual

Course Code: EEE 2203 Course Title: Signals and Linear Systems Credits: 3.00

Rationale of the Course: This course is a core requirement for students of Electrical and Electronic Engineering (EEE). It develops students' ability to mathematically model, analyze, and design real-world electrical systems. By understanding the nature of signals and system behavior, students enhance their problem-solving capabilities and analytical thinking in both time and frequency domains, which are essential for advanced studies in communication, control systems, and signal processing.

Course Content:

Transient Circuit Analysis: Analyze first and second order transient circuits, sequential switching circuits using differential equations to recognize natural, forced, and complete response.

Classification of Signals and Systems: Signals—classification, basic operations on signals, elementary signals, representation using impulse function; Systems—classification. Properties of Linear Time Invariant (LTI) systems: linearity, causality, time invariance, memory, stability, invariability.

Time Domain Analysis of LTI Systems: Differential equations—system representation, order of the system, solution techniques, zero state and zero input response, system properties; impulse response—convolution integral, determination of system properties; state variable—basic concept, state equation, and time domain solution.

Frequency Domain Analysis of LTI Systems: Fourier series—properties, harmonic representation, system response, frequency response of LTI systems; Fourier transformation—properties, system transfer function, system response and distortion-less systems. Analogous systems: force-voltage and force-current analogy, electro-mechanical systems.

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

Laplace Transformation: Fourier to Laplace, properties, inverse transform, solution of system equations, system transfer function, system stability and frequency response and application, convolution integral and its application, superposition integral.

Text Books:

1. Linear Systems and Signals, 2nd Edition, B. P. Lathi

Reference Book:

1. Signals and Systems, A.V. Oppenheim and A. S. Willsky.
2. Fundamentals of Signals and Systems, Benoit Boulet.
3. Digital Signal Processing, John G. Proakis.

Course Code: EEE 2205 Course Title: Digital Electronics Credits: 3.00

Rationale of the Course: This course provides foundational knowledge in digital electronics, covering number systems, Boolean algebra, and logic circuit design. It enables students to analyze, design, and implement combinational and sequential logic systems using standard digital components. Essential topics include binary arithmetic, minimization techniques, logic families, counters, shift registers, and data converters—preparing students for advanced digital system applications in modern electronics and embedded systems.

Course Content:

Number System, Binary Codes and Boolean Algebra: Conversion of bases, representation of negative numbers, 1's complement, 2's complement, arithmetic using 2's complement, hexadecimal code, weighted codes — BCD, Excess-3 code, Gray Code. Logic gates and Boolean algebra.

Boolean Function Representation and Minimization Techniques: Introduction to Boolean functions and their standard and canonical forms. Techniques for minimizing Boolean expressions using Karnaugh maps (K-maps) to simplify logic circuits efficiently.

Combinational Logic Circuits: Half adder, full adder, half subtractor, full subtractor, full adder using half adder, BCD adder, carry look-ahead, multipliers, multiplexers/de-multiplexers, encoders, and decoders.

Sequential Logic Circuits: Latches; edge-triggered flip-flops: SR, D, JK, master-slave JK; excitation tables; conversion of flip-flops; state diagrams.

Counters: Design and operation of synchronous and asynchronous counters; up/down counters; design of synchronous counters; cascaded counters; counter decoding; counter applications.

Shift Registers: Shift register functions; serial in/serial out, serial in/parallel out, parallel in/parallel out, bidirectional shift registers; shift register counters; shift register applications.

Analog to Digital & Digital to Analog Converters: Design of various A/D and D/A converters.

Digital Logic Families: Parameters of logic families; introduction to logic families — DTL, RTL, TTL, CMOS.

Text Books:

1. "Digital Design" by M. Morris Mano & Michael D. Ciletti

Reference Book:

1. "Digital Systems: Principles and Applications" by Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss
2. "Digital Principles and Applications" by Donald P. Leach & Albert Malvino
3. "Digital Fundamentals" by Thomas L. Floyd

Course Code: EEE 2206 Course Title: Digital Electronics Lab Credits: 1.5

Rationale of the Course: One of the core courses of EEE is Digital Electronics. To understand this subject, this lab course plays vital role.

Course Content: Sessional based on the theory course of EEE 2205.

Text Books: Lab Manual

Course Code: EEE 2208 Course Title: Electrical Services Design and CAD Lab Credits: 1.50

Rationale of the Course: Electrical Services design lab is required to make students understand the job requirement and to use subjective knowledge in practical field.

Course Content:

Electrical Measurements and Lighting Systems: Measurement of energy using energy meters (kWh), voltage behavior in series and parallel circuits, operation of incandescent and fluorescent lamps.
Power System Components and Wiring Techniques: Study of generators, transformers, bus bars, cables, circuit breakers, insulators, and poles; residential house wiring, wire connections, and switchboard design.
Substation Layout and AutoCAD Application: Introduction to power substations, typical S/S components and layouts; hands-on drafting of house wiring and substation designs using AutoCAD.
Practical Wiring and Open Lab Sessions: Implementation of wiring plans in lab setup, live demonstration of wiring and protection systems, open lab sessions for project development and hands-on learning.

Textbooks: Lab Manual

Course Code: HUM 3141 Course Title: Legal Issues and Management for Engineers Credits: 3.00

Rationale of the course: One of the elementary requirements for the students in Electrical and Electronic Engineering to understand project management, decision making abilities, concept of business and industrial laws.

Course Content:

Management Functions and Organization: Evolution, management function: organization, theory and structure, span of control, authority delegation, manpower planning.
Personal Management: Importance, need hierarchy, motivation, leadership, wage incentives, performance appraisal, and participative management.
Operation Management: Production planning and control (PPC) functions, quantitative methods applied in production, quality management, location and layout planning, safety and loss management.
Cost and Financial Management: Elements of cost products, cost analysis, investment analysis, and benefit-cost analysis, risk analysis.
Management Accounting: Cost planning and control, budget and budgetary control.
Marketing Management: Concepts, strategy, sales promotion, patent laws.
Technology Management: Management of innovation and changes, technology life cycle.
Business and Industrial Law: Law of contract, elements of valid contract, consideration, parties competent to contract, sale of goods, hire and purchase, negotiable instruments.
Industrial Law in Bangladesh: Various ordinances on payment of wages, legislation relating to employment in industries, factories, shops, agriculture, Trade Union Act.
Safety: Evolution of modern safety concepts, industrial hazard, safety and risk management, productivity, worker health and safety, proactive management techniques, safety standards and regulations for engineering works, fire safety, hazardous materials.

Text Books:

1. Management: Mary Coulter and S. P. Robins

Reference Books:

1. Fundamentals of Management: Ricky W. Griffin

Course Code: ME 3181 Course Title: Basic Mechanical Engineering Credits: 3.00

Rationale of the course: One of the basic requirements for the students in Electrical and Electronic Engineering to understand basic mechanical engineering which includes laws of thermodynamics, cycle of thermodynamics, different types of engines and so on.

Course Content:

Sources of Energy: Introduction to sources of energy, concept and fundamentals; renewable and non-renewable energy sources and their potential.
Heat Transfer: Introduction; modes of heat transfer; steady and unsteady state heat conduction; radiation heat transfer; natural and forced convection; heat exchangers.
Thermodynamics: Systems and surroundings; conversion of energy; different thermodynamic processes; energy transfer as heat for a control volume; reversibility and irreversibility; second

law of thermodynamics and entropy; analysis of thermodynamic cycles; PV and TS diagram representations.

Internal Combustion Engines: Introduction to IC engines and their cycles; heat engines; diesel and petrol engines; gas turbines with accessories; steam generation and turbines; steam generating units with accessories and mountings.

Refrigeration and Air Conditioning: Basic principles and applications of refrigeration and air conditioning.

Fluid Mechanics: Introduction; continuum; fluid classification and properties; fluid statics; basic flow concepts and equations; fluid measurement; viscous flows; boundary layers.

Turbo-machineries: Pelton wheel, Francis turbine, Kaplan turbine, centrifugal and reciprocating pumps, fans, blowers, and compressors.

Text Books:

1. Fundamentals of Mechanical Engineering: R. L. Timings

Reference Books:

1. Mechanical Engineering Fundamentals and Problem Solving: Arvid Eide, Roland Jenison, Larry Northup, and Steven

Course Code: ME 3182 **Course Title: Basic Mechanical Engineering Lab** **Credits: 1.50**

Rationale of the course: One of the fundamental criteria for Electrical and Electronic Engineering students is to understand practical concepts in basic mechanical engineering, which has been studied in ME 3181.

Course Content: Sessional based on the theory course of EEE ME 3181.

Text Books: Lab Manuals

Course Code: EEE 3101 **Course Title: Transmission & Distribution of Electrical Power** **Credits: 3.00**

Rationale of the Course: One of the core requirements for Electrical and Electronic Engineering students is to understand how electrical power is transferred from generating end to distributing end along with how the transmission efficiency and reliability is increased that has been studied in EEE 3101.

Course Content:

Inductance of Transmission Lines: Flux linkages; internal flux inductance; inductance of single-phase two-wire lines; inductance of composite conductor lines; GMD concept;

inductance of 3-phase lines with equilateral and unsymmetrical spacing; parallel circuit 3-phase lines.

Capacitance of Transmission Lines: Electric field; potential difference; capacitance of two-wire lines and group of conductors; capacitance of 3-phase lines (equilateral and unsymmetrical spacing); effect of earth; capacitance of parallel circuit lines.

Resistance and Skin Effect: Resistance variation with temperature; influence of skin effect on resistance.

Current and Voltage Relations: Representation of short, medium, and long lines; T and π models; exact solution and equivalent circuits of long lines; ABCD constants and line equations; measurement and combination of line constants.

Circle Diagrams & Control: Power circle diagrams (sending and receiving ends); maximum power; voltage and power factor control using tap-changing transformers, induction regulators, synchronous condensers, static capacitors; Ferranti effect.

Mechanical Characteristics of Lines: Sag and stress analysis; wind and ice loading; supports at different elevations; erection conditions; temperature effects.

Overhead Line Insulators: Types and construction; potential distribution in strings; string efficiency; equalizing methods; special insulators; corona effect; insulator testing.

Insulated Cables: Comparison with overhead lines; insulating materials; electrostatic stress grading; three-core cables; dielectric losses and heating; oil/gas-filled cables; cable testing and capacitance measurement.

Distribution System: Radial, ring main, and interconnection systems.

Text Books:

1. V.K. Mehta, Rohit Mehta, Principles of Power Systems

Reference Books:

1. Power System Analysis by John J. Grainger & William D. Stevenson. Jr.

Course Code: EEE 3103 **Course Title: Measurement and Instrumentation** **Credits: 3.00**

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill for analyzing different types of electrical and electronic measurements system.

Course Content:

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.

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.
Instrumentation: Extension of instrument range. Use of current transformer (C.T.) and potential transformer (P.T.), Errors in C.T. and P.T. and calculation of their burden.
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.
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.
Electronic Measuring Instruments: Microphone, Camera, Q-meter, CRO, Microwave network analyzer, and Sensor data acquisition using microcontrollers.

Text Books:

1. Electrical and Electronic Measurement and Instrumentation: A. K. Sawhney.

Reference Books:

1. Elements of Electronic Instrumentation and Measurement: J. J. Carr.

Course Code: EEE 3104 **Course Title: Measurement and Instrumentation Lab** **Credits: 1.5**

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering, to develop the skill for analyzing Wattmeter and energy meter, multiplier, CT, PT, measurement of total power of a system.

Course Content: Sessional based on the theory course of EEE 3103.

Text Books: Lab Manual

Course Code: EEE 3105 **Course Title: Electromagnetic Fields & Waves** **Credits: 3.00**

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering, to develop the skill for analyzing Magneto statics, Time dependent fields, Electromagnetic waves, Electromagnetic wave propagation in different types of medium.

Course Content:

Electrostatics: Review of vector analysis concepts. Coulomb's law and forces; electric field intensity; electrical flux density; Gauss's theorem with applications; electrostatic potential; equipotential surfaces; boundary conditions; method of images; Laplace's and Poisson's equations and solutions; energy of an electrostatic system.
Magnetostatics: Magnetic field concepts; flux density; magnetic field intensity; Faraday's law; Biot-Savart law; Ampere's law; vector magnetic potential; energy of magnetostatic system; mechanical forces and torques in electrical and magnetic fields; solutions to static field problems.
Electromagnetic Fields and Radiation: Introduction to displacement current; Maxwell's equations in various coordinate systems and applications; boundary conditions for time-varying systems; retarded potentials.
Electrostatics of Circuits: Circuit concepts derived from field equations; high-frequency circuit concepts; circuit impedances; concepts of good and perfect conductors; depth of penetration; internal impedance; power loss calculation; skin effect in practical conductors.
Propagation and Reflection of Electromagnetic Waves in Unbounded Media: Plane wave propagation; polarization; power flow and Poynting theorem; transmission line analogy; reflection from conductor and dielectric boundaries.
Radio Wave Propagation: Plane wave propagation through ionosphere; ground wave propagation; effect of earth curvature on propagation.

Text Books:

1. Matthew N. O. Sadiku, Elements of Electromagnetics

Reference Books:

1. David k. Cheng, Field and Wave Electromagnetics.

Course Code: EEE 3107 **Course Title: Communication Engineering I** **Credits: 3.00**

Rationale of the Course: Communication engineering is a core aspect of many EEE applications, including telecommunications, broadcasting, and data transmission. This course provides the necessary background for students to understand and contribute to these areas.

Course Content:

Overview of Communication Systems: Basic principles of communication; fundamental elements of a communication system; message sources; input–output transducers; transmission policies; analog and digital communication systems with their advantages and disadvantages; introduction to communication networks and communication traffic; telephone communication; satellite communication; RADAR communication; fiber optic communication; cellular communication; radio and TV broadcasting; radio switching systems; cognitive radio networks.

Transmitter: Elements of a transmitter and their functions; transmission technologies; concept of wireless transmission using 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; quantization and quantization noise; non-uniform quantization; signal-to-quantization-error ratio; encoding techniques; line coding formats; sample-and-hold circuits; quantizer and encoder circuits.
Modulation: Modulation principles and importance; definition and graphical representation; generation of modulated signals; mathematical expressions of modulated signals; frequency spectrum and bandwidth requirements of AM, FM, and PM; design and fabrication of AM, FM, and PM transmitter circuits.
Transmission Media and Channels: Types of transmission media and their properties; principles of information transmission through wires; coaxial cable, waveguide, optical fiber, and radio links; channel concept and classification; probability density function (PDF), cumulative distribution function (CDF), and moment generating function (MGF) of channel gain; modeling of fading channels; expressions for received signals; propagation delay; bandwidth; channel capacity and its classification; outage probability; bit error rate (BER) and symbol error rate (SER) with calculations.
Noise, Fading, Interference, and Correlation: Sources and characteristics of noise; signal-to-noise ratio and noise figure; types and measures of fading channels; types of interference and mitigation techniques; types of correlation and mitigation technologies; effects of noise, fading, interference, and correlation on transmission performance.
Digital Communication Link: Digital link concepts; design of digital communication links.
Receiver: Receiver types; elements of receivers and their functions; superheterodyne receiver; design and fabrication of matched filter circuits; analog, digital, and correlator receiver circuits; receiving antennas; channel state information at the receiver.
Demodulation and Decoding: Principles and importance of demodulation and decoding; demodulation and decoding of AM, FM, and PM signals; design and fabrication of AM, FM, and PM receiver circuits.

Text Books:

1. Matthew N. O. Sadiku, Elements of Electromagnetics

Reference Books:

1. David k. Cheng, Field and Wave Electromagnetics.

Course Code: EEE 3110 **Course Title: Independent Design Project** **Credits: 1.00**

Rationale of the Course: One of the core requirements for students majoring in Electrical and Electronic Engineering is to develop practical knowledge in designing and implementing electronic projects. This course aims to equip students with essential hands-on skills such as circuit design, coding for embedded systems, soldering techniques, and debugging. Through

project-based learning, students will gain a deeper understanding of how theoretical concepts are applied in real-world electronic systems, fostering creativity, problem-solving abilities, and innovation in hardware-based design.

Course Content:

Electronic Equipment and Measurement Devices: Acquaintance with various types of electronic equipment and measurement devices.
Component Identification: Study of resistor color codes, BJT, and MOSFET terminal identification.
Soldering Techniques: Understanding soldering and desoldering processes.
PCB Design: Study of basic PCB design software and circuit designing.
Arduino Programming: Learning Arduino software and project creation.
Microcontroller Basics: Introduction to basic microcontrollers and their implementation.
Project Design and Implementation: Designing and implementing projects based on given requirements.
Open Lab: Hands-on practical sessions and experimentation.

Text Books: Lab manual

Course Code: EEE 3201 Course Title: Power System Analysis Credits: 3.00

Rationale of the Course: This course is to provide fundamental knowledge for B.Sc. (EEE) students who wish to specialize in Power Engineering in their profession. It introduces the course participants to the overall structure of the electric power supply system, starting from power generation to power transmission and distribution. It includes basic concepts of power systems operation, fault analysis, and power systems protection techniques.

Course Content:

Power Network Representations: Per-unit (P.U.) method of performance calculation; P.U. impedance of three-winding transformers.
Power Flow Studies: Power flow in simple systems; load flow analysis of large systems using Gauss-Seidel method; control of voltage, power, and reactive power.
Recent Trends in Transmission Systems: Overview of Flexible AC Transmission Systems (FACTS), High Voltage DC Transmission (HVDC), and SCADA.
Symmetrical Faults: Symmetrical three-phase faults on synchronous machines; symmetrical components; sequence impedance and networks of generators, transformers, and lines; double line to ground fault analysis.
Unsymmetrical Faults: Single line to ground fault; line-to-line fault analysis.
Line Parameters: Inductance and capacitance of overhead power lines; equivalent circuit representation of short, medium, and long lines; single line and reactance diagrams; per-unit system representation.

Power System Stability: Stability problems; steady-state vs transient stability; swing equation and equal area criterion; solution methods; factors affecting transient stability; methods to improve stability.

Text Books:

1. Power System Analysis: William D. Stevenson and John J. Grainger

Reference Book:

1. Power System Analysis: V. K. Mehta
2. Power System Analysis: Hadi Sadat

Course Code: EEE 3202 Course Title: Power System Analysis Lab Credits: 1.50

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering, to develop the skill for analyzing instantaneous current, instantaneous power, Reduction of Bus Admittance Matrix, Unsymmetrical Phasors into Symmetrical Components.

Course Content: Sessional based on the theory course of EEE 3201.

Text Books: Lab Manual

Course Code: EEE 3203 Course Title: Industrial Electronics Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill for analyzing and designing the power converter circuits for various household, commercial and industrial applications.

Course Content:

Power Semiconductor Devices and Their Characteristics: Introduction to power diodes, power transistors, and thyristors; types and characteristics of diodes including general-purpose, fast recovery, Schottky, and silicon carbide diodes; analysis of reverse recovery behavior; study of MESFETs, IGBTs, and SITs with emphasis on steady-state and switching characteristics.
Rectifiers and Harmonics: Operation and analysis of single-phase rectifiers including half-wave, full-wave, and full-wave with RL load; comparative study of diode rectifiers; harmonic generation and mitigation techniques; examination of three-phase rectifiers including multi-phase star and bridge configurations with RL load; harmonics in three-phase systems and filtering methods.
Controlled Rectification and Power Conversion: Design and application of single-phase and three-phase controlled rectifiers; trigger circuit design; harmonic distortion and power quality considerations; exploration of DC-DC converters such as step-up (boost), step-down (buck),

and full-bridge types; switch mode regulators including boost, buck, buck-boost, and Cuk configurations.

Power Conditioning and Inverter Technology: Overview of power supplies including line disturbances, power conditioning equipment, uninterruptible power supplies (UPS), and harmonic suppression techniques; principles and applications of cyclo-converters; inverter technologies covering gate driver circuits for single-phase and three-phase systems; harmonics in inverter outputs and their mitigation; pulse width modulation (PWM) techniques including single pulse, multiple pulse, sinusoidal, and modified sinusoidal schemes aimed at harmonic reduction; advanced inverter topologies such as series and multilevel inverters.

Motor Drives and Industrial Applications: Drives for controlling the speed of DC, induction, and synchronous motors; industrial power electronic applications including variable frequency drives (VFDs), solid-state transformers, induction heaters, with emphasis on the harmonic impact on motor performance.

Text Books:

1. M.H. Rashid, Power Electronics– Circuit, Devices &Applications, Pearson.

Reference Book:

1. Ned Mohan, Power Electronics-Converters, Applications and Design, Wiley& Sons

Course Code: EEE 3204 Course Title: Industrial Electronics Lab Credits: 1.50

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill for analyzing and designing extended electronic circuitry. Designing different kinds of filters and multi-vibrators are the key aim of this course. After learning this course, a student will be able to implement those circuits in real life problem solving electronic devices.

Course Content:

Sessional based on the theory course of EEE 3203.

Text Books: Lab Manual

Course Code: EEE 3205 Course Title: Digital Signal Processing Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill for analyzing different types of digital signals and filters.

Course Content:

Discrete-Time Signals: Concept of discrete-time signals, basics of sampling and reconstruction, sampling theorem. Types of sequences including periodic, energy, power, unit-sample, unit step, unit ramp, and complex exponentials. Arithmetic operations on sequences.
Discrete-Time Fourier Transform (DTFT): Frequency concepts in discrete and continuous domains, relationship between radian and radian/sec. Frequency response of discrete systems. Representation of LTI systems in complex frequency domain.
Z-Transform: Definition and mapping between s-plane and z-plane, unit circle, convergence and region of convergence (ROC). Properties of Z-transform, examples with sequences. Characteristic signal families and ROC. Operations such as convolution, correlation, multiplication via Z-transform. Initial value theorem, Parseval's relation, inverse Z-transform by contour integration, power series and partial fraction expansions with examples.
Discrete Fourier Transform (DFT): Concepts and relations for DFT/IDFT, relationship between DTFT and DFT. Twiddle factors and properties. Computational complexity of direct DFT. DFT/IDFT as linear transformations and matrix methods. Multiplication of DFTs, circular convolution via graphical and matrix methods. Linear filtering using DFT. Aliasing error. Filtering of long data sequences using Overlap-Save and Overlap-Add methods with examples.
Fast Fourier Transform (FFT): Radix-2 algorithms including decimation-in-time (DIT) and decimation-in-frequency (DIF). Signal flow graphs, butterfly computations, bit reversal techniques, examples and exercises for DIT and DIF FFT butterflies.
Filter Design: Basics of IIR and FIR filters, difference equations. Design of Butterworth IIR analog filters using impulse invariant and bilinear transforms. Design of linear phase FIR filters: number of taps, rectangular, Hamming, and Blackman windows. Effect of quantization.
Digital Signal Processor (DSP): Overview of architecture and key instruction sets of TMS320C5416/6713 processors. Writing small assembly language programs.

Text Books:

1. Digital Signal Processing: Principles, Algorithms & Application, J.C. Proakis & M.G. Manslakis, PHI.

Reference Books:

1. Digital Signal Processing-A computer-based approach, S. Mitra, TMH
2. Fundamental of Digital Signal Processing using MATLAB, Robert J. Schilling, S.L. Harris, Cengage Learning.

Course Code: EEE 3206 Course Title: Digital Signal Processing Lab Credits: 3.00

Rationale of the Course: This lab provides engineering students practical experience in analyzing and processing signals, linking DSP theory to real-world applications. It equips students with skills to design and implement DSP systems used in telecommunications, multimedia, biomedical, and automation fields.

Course Content: Sessional based on the theory course of EEE 3206.

Text Books: Lab manual

Course Code: EEE 3207 Course Title: Communication Engineering II Credits: 3.00

Rationale of the Course: To provide students with fundamental knowledge of communication systems, including network architectures, OSI model layers, and the basics of mobile cellular communication (3G, 4G, 5G, and beyond).

Course Content:

Technologies at the Transmitting Side: Overview of multiplexing, beamforming, and coding techniques. Analog modulation methods including DSB-SC, DSB-WC, SSB-SC, SSB-WC, and VSB. Analog pulse modulation (PAM, PWM, PPM) and digital modulation techniques such as ASK, FSK, PSK, QAM, PCM, DPSK, and advanced modulations (MSK, GMSK, DPCM). Multiplexing principles and synchronization for TDM, FDM, CDM, SDM, WDM, SDH/SONET, and PDH. Beamforming types (analog, digital, switched, adaptive) including 5G applications. Coding techniques covering source coding, Huffman, block, convolution, and cyclic codes with error correction capabilities.
Technologies in the Transmission Media: Working principles of voltage, current, and power amplifiers, including audio, video, RF, and IF amplifiers. Relay technologies such as amplify-and-forward (AF), decode-and-forward (DF), and regenerative repeaters.
Technologies at the Receiving Side: De-multiplexing and multiple access techniques (TDMA, FDMA, CDMA, SDMA). Demodulation and noise performance of various modulation schemes. Diversity combining techniques (SC, MRC, EGC, SSC) and principles of linear and nonlinear equalization. Random access protocols like Aloha and Slotted Aloha.

Text Books:

1. Electronic Communication Systems: John F. Kenedy
2. Introduction to Data Communication and Networking: Behrouz A. Forouzan

Reference Books:

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

Course Code: EEE 3208 Course Title: Communication Engineering II Lab Credits: 1.50

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the knowledge about the microprocessors and microcomputer-based system design along with interfacing procedures of different interfacing devices with the existing microprocessors and microcomputer-based system.

Course Content: Sessional based on the theory course of EEE 3207.

Text Books: Lab manual

Course Code: EEE 3209 **Course Title: Power Plant Engineering, Environment and Ethics** **Credits: 3.00**

Rationale of the Course: This course is a core requirement for students majoring in Electrical and Electronic Engineering, aimed at developing foundational and practical knowledge in electrical power generation and energy conversion. It covers the principles and operation of various power generating plants, economic aspects of power generation, tariff structures, and the configuration of power supply systems. The course also introduces essential concepts such as bus-bar arrangements, short-circuit current control using reactors, and other critical elements necessary for efficient and reliable power system operation.

Course Content:

Fundamentals of Power Plant Engineering: Basics of energy, types of power plants, ethical considerations in energy use, fuel classifications, energy conversion efficiency, environmental and societal impacts of energy resource utilization.
Power Plant Technologies: Technical operation and challenges of steam (thermal), hydro-electric, diesel and gas turbine, and nuclear power plants; reactor design, nuclear waste disposal, safety protocols, environmental and ethical implications.
System Design and Load Management: Load variations in power plants, electric power system design principles, ethical aspects of energy efficiency, load curves, demand factors, economic aspects of power generation, tariff structures, cost optimization.
Performance and Sustainability: Key performance indicators—load factor, diversity factor, utilization factor; sustainable practices, efficient resource use in planning and operation of power systems.
Environmental and Ethical Responsibilities: Engineer's role in minimizing environmental degradation, professional ethics, accountability, sustainable decision-making in energy infrastructure development.

Text Books:

1. V.K Mehta, Pohit Mehta-Principles of Power System, 4th revised edition 2011, S. Chand.

Reference Books:

1. Power Plant Engineering by P. K. Nag.
2. Power Plant Engineering by A. K. Raja

Course Code: EEE 4101 Course Title: VLSI Circuits and Design Credits: 3.00

Rationale of the Course: This course introduces VLSI technology, focusing on designing analog and digital IC building blocks using CMOS technology. Students learn IC fabrication, CMOS logic design, layout techniques, and basics of Verilog and FPGA design. It prepares students for real-world applications like microprocessors, mobile devices, and embedded systems.

Course Content:

Introduction to VLSI Design & MOS Transistor: Integrated circuits trends, choice of technology, design approaches, design process, Moore's Law, VLSI design style, overview of design tools. MOS device structure, MOS capacitor, modes of operation, threshold voltage, body effect, NMOS & PMOS operation modes, I-V equations and characteristics.
NMOS & CMOS Inverters: Principle of inverters, NMOS inverter with resistor load, NMOS enhancement & depletion transistor loads, CMOS inverter, transfer characteristics, noise margin, rise and fall times, propagation delay, switching characteristics, gate transistor sizing, power consumption, NMOS pass transistor and CMOS pass gate circuits, buffer chain design.
IC Fabrication Technology: MOS, NMOS and CMOS processes, wafer processing, photolithography, oxidation, etching, ion implantation, metallization, yield, electrical parameters, scaling, design rules, resistance and capacitance estimation, layout matching, stick diagrams, area estimation, reliability issues (latch-up, electromigration).
MOS Logical Circuit Design: Combinational, sequential, random logic circuits; basic NMOS and CMOS gates; synthesis of complex CMOS gates; pass transistor and transmission gate logic; pseudo-NMOS, dynamic logic, clocked CMOS and domino logic; structured design examples including parity generator, bus arbitration logic, multiplexers, PLA design; clocked sequential circuit design, shift registers, latches, flip-flops.
Subsystem Design: 4-bit arithmetic processor, bus architectures, shifter, general purpose ALU design.
Memory Elements Design: System timing considerations; three-transistor and one-transistor dynamic memory cells; pseudo-static RAM/register cells; 4-transistor dynamic and 6-transistor static CMOS memory cells; 4x4 bit register array; 16-bit static CMOS memory array.
FPGA & Verilog Design: Introduction to FPGA, design flow, architecture, interconnection frameworks, SRAM, anti-fuse, EPROM, EEPROM programming technologies; FPGA implementation of modulo-4 counter; Xilinx FPGAs, Altera CPLDs. Verilog history, applications, benefits, coding style; Verilog models of basic gates, half and full adders, counters, flip-flops, basic RAM.

Textbook:

1. Design of VLSI Systems – A Practical Introduction by Linda E. M. Brackenbury

Reference Books:

1. A Circuits and Systems Perspective (4th Ed.) – Neil Weste, David Harris
2. A Design Perspective (2nd Ed.) – Jan Rabaey, Anantha Chandrakasan, Borivoje Nikolic

Course Code: EEE 4103 Course Title: Control System Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the knowledge of applying controller on physical systems. Understanding the dynamics of a physical system and representing the system in both frequency and time domain along with the controlling of the system are the key aim of this course. After learning this course, a student will be able to use the appropriate controller and optimizing the control parameters.

Course Content:

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, Block diagram, 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 Nichol's 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.

Text Books:

1. Control System by Norman S. Nise.

Reference Book:

1. Automatic Control System by S Hasan Saeed.
2. Modern Control Engineering by Katsuhiko Ogata

Course Code: EEE 4104 Course Title: Control System Lab Credits: 1.50

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the knowledge of how to model a system and how to analyze the system property as well as to control the system with employing control technique.

Course Content: Sessional based on the theory course of EEE 4103.

Text Books: Lab Manual

Course Code: EEE 4105 Course Title: Microprocessors and Embedded Systems Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the knowledge about the microprocessors and embedded system design along with interfacing procedures of different interfacing devices with the existing microprocessors and microcomputer-based system.

Course Content:

Introduction to Basic Computer System: Overview of computer system architecture, bus architecture, basics of memory system, central processing unit (CPU) overview, read-write concepts, pipeline and non-pipeline architectures.
Introduction to 8085 and 8086 Microprocessors: Analysis of schematic diagrams, differences between 8085 and 8086 microprocessors. 8086 Microprocessor Architecture: Study of 8086 registers, flag registers, and related arithmetic operations.
Memory Addressing: Logical and physical addresses and related calculations.
8086 Instruction Set and Addressing Modes: Basics of instructions, addressing modes, and problem-solving using 8086 instruction sets. Introduction to 8086 machine code formats; conversion of assembly language programs and instructions to machine code
Comparison of Microprocessors: Features of 80186, 80286, 80386, and 80486; pin diagram and functional description of 8086 microprocessor pins and signals.
Interfacing and Programmable Devices: Introduction to interfacing basics; 8253/8254 Programmable Interval Timer (PIT), its features, pin diagram, read/write logic, control word generation, and mode-based problem solving.
8255 Programmable Peripheral Interface (PPI): Functional description, read/write logic, control word generation, and practical problem solving.
Advanced Architectures and Embedded Systems: Von Neumann and Harvard architectures; memory and I/O interfacing; FPGA/ASIC-based specialized logic design; software development under real-time constraints.
Hardware-Software Integration: Real-time scheduling, device drivers, system modeling, performance optimization (speed, power, area), and rigorous testing on platforms like microcontrollers, PLCs, and FPGAs.

Text Books:

1. Mohamed Rafiquzzaman, PH.D. - Microprocessors and Microcomputer-Based System Design.

Reference Books:

1. Digital Design & Computer Architecture by David Haris, Sarah L. Haris.

Course Code: EEE 4106 Course Title: Microprocessors and embedded Systems Lab Credits: 1.50

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the knowledge about the different microprocessor kits as well as how to solve some real time problems.

Course Content: Sessional based on the theory course of EEE 4105.

Text Books: Lab Manual

Course Code: EEE 4100 Course Title: Capstone Project Part I Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to achieve the concept of self-reliance, how to develop initiative, writing research thesis and project.

Course Content:

Literature Review and Problem Identification: Study relevant literature to identify gaps and define the research problem clearly.
Project Proposal Writing: Prepare a detailed proposal outlining objectives, methodology, scope, timeline, and expected outcomes.
Development of Project Idea: Refine and develop the project concept into a workable plan with clear deliverables and milestones.
Preparation for Presentation on Project Progress: Prepare and deliver progress presentations demonstrating work done, challenges, and future plans.

Course Code: EEE 4201 Course Title: Switchgear and Protection Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to study Power system and its branches. Switchgear & Protection is one of the branches of power system. Students need to study it to know about nature of various types of protection against various types of faults in Power system.

Course Content:

Introduction to Switchgear: Introduction to switchgear, essential features, switchgear equipment, bus bars, bus-bar arrangements, switchgear accommodation, faults, short-circuits, short-circuit currents, and faults in power systems.
Fuses: Desirable characteristics of fuse elements, fuse element materials, important terms, low voltage fuses, high voltage fuses, and current carrying capacity calculation of fuse elements.

Protective Relays: Fundamental requirements of protective relays, relay voltage ratings (high, medium, and low), basic protective zones, relaying schemes, basic relays, electromagnetic attraction relays, induction relays, relay timing, important terms, time/P.S.M. curve, calculation of relay operating time, relay types including induction type non-directional and directional overcurrent relay, directional power relay, distance or impedance relay, differential relay, and voltage balance differential relay.
Circuit Breakers: Operating principles of circuit breakers, arc phenomenon, arc extinction principles and methods, important terms, types of circuit breakers including O.C.B., air blast C.B., SF6 C.B., vacuum C.B., switchgear components, problems of circuit interruption, resistance switching, circuit breaker rating, and related mathematical problems.
Protection of Alternators and Transformers: Various protections for alternators including differential and interturn protection with related mathematics; transformer protections including Buchholz's relay; protection of bus bars, transmission lines, feeders, and relay testing.
Overvoltage Protection: Surge absorbers, lightning arresters, horn gaps, their ratings and testing.
Static Relays: Introduction to solid-state devices in the construction of static relays and different types of static relays.
Power System Substation Design: Design of a power system substation showing all kinds of protecting devices with proper connections.

Text Books:

1. **"**Principles of Power System" by V.K. Mehta.
2. "Power System Protection and Switchgear" by Oza, Nair, Mehta & Makwana

Reference Book:

1. Switchgear and protection: Theory, practice and solved problems by S. S Rao.

Course Code: EEE 4202 Course Title: Switchgear and Protection Lab Credits: 1.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to analyze Power system and its branches. Switchgear & Protection is one of the branches of power system. Students need to study it to know about nature of various types of protection against various types of faults in Power system.

Course Content: Sessional based on the theory course of EEE 4201.

Text Books: Lab Manual

Course Code: EEE 4204 Course Title: Industrial Attachment Credits: 1.00

Rationale of the Course: This course is one of the core requirements for students majoring in Electrical and Electronic Engineering. It is designed to help students develop practical skills through training in relevant industrial sectors. The industrial attachment allows

students to apply theoretical knowledge in real-world settings, gain hands-on experience, and understand professional work environments.

Course Content:

Orientation & Briefing: Introduction to industrial attachment objectives, expectations, and guidelines.
Industrial Attachment in Assigned Organization: Practical training and work experience in the assigned industrial sector.
Report Writing & Presentation: Preparation and submission of attachment report followed by presentation on the industrial experience.

Course Code: EEE 4200 Course Title: Capstone Project Part II Credits: 3.00

Rationale of the Course: This course is one of the core requirements for students majoring in Electrical and Electronic Engineering. It is designed to help students develop the skills required for conducting independent research, writing technical and academic reports, and applying various engineering methodologies. Through this course, students gain hands-on experience in solving real-world problems using innovative, cost-effective, and sustainable approaches. It also emphasizes

Course Content:

Completion of Project: Finalize all aspects of the project, ensuring all design, development, and testing phases are complete and the solution meets the specified requirements.
Dissertation Writing: Prepare a comprehensive dissertation documenting the research process, methodologies, design, implementation, results, and conclusions.
Preparation for Project Presentation: Organize and rehearse the project presentation, focusing on clear communication of objectives, methods, outcomes, and significance to an academic or professional audience.

ELECTIVE COURSE I

Course Code: EEE 4141 Course Title: High Voltage Engineering Credits: 3.00

Rationale of the Course: One of the core requirements for the students in Electrical and Electronic Engineering to develop the knowledge about HVAC and HVDC. Also, the branches and equipment of the system.

Course Content:

Introduction: High voltage engineering — its importance, classification, and scope. Overview of electric field classifications and electrode configurations.

Breakdown Mechanisms of Materials: Study of electric breakdown in gases, including Townsend's first and second ionization coefficients, Townsend's spark formation criterion, streamers, Paschen's law, Penning effect, corona discharges, time lag, and power loss due to corona. Examination of electronegative gases and breakdown in solid and liquid dielectrics. Applications of gases in high voltage systems.

Generation of Power Frequency High Voltage: Methods for generating high DC voltages using rectifiers, electrostatic generators, and voltage multipliers. Generation of high AC voltages through cascaded transformers and resonant circuits.

Generation of High Frequency Voltage and Currents: Characteristics of impulse wave shapes and standards. Design and operation of single- and multistage impulse generators, including impulse current generators.

Measurement of High Voltage and Currents: Techniques and devices such as sphere gaps, uniform field spark gaps, rod gaps, electrostatic voltmeters, generating voltmeters, peak voltmeters, voltage dividers, and Rogowski coils.

High Voltage Testing: Procedures for destructive and non-destructive testing of power cables, power capacitors, overhead line insulators, power transformers, circuit breakers, and insulating oil. Measurement of insulating resistance, loss tangent, and partial discharge.

Overvoltage Phenomena and Insulation Coordination: Analysis of lightning and switching surges, formation of lightning strokes, and protective devices such as surge absorbers, surge diverters, and lightning arresters. Concepts of Basic Insulation Level (BIL), Switching Impulse Level (SIL), and insulation coordination.

Text Books:

1. High Voltage Engineering by C.L. Wadhwa.

Reference Books:

1. High Voltage Engineering by M S Naidu, V Kamaraju
2. An Introduction to High Voltage Engineering by Subir Ray

Course Code: EEE 4143 Course Title: Power System Operation and Control Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the knowledge of power system operation and control.

Course Content:

Principles of Power System Operation: Overview of SCADA systems and the transition from conventional to competitive power system environments.
Unit Commitment and Static Security Analysis: Scheduling generation units efficiently while ensuring system stability under static conditions.
State Estimation: Techniques to estimate the current operating state of the power system accurately for reliable operation.
Optimal Power Flow: Methods to determine the most efficient generation dispatch while satisfying system constraints.
Automatic Generation Control and Dynamic Security Analysis: Control strategies to balance generation and load in real-time, ensuring system security during dynamic changes.
Voltage Security Analysis: Assessment of voltage stability to prevent voltage collapse in the power system.
Supervisory Control and Data Acquisition: Integration of monitoring and control for efficient and secure system management.
Ancillary Services: Support functions such as frequency control and reserve management essential for reliable power system operation.

Text Books:

1. Power Generation, Operation and Control: A. J. Wood, B. F. Wallenberg and G. B. Sheblé

Reference Books:

1. Power System Stability and Control: L. L. Grigsby

Course Code: EEE 4145 Course Title: Power System Protection Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the concept of power system protection which includes protecting transformers, power lines using different strategies.

Course Content:

Philosophy of Switchgear and Protection: Understanding the fundamental purpose of switchgear in power systems and the principles behind protective devices.
Circuit Breakers: Operating principles of arc extinction in DC and AC circuit breakers, including recovery voltage, rate of rise of recovery voltage, and transient phenomena such as switching surges. Topics also cover disconnection of unloaded transformers and transmission lines, and circuit breaker speed.
Types and Testing of Circuit Breakers: Construction, operation, ratings, and testing of bulk oil, minimum oil, SF6, ABCB, ACB, and VCB circuit breakers, along with guidelines for their selection.
Travelling Waves and Surge Protection: Analysis of travelling waves in transmission lines and protective devices such as surge absorbers, lightning arresters, and horn gaps, including their ratings and testing procedures.
Protective Relaying: Overview of relay voltage ratings across high, medium, and low voltages; basic protective zones and relaying schemes.
Electromechanical Relays: Principles and general equations for various relays including overcurrent, balanced current, overvoltage, distance, directional, positive sequence, negative sequence, and differential relays, with their practical applications.
Static Relays: Introduction to solid-state devices in static relays and different types of static relays used in modern protection systems.
Generator and Transformer Protection: Specific protection schemes including Buchholz relay, protection of bus bars, transmission lines, feeders, and associated relay testing.

Text Books:

1. Fundamentals of Power System Protection: Y. G. Paithankar, S. R. Bhide

Course Code: EEE 4147 Course Title: Nuclear Power Engineering Credits: 3.00

Rationale of the Course: This course provides a foundational understanding of nuclear engineering, covering topics such as radioactivity, nuclear fission and fusion, reactor operations, safety, and socio-economic impacts. It highlights the diverse applications of nuclear technology in fields like medicine, energy, agriculture, and industry. By completing this course, students will be well-prepared for advanced topics in power plant engineering, nuclear power systems, and project management.

Course Content:

Basic Concepts: Overview of nuclear energy, structure of atoms and nuclei, principles of radioactivity, nuclear processes including fission and fusion.
Nuclear Systems: Study of particle accelerators, isotope separators, neutron chain reactions, and various reactor types.

Nuclear Power Generation: Layout and operation of Nuclear Power Plants (NPPs), including pressurized water reactors, boiling water reactors, CANDU reactors, gas-cooled reactors, liquid metal-cooled reactors, breeder reactors, auxiliaries, instrumentation, and control systems.
Grid Interconnection Issues: Impact of frequency and voltage fluctuations on NPP operation and grid stability.
Advanced Nuclear Technologies: Exploration of next-generation reactors such as very high temperature reactors, biological effects of radiation, and reactor safety and security measures.
Case Studies: Analysis of major nuclear incidents—Three Mile Island, Chernobyl, and Fukushima—along with discussions on fuel cycles and radioactive waste disposal.

Textbook:

1. Lamarsh, J.R., and Baratta, A.J. Introduction to Nuclear Engineering, 3rd Edition, Prentice Hall, 2001.

Reference Books:

1. Rust, J.H. Nuclear Power Plant Engineering, Haralson, 1979.
2. Glasstone, S., and Sesonske, A. Nuclear Reactor Engineering: Reactor Design Basics, 4th Edition, Elsevier, 1996.
3. Shultis, J. Kenneth, and Faw, Richard E. Fundamentals of Nuclear Science and Engineering, 3rd Edition, CRC Press, 2016.

Course Code: EEE 4149 **Course Title: Smart Grids** **Credits: 3.00**

Rationale of the Course: This course addresses the global shift in electric power systems towards decarbonization, modernization, and smarter management using advanced technologies. It introduces key smart grid concepts such as Smart Grid Architecture Model (SGAM), Virtual Power Plants (VPP), Demand Response (DR), Advanced Metering Infrastructure (AMI), and Distribution Automation (DA). The course covers essential communication and security protocols (e.g., TCP/IP, IEC 61850, Modbus) and power electronic devices and energy storage systems like D-STATCOM and Li-ion batteries. Upon completion, students will understand the evolution of power networks and smart cities, preparing them to contribute to efficient, sustainable power systems in their careers.

Course Content:

The Smart Grid: Covers the definition, structure, and implementation of Smart Grids, including SGAM (Smart Grid Architecture Model), and national initiatives. Discusses early models such as Active Distribution Network, Virtual Power Plant, and IntelliGrid. Introduces key enabling technologies including ICT, sensing, control, power electronics, and energy storage systems.
Information and Communication Technologies (ICT): Focuses on various communication channels (wired, optical fiber, radio, satellite), switching techniques, layered communication

models (OSI, TCP/IP), and widely used smart grid communication protocols (IEEE 802, Modbus, DNP3, IEC 61850).

Information Security: Introduces fundamental concepts of encryption (symmetric and public key), authentication mechanisms, and digital signatures. Covers cybersecurity standards relevant to the smart grid environment including IEEE 1686 and IEC 62351.

Smart Meters and Demand-Side Integration (DSI): Explains the construction of smart meters, their signal processing capabilities, and communication interfaces with HAN, NAN, and WAN. Covers smart metering protocols and demand-side integration techniques including DSM, DR, and DSP along with hardware and implementation strategies.

Distribution Automation (DA) and Distribution Management System (DMS): Describes substation components such as CTs, VTs, IEDs, and RTUs. Focuses on automation strategies like fault isolation and voltage regulation. Details the structure and components of DMS, including SCADA systems, outage management, and distributed energy resources (DER) operations.

Power Electronics and Energy Storage Systems: Discusses major power electronic devices like VSC, CSC, FCLs, D-STATCOM, TCR, TSC, TSSC, and UPFC. Introduces various energy storage technologies including flywheels, supercapacitors, batteries (lead-acid, Li-ion, NaS), and fuel cells.

AI in Smart Grids: Covers the application of artificial intelligence in smart grids for load classification, forecasting, theft and fault detection, intelligent scheduling, and efficiency improvement. Also introduces cybersecurity measures using AI and the potential role of blockchain technology in smart grids.

Textbooks

1. Ekanayake, Janaka B., et al., Smart grid: technology and applications. John Wiley & Sons, 2012.

Reference books

1. Biswarup Das, Power Distribution Automation, IET.
2. Hadi Saadat, Power System Analysis, McGraw-Hill, 1999.
3. Power Electronics: Circuits, Devices, and Applications, Muhammad H. Rashid, International Edition.
4. Mohan, Undeland, Robins, Power Electronics, 3rd Edition, John Wiley & Sons.
5. R. Krishnan, Electric Motor Drives – Modeling, Analysis, and Control.

Course Code: EEE 4151 **Course Title: Electronic Drives and Controls** **Credits: 3.00**

Rationale of the Course: This course introduces the fundamentals of electric drive systems used to control motor speed, torque, and direction. It focuses on their applications in industries and households, covering starting, braking, and speed regulation. Students will gain knowledge of machine behavior and control techniques for variable speed and position-based operations.

Course Content:

Components of Electrical Drives: Electric machines, power converters, controllers; dynamics of electric drives; torque equation; equivalent values of drive parameters; components of load torque; types of loads; four-quadrant motor operation; steady-state stability; load equalization; motor duty classes; determination of motor rating.
DC Motor Drives: DC motors and their performance, braking methods, transient analysis of separately excited DC motors; converter control with 1-phase and 3-phase inputs; analysis of separately excited and series motors; chopper-controlled DC drives; converter ratings; closed-loop control.
Control System Modeling: Transfer functions of DC motors; linear models of power converters; sensing and feedback elements; current and speed control loops; P, PI, and PID controllers; system response comparisons; simulation of converter and chopper-fed DC drives.
Induction Motor Drives: Stator voltage control; torque-slip characteristics; operations with different loads; V/f control; scalar and vector control; direct torque and flux control; current and slip control; harmonic effects and mitigation; slip power recovery.
Synchronous Motor Drives: Speed control methods; adjustable frequency operations; principles of synchronous motor control; VSI drive with open-loop control; self-controlled synchronous motor using electronic commutation or load-commutated inverters.
Stepper and Special Motor Drives: Hybrid, variable reluctance, and permanent magnet stepper motors; full-step, half-step, and micro-stepping operations; switched reluctance motors (SRM); brushless DC (BLDC) and permanent magnet synchronous motors (PMSM); drive controller design.
Harmonics: Study of input harmonics and their impact on power grids; input filter design; output harmonics and their effects on connected rotating machines; design considerations for harmonic mitigation.

Textbooks

1. Fundamental of Electrical Drives, G.K. Dubey, New Age International Publication.

Reference Books:

1. R. Krishnan, *Electric Motor Drives: Modeling, Analysis, and Control*, Prentice Hall, 2001.
2. Bimal K. Bose, *Modern Power Electronics and AC Drives*, Prentice Hall, 2002.
3. Vedam Subrahmanyam, *Electric Drives*, McGraw Hill Education, 2010.
4. Ion Boldea, *Electric Drives*, CRC Press, 2006.
5. M. H. Rashid, *Power Electronics: Circuits, Devices, and Applications*, Pearson, 2013.

Course Code: EEE 4153 Course Title: Industrial Automation system Credits: 3.00

Rationale of the Course: The course aims to build a strong foundation in Industrial Automation by combining theoretical knowledge with hands-on experimentation and real-life problem-solving. It enables students to understand industrial instrumentation and actuation, design and implement classical automation systems (e.g., relay-based), and gain familiarity with microcontroller, PLC, DCS, and SCADA-based systems used in manufacturing and process industries. This course prepares students for practical engineering roles in the industrial sector.

Course Content:

Automation in Manufacturing Industries: Introduction to automation in production systems, principles and strategies of automation, basic elements of automated systems, advanced automation functions, and levels of automation. Covers automated flow lines, transfer mechanisms, analysis of transfer lines without and with storage buffers.

Material Handling and Identification Technologies: Overview of material handling systems, types of material handling equipment, conveyor systems, automated guided vehicles (AGVs), automated storage systems, interfacing handling and storage with manufacturing, and an introduction to automatic identification methods.

Automated Manufacturing Systems: Components and classification of manufacturing systems, cellular and flexible manufacturing systems (FMS), planning and implementation of FMS, automated assembly systems including design and analysis of single and multi-station machines.

Automation in Process Industries: Covers computer-based industrial automation including Direct Digital Control (DDC), Distributed Control System (DCS), and SCADA architectures. SCADA applications include RTUs, pumping stations, evacuation processes, mass flow and other meters, leak detection, and pipeline automation.

Programmable Logic Controller (PLC): Block diagram and architecture of PLCs, PLC programming languages and instruction sets, alarm and interlock design, PLC networking, and safety considerations with industrial case studies.

Process Safety Automation: Process safety integration through PLCs, linking safety PLCs with DCS, and applying international standards in process safety control systems.

Usage of Microcontrollers in Industrial Automation: Introduction to microcontrollers and their application in automation tasks.

Distributed Control System (DCS): Architecture of Local Control Units (LCUs), interfacing issues, DCS design and networking strategies, and security considerations.

Communication Protocols: Overview of industrial protocols like Profibus, Fieldbus, and HART; data acquisition, real-time monitoring, historian systems, integration of business-process data, and RTUs vs. PLCs/DCS.

Textbooks

1. M.P.Groover, "Automation, Production Systems and Computer Integrated Manufacturing", 5th Edition, Pearson Education, 2009.

ELECTIVE COURSE II

Course Code: EEE 4251 Course Title: Solid State Devices Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the knowledge regarding the operations of solid-state devices.

Course Content:

Semiconductors in Equilibrium: Covers energy band structure, intrinsic and extrinsic semiconductors, Fermi level positioning, carrier (electron and hole) concentrations, and their temperature dependence. Discusses the invariance of the Fermi level in equilibrium conditions.
Carrier Transport Mechanisms: Introduces drift and diffusion processes, generation and recombination of excess carriers, built-in electric fields, Einstein relations, and the continuity and diffusion equations for both holes and electrons. Includes quasi-Fermi level concept under non-equilibrium.
PN Junction: Describes basic PN junction structure and equilibrium properties including contact potential, equilibrium Fermi level, and space charge region. Explains non-equilibrium behavior such as forward and reverse bias, carrier injection, and majority/minority carrier currents. Also includes transient and small-signal AC response of PN junctions.
Metal-Semiconductor Junction: Discusses energy band diagrams, formation of rectifying (Schottky) and ohmic contacts, and their characteristics in semiconductor devices.
MOS Structure and MOSFET: Covers MOS capacitor structure and operation, energy band diagrams, flat-band and threshold voltages, and how threshold voltage can be controlled. Explains static C–V characteristics and qualitative theory of MOSFET operation including the body effect and I–V characteristics.

Text Books:

1. Solid State Electronic Devices: B. G. Streetman

Reference Books:

1. Electronics Materials and Devices: D. K. Ferry and J. P. Bird

Course Code: EEE 4253 Course Title: Wireless Communication Credits: 3.00

Rationale of the Course: This course introduces the fundamental concepts and technologies underlying modern wireless communication systems. It covers radio wave propagation, modulation techniques, cellular systems, wireless standards, and advanced topics like MIMO, OFDM, and wireless security. Students will gain both theoretical knowledge and practical understanding essential for designing and analyzing wireless communication networks.

Course Content:

Introduction to Wireless Communication: Covers fundamental principles of wireless communication systems, including electromagnetic wave propagation, path loss models, and characteristics of fading channels such as Rayleigh and Rician fading.
Modulation Techniques: Introduces analog and digital modulation schemes including AM, FM, PSK, QPSK, and QAM. Discusses error performance of these schemes in fading channel environments.
Cellular Concepts: Explains core concepts such as frequency reuse, cell splitting, handoff techniques, co-channel interference, system capacity, and the concept of trunking to manage resource allocation.
Multiple Access Techniques: Discusses various multiple access methods including FDMA, TDMA, CDMA, and OFDMA. Also includes an overview of the evolution and features of 4G and 5G mobile communication standards.
Advanced Wireless Communication: Introduces advanced technologies such as MIMO systems, Orthogonal Frequency Division Multiplexing (OFDM), spatial and temporal diversity techniques, and channel coding methods for error correction.
Wireless Security and Emerging Technologies: Outlines basic wireless security principles, threats, and protection mechanisms. Introduces Wireless Sensor Networks (WSNs) and discusses emerging trends in wireless communication such as IoT integration and AI-driven network optimization.

Text Books:

1. Theodore S. Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Prentice Hall, 2002.

Reference Books:

1. Simon Haykin and Michael Moher, *Modern Wireless Communications*, Pearson.
2. Andrea Goldsmith, *Wireless Communications*, Cambridge University Press, 2005.
3. William Stallings, *Wireless Communications & Networks*, 2nd Edition, Pearson.

Course Code: EEE 4255 Course Title: Optoelectronics Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the knowledge of electromagnetism, light amplification, photonics and optoelectronics devices.

Course Content:

Optical Properties in Semiconductors: Covers the behavior of semiconductors under light, including direct and indirect band-gap materials. Discusses radiative and non-radiative recombination, optical absorption, photo-generated excess carriers, minority carrier lifetime, luminescence, and quantum efficiency in radiation processes.

Properties of Light: Introduces both the particle and wave nature of light. Discusses key phenomena such as polarization, interference, diffraction, and blackbody radiation that are essential to understanding light interaction with materials.
Light Emitting Diodes (LEDs): Explains the working principles of LEDs, types of materials used for visible and infrared emissions, internal and external quantum efficiencies, loss mechanisms, device structures, and techniques for coupling LEDs to optical fibers.
Photo-Detection Devices: Describes photoconductors, junction photodetectors, PIN photodiodes, avalanche photodiodes, and phototransistors. Focuses on their working principles and performance characteristics.
Stimulated Emission and Light Amplification: Covers the principles of spontaneous and stimulated emission, Einstein relations, conditions for population inversion, absorption of radiation, and the basics of optical feedback and threshold conditions necessary for lasing action.

Text Books:

1. Optoelectronics & Photonics: Principles & Practices 2nd Edition by Safa Kasap

Reference Books:

1. Semiconductor Optoelectronic Devices: P. Bhattacharya

Course Code: EEE 4257 Course Title: Biomedical Engineering Credits: 3.00

Rationale of the Course: One of the most important elective courses for the students majoring in Electrical and Electronic Engineering to develop the skill for analyzing different types of biomedical equipment.

Course Content:

Introduction to Biomedical Engineering and Human Physiology: Overview of biomedical engineering principles with a focus on human body physics, including cellular structure, body fluids, and key physiological systems such as the respiratory, circulatory, and nervous systems. Topics include membrane potentials, nerve signals, and blood pressure measurement.
Human Body as a Control System and Radiation Interaction: Understanding the body's physiological control mechanisms and the interaction of electromagnetic radiation with living tissue. This includes biological effects of ionizing radiation, dosimetry, radiation protection, and electromagnetic interference with medical electronics.
Biomedical Instrumentation and Sensors: Study of essential biomedical devices such as biopotential electrodes, microelectrodes, sensors, transducers, and amplifiers, along with analytical instruments like colorimeters, pH meters, chromatographs, and spectrophotometers.
Medical Imaging Techniques: Fundamentals of diagnostic imaging including X-ray production and image contrast, ultrasound imaging with its physical principles and Doppler flow detection, and computed tomography with voxel reconstruction.
Electrocardiography (ECG): overview of ECG signal.

Text Books:

1. Introduction to Biomedical Engineering by John D. Enderle
2. Introduction to Biomedical Imaging by Andrew Webb

Reference Book:

1. Analysis & Applications of Analog Electronic Circuits in Biomedical Instrumentation by Robert B. Northrop

Course Code: EEE 4259 **Course Title: Nanotechnology and Nanoelectronics** **Credits: 3.00**

Rationale of the Course: This course introduces students to the fundamentals of nanoscience and nanoelectronics, focusing on material properties, fabrication techniques, and applications. It covers nanoscale devices such as resonant-tunneling diodes, transistors, and single-electron devices, along with nanowires, nanotubes, and low-power technologies. The course prepares students for advanced research in nanoelectronics, semiconductors, and nanosensors.

Course Content:

Types of Nanotechnology and Nanomaterials: Overview of nanotechnology classifications, molecular nanotechnology concepts, and various methods for preparing nanomaterials.
Basics of Fabrication Techniques: Introduction to fabrication and processing industries; wafer manufacturing; deposition methods including evaporation, sputtering, chemical vapor deposition (CVD), and epitaxy; wet and dry etching; photolithography; electron beam lithography; and stamp technology.
Fabrication of Nanoparticles: Chemical and organic synthesis methods, self-assembly processes, and other nanoparticle fabrication techniques.
Nanotools and Characterization Techniques: Use of advanced instruments such as scanning tunneling microscopes (STM), atomic force microscopes (AFM), electron microscopes, and fluorescence-based measurement techniques for nanoscale characterization.
Nanoelectronics: Fundamentals of quantum mechanics including the Schrödinger equation and particle-in-a-box model; band theory of solids; relevance of nanoelectronics; Moore's Law and the ITRS roadmap.
Nanostructure-Based Electronic Devices: Principles and applications of quantum tunneling, resonant tunneling diodes, quantum cascade lasers, and single-electron transistors, including Coulomb blockade phenomena.

Text Books:

1. Nanotechnology and Nanoelectronics Materials, Devices, Measurement Techniques by W. R. Fahrner

Reference Books:

1. K. E. Gonsalves, *Nanostructures and Nanomaterials: Synthesis, Properties and Applications*, Cambridge University Press, 2017.
2. S. M. Sze and K. K. Ng, *Physics of Semiconductor Devices*, 3rd Edition, Wiley, 2006.

Course Code: EEE 4261 Course Title: Analog Integrated Circuit Credits: 3.00

Rationale of the Course: Analog circuits are essential for processing real-world signals in communication, control, and power systems. With increasing integration in mixed-signal and system-on-chip designs, knowledge of analog and VLSI circuit design is vital for EEE students. This course provides exposure to modern analog IC design techniques, CAD tools, and their applications in communications, data conversion, instrumentation, and power management. It also complements advanced courses in VLSI, nanoelectronics, and optoelectronics, preparing students for careers in the semiconductor industry.

Course Content:

Analog IC Design: Overview of Bipolar, MOS, and BiCMOS IC technologies, their impact on design, the eggshell analogy, application areas, and future trends in analog IC design.
Transistor Review: Large and small signal models; compact models for Bipolar, FET, and BiCMOS transistors; design of amplifiers with passive and active loads; Cascode stages.
Current Sources and Mirrors: Design of multiple current sources and sinks using Bipolar and FET technologies; basic, cascode, and active current mirrors; effects of channel modulation, transistor mismatch, and aspect ratio errors; Wilson current mirror.
Voltage and Current References: Techniques for supply voltage and temperature-independent biasing; band-gap references; constant-Gm biasing; wide band-gap voltage references.
Differential Pairs: Differential versus single-ended amplifier operations; differential and common-mode voltages; common-mode rejection ratio (CMRR); input common mode range (ICMR); transfer characteristics; small signal and frequency response analysis.
High-Gain Amplifiers: Design and analysis of operational amplifiers (Op Amps) using BJTs and FETs; hierarchy of analog integrated circuits within Op-Amps; internal IC Op-Amp structure; high-performance Op-Amps.

Text Books:

1. Razavi B. Design of analog CMOS integrated circuits. Tata McGraw-Hill Education; January 1, 2017.

R**eference Books:**

1. Allen PE, Holberg DR. CMOS analog circuit design. Elsevier; 2011.
2. Jaeger RC, Blalock TN. Microelectronic circuit design. New York: McGraw-Hill; 1997.

ELECTIVE COURSE III

Course Code: EEE 4261 **Course Title: Optical Fiber Communication** **Credits: 3.00**

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the knowledge of optical fiber communication including propagation characteristics and capacity of the system.

Course Content:

Introduction: Historical perspective on fiber optics, basic system components, nature of light, advantages, and applications of fiber optic technology.
Optics Review: Ray theory and its applications, lenses, imaging principles, numerical aperture, and diffraction phenomena.
Light Wave Fundamentals: Electromagnetic wave properties, dispersion, polarization, resonant cavities, reflection at plane boundaries, and critical angle concepts.
Integrated Optic Waveguides: Slab waveguide structure, modes in symmetric and asymmetric waveguides, coupling mechanisms, dispersion, and distortion; overview of integrated optic components.
Optic Fiber Waveguides: Step-index and graded-index fibers, attenuation factors, pulse distortion, information rate limitations, fiber construction, and cable design.
Light Sources: Characteristics and applications of LEDs, laser diodes (LD), distributed feedback lasers, optical amplifiers, fiber lasers, and vertical cavity surface emitting lasers (VCSELs).
Optical Networks, Interfaces, and Protocols: Necessity of optical data communication networks alongside conventional systems; overview of conventional data systems; Optical Fiber LANs and physical layer design; Synchronous Optical Network (SONET); Fiber Distributed Data Interface (FDDI-1 and FDDI-2), including topology, standards, protocols, construction, and performance analysis; FDDI's role in extended LAN environments.
Couplers and Connectors: Principles of connectors, end preparation, splicing techniques, source coupling; network distribution components including directional couplers, star couplers, switches, isolators, wavelength division multiplexing (WDM), and fiber Bragg gratings.
Modulation Techniques: LED and LD modulation methods; analog and digital modulation formats; optical heterodyne receivers; noise sources (thermal, shot noise), signal-to-noise ratio (SNR), error rates, and receiver circuit design.
System Design: Analog and digital fiber optic system design principles, with real-life problem-solving examples.

Text Book:

1. Optical fiber communications: John M Senior

Reference Book:

1. Optical Fiber Communication: G. Keiser

Course Code: EEE 4262 **Course Title: Optical Fiber Communication Lab** **Credits: 1.50**

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill of analyzing and practicing the theoretical concept gained in course EEE 4261.

Course Content: Sessional based on the theory course of EEE 4261.

Text Book: Lab Manual

Course Code: EEE 4263 **Course Title: Data Communication and Computer Networks** **Credits: 3.00**

Rationale of the Course: One of the core or optional requirements for the students majoring in Electrical and Electronic Engineering as well as for the students majoring in Electronic and Telecommunication Engineering & Computer Science and Engineering to develop the skill for analyzing and designing Computer Networks for Data Communication. Different layers of the Internet model are introduced as the students finally can design a model for data communication with security.

Course Content:

Introduction: Concept of communication and communication models.
Protocols and Architectures: Characteristics of protocols, their implementation, OSI-ISO 7-layer model, and TCP/IP suite.
Data Encoding and Transmission: Digital and analog signals, transmission media, encoding techniques, and transmission impairments.
Data Link Control (DLC) and Multiplexing: Error detection and control, flow control, and multiplexing methods.
LAN Technologies: Ethernet and its standards, Token Ring; LAN components including topology, repeaters/hubs, bridges/switches, and routers.
Internetworking: Concepts of intranet, extranet, internet; internetworking with TCP/IP including IP addressing, subnetting, and masking; common network applications such as web, mail, DNS, DHCP.
Transport Protocols: Overview of TCP and UDP protocols.
Switching and Routing: Circuit switching and its applications; packet switching including virtual and datagram packet switching, with applications.
Network Security, Design, and Management: Basic principles of network security, along with network design and management considerations.

Text Books:

1. Data Communications and Networking by Behrouz A Forouzan.

Reference Books:

1. Data and Computer Communications by William Stallings.
2. Computer Networks by Tanenbaum Andrew S.
3. Computer Networks, a system approach by Morgan Kaufmann.

Course Code: EEE 4264 Course Title: Data Communication and Computer Networks Lab Credits: 1.50

Rationale of the Course: This course, under Applied Technology, builds on basic communication systems to introduce data communication and computer networking. It covers how data is transferred across various networks (LAN, MAN, WAN, Internet), key protocols and standards, and switching techniques, preparing students for the rapidly growing

Course Content: Sessional based on the theory course of EEE 4263.

Text Books: Lab manual

Course Code: EEE 4265 Course Title: Robotics and Automation Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the knowledge of optical fiber communication including propagation characteristics and capacity of the system.

Course Content:

Introduction to Robotics and Automation: Overview of robotics and automation; significance in modern industry; evolution of robotic systems; fundamental concepts.
Components of Robots – Sensors and Actuators: Types and functions of sensors (proximity, vision, force) and actuators (electric, hydraulic, pneumatic); interaction with the environment; enabling robotic perception and action.
Robot Kinematics and Dynamics: Mathematical modeling of motion; forward and inverse kinematics; analysis of forces and torques; foundations for accurate robotic movement and control.
Control Systems and Automation Techniques: Feedback and feedforward control strategies; PID control; real-time control algorithms; integration of automation methods for task execution.
Applications of Robotics and Automation: Industrial, healthcare, agricultural, and service-sector applications; benefits in productivity, accuracy, and operational safety.

Text Book:

1. Optical fiber communications: John M Senior

Reference Book:

1. Optical Fiber Communication: G. Keiser

Course Code: EEE 4266 Course Title: Robotics and Automation Lab Credits: 1.50

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill of analyzing and practicing the theoretical concept gained in course EEE 4265.

Course Content: Sessional based on the theory course of EEE 4265.

Text Book: Lab Manual

Course Code: EEE 4267 Course Title: Artificial Intelligence and Advance Machine Learning Credits: 3.00

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the knowledge of optical fiber communication including propagation characteristics and capacity of the system.

Course Content:

Introduction to Optical Fiber Communication: Overview of optical fiber communication systems, highlighting their significance and fundamental principles.
Light Propagation and Optical Fiber Structure: Study of light transmission through optical fibers and their physical construction enabling efficient propagation.
Modes and Modal Dispersion: Analysis of light propagation modes within fibers and the effects of modal dispersion on signal integrity.
Attenuation and Optical Fiber Losses: Examination of causes of signal loss in fibers and techniques to reduce attenuation.
Optical Sources and Detectors: Overview of devices used for generating and detecting optical signals, including LEDs and photodetectors.
Optical Fiber Cables and Connectors: Description of fiber cable types, construction, and connector technologies ensuring reliable connectivity.
Optical Amplifiers and Repeaters: Exploration of amplification methods to maintain signal strength across long-distance transmissions.
System Design Considerations and Link Budget Analysis: Fundamentals of designing optical communication systems with proper power budgeting and performance metrics.

Dispersion Compensation Techniques: Techniques to counteract dispersion effects to preserve signal quality.
Nonlinear Effects in Optical Fibers: Introduction to nonlinear optical phenomena impacting fiber performance and mitigation strategies.
Wavelength Division Multiplexing (WDM): Explanation of multiplexing multiple wavelengths to increase data capacity in fiber systems.
Optical Network Components and Architectures: Survey of essential network elements and architectural frameworks in optical communications.
Recent Trends in Optical Fiber Communication: Insight into current innovations and emerging technologies shaping the field.

Text Book:

1. Optical fiber communications: John M Senior

Reference Book:

1. Optical Fiber Communication: G. Keiser

Course Code: EEE 4268 Course Title: Artificial Intelligence and Advance Machine Learning Lab Credits: 1.50

Rationale of the Course: One of the core requirements for students majoring in Electrical and Electronic Engineering is to develop the practical skills necessary to analyze and apply the theoretical concepts learned in the course EEE 4267. This sessional course provides hands-on experience that reinforces foundational knowledge in robotics and automation through experimental work, simulations, and project-based learning.

Course Content: Sessional based on the theory course of EEE 4267.

Text Book: Lab Manual

Course Code: EEE 4271 Course Title: Renewable Energy Credits: 3.00

Rationale of the Course: This course introduces students to renewable energy resources, their potential, and availability as alternatives to conventional energy sources. Upon completion, students will understand renewable energy technologies, their integration with traditional systems, and hybrid solutions. The course develops skills in designing, analyzing, and optimizing renewable energy systems, and covers modern power system integration, virtual power plants, smart grids, e-mobility, and power system reliability for sustainable energy futures.

Course Content:

Course Introduction: Review of prerequisites, overview of Renewable Energy Technologies (RET), and prospects and challenges in Bangladesh.
Solar PV: Solar radiation calculation, PV fundamentals, types and materials of cells, modeling, V-I characteristics, maximum power point, fill factor, SHS design, microgrid vs mini-grid, grid integration, and storage technologies.
Wind Energy: Types of turbines and generators, aerodynamic principles (drag and lift), blade design, horizontal and vertical axis turbines, Betz' and Glauert's theories, and Blade Element Momentum (BEM) method.
Solar Thermal: Challenges and opportunities, Concentrated Solar Energy (CSE), Concentrating Solar Power (CSP) technologies, thermal storage, heat exchangers, system control, and economics.
Hydroelectric, Wave & Tidal Power: Turbine classification, hydropower components, efficiency, turbine characteristics and losses, specific speed, selection criteria, protection and control, power calculation, and tidal generation schemes including barrage and dynamic tidal power.
Biomass & Geothermal: Biomass sources and conversion (pyrolysis, gasification, hydrothermal liquefaction), steam power plants, binary cycle (ORC), single- and double-flash geothermal plants, geothermal heat pumps (ground coupled, vertical, horizontal, hybrid systems).
Energy Storage & Grid Integration: Types of storage, fault ride-through capability, and future modern grid concepts.

Text Book:

1. John Twidell and Tony Weir, Renewable Energy resources, 2nd edition Tylor & Francis, NY 10016, USA

Reference Book:

1. Gianluigi Migliavacca, Advance Technologies for Future Transmission Grid, Springer ISBN 978-1-4471-4549-3
2. J. Momoh, Smart Grids: Fundamentals of Design and Analysis, IEEE Press, John Wiley and Sons, Inc., 2012. (NTU eBook Collection)

Course Code: EEE 4272 Course Title: Renewable Energy Lab Credits: 1.50

Rationale of the Course: One of the core requirements for the students majoring in Electrical and Electronic Engineering to develop the skill of analyzing and practicing the theoretical concept gained in course EEE 4271.

Course Content: Sessional based on the theory course of EEE 1102.

Text Book: Lab Manual

Part D

20. Grading/Evaluation

Evaluation of students' performance will be based on **Continuous Internal Evaluation (CIE)** and **Semester End Examination** (SEE). SEE includes midterm examination and final examination whereas CIE contains class-test, quiz, attendance, presentation and assignments/case study/term paper/project/viva/group work. CIE will cover 50% of the total marks and the remaining 50% are reserved for SEE. For Lab courses evaluation will be based on attendance, Lab assessment, Lab report, Quiz, Viva and Project. The distribution of marks is as follows:

Theory course:

SEE	Mid Term	20%
	Final	30%
CIE	Class-test, quiz, attendance, presentation and assignments / case study / term paper / project / viva / group work	50%
	Total	100%

Lab course:

SEE	Viva / Presentation on Project	20%
	Quiz	20%
CIE	Attendance	10%
	Lab Assessment/Project	30%
	Report	20%
	Total	100%

Capstone Project part I:

SEE	Viva / Presentation on Progress	50%
CIE	Project Proposal Report	40%
	Attendance	10%
	Total	100%

Industrial Attachment:

SEE	Presentation / Viva	50%
CIE	Report	50%
	Total	100%

Capstone Project part II:

SEE	Performance	20%
	Attendance	10%
CIE	Viva / Presentation on Project	40%
	Dissertation	30%
	Total	100%

1) Grading Scale and Grades

Numerical Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

2) Cumulative Grade Point Average

Student's performance will be evaluated on the basis of Grade Point Average (GPA) semester wise and Cumulative Grade Point Average (CGPA) of total completed courses.

The CGPA will be computed in the following manner:

$$\text{CGPA} = \frac{\text{Sum of (Earned Credit} \times \text{Corresponding Grade Points)}}{\text{Total Credits}}$$

3) Retake

a. If a student obtains F grade(s) in any courses for any reasons, s/he must retake the course(s) within the succeeding two semesters.
b. For retake and improvement, a student can take a maximum of 18 credits or 6 courses altogether within the succeeding two semesters.
c. If s/he passes after appearing at the retake examination, the (passed) result will be used for calculation of GPA and CGPA, but past grade must be recorded in the students' database; or grade report will be shown as 'R' (Retake). But in final official transcript (after completion of the degree) 'R' will not be shown.
d. If a student obtains F grade(s) after the end of the program, s/he will get a chance to complete the course (s) within additional 3 years after the end of his/her specific time of completing the degree. But in case of fail in prerequisite course(s), the student must retake the course in the succeeding semester.
e. Except for Pre-Requisite course(s), a student can retake the course(s) at his/her convenient semester(s).
f. A retake student will complete all course curriculums (i.e., class attendance, class test, assignment etc.) including midterm and final examinations of the specific course(s). In special cases, if the student cannot attend classes or continuous assessment (i.e., assignment, class test etc.), previous marks can be accepted to calculate GPA.
g. If course(s) cannot be offered due to any reason (i.e., course drop or unavailability of students etc.), department can take necessary steps to arrange only midterm and final examination for the retake student(s). In such cases, other marks except midterm and final examination will be carried forward from the previous semester where s/he attended the course(s).
h. The department may arrange separate examinations with separate questions (for midterm and final examinations only) for retake students if it cannot be accommodated in the regular examination schedule. But the examination must be completed in not more than 7 working days after the completion of midterm or final examinations.
i. Students who want to retake a course must get his/her registration completed at the beginning of each semester.
j. A student will have to pay requisite fee of the per credit fees for the retake course(s).
k. Retake rules are applicable for both Undergraduate and Graduate/Masters programs.
l. If a student retakes his/her failed course(s) after finishing normal duration of the program, s/he will pay only registration fee, exam fee and requisite fee for retake of course(s). If s/he fails to improve again, no refund of fees will be made.

4) Improvement

a. A student obtaining B-, C+, C and D grades in theory course only may improve the grade(s) by appearing in the midterm and final examinations or final examination.
   A student may improve above mentioned grade(s) in any semester along with regular courses. In case of improvement after passing all courses of the respective program, a

student will be allowed once in the succeeding semester, but s/he has to take approval from the head/coordinator of the department

b. For improvement and retake a student can take a maximum of 18 credits or 6 courses altogether within succeeding two semesters.
c. To prepare the improvement results, the course teachers can only modify midterm and final examination marks of the students in the result automation process. Other marks (i.e., class test, assignment etc.) will be automatically generated by the software from the previous database.
d. A student will have to pay requisite fee of the per credit fees for the improvement of grades.
e. If an examinee fails to improve his/her result, the previous result in the software will stand.
f. If a student improves his/her course(s) after finishing normal duration of the program, s/he will pay only registration fee, exam fee and requisite fee for improve of course(s). If s/he fails again, no refund of fees will be made.

5) Semester Drop & Cancelation of Admission

a. After getting enrolled for a semester, if any student fails to continue academic activities (i.e., class, exam, practical, assignment, presentation etc.) up to midterm examination, s/he will be considered as a semester drop student. In this case s/he will not be allowed to sit for the final exam.
b. After getting enrolled for a semester, if any student completes all academic activities, but fails to appear at the midterm examination, the student may be allowed to sit for the final exam.
c. Semester drop student may get readmission in the subsequent semester on payment of semester drop fee and his/her paid amount (full/partial) will be adjusted at the time of readmission. However, if any student discontinues the study forever, s/he will not get back the money paid at the time of admission.
d. In case of semester drop or withdrawal, a student will be considered as a fresh student for the semester. S/he will get all chances for improvement, retake and re-admission like a fresh student. However, a student must complete his/her program within the time mentioned in section 7 from the time of his/her first semester admission
e. After cancellation of admission, If a student returns, s/he will be admitted to the same semester by paying the requisite fee (considered as semester drop student), but s/he must complete degree within stipulated time period.
f. If a student wants to cancel his/her admission, s/he should have to pay requisite fee for Admission Cancellation.

6) Re-Admission

a. Students failing to get promotion to the next semester must seek Re-Admission (Re-Ad) within the stipulated time of his/her program.

b. Grades, other than F, obtained by a student in the preceding semester of re-admission will remain valid; and the student will have to repeat the courses in which s/he did not earn credit (if failed). Improvement (other than F) of any grades (B and lower) may be allowed.
c. The registration number of the student will remain the same.
d. Students will have to pay tuition fees only for repeated course (s). Also, s/he is to pay other fees (except development fees as it is payable once for a semester).