

Department of Electrical and Electronic Engineering
Faculty of Engineering and Technology
Islamic University, Kushtia, Bangladesh
(Effective from Session 2018-2019)

A Short Introduction

Islamic University is one of the sixth major public universities in Bangladesh and largest seat of higher education in the south-west part of the country financially aided by the Organization of the Islamic Conference (OIC) and the government of Bangladesh through University Grants Commission, Bangladesh. It was established on 22 November 1979 by the Islamic University Act. Islamic University began its academic operations on 28 June 1986. The university is recognized as the hub of academic and research activities, sports and cultural programs with a very innate and peaceful environment. It is a major international centre for an excellent integration of Islamic Studies with general Studies and Studies of modern science, engineering and technology. The university provides both local and foreign students with the facilities of undergraduate studies, postgraduate research and teaching. It is a campus-oriented university, where all the academic and administrative buildings, central library, student's residential halls, teacher's dormitories, gymnasium, play grounds, tennis court and other facilities are in one self-contained 175-acre land at Shantidanga-Dulalpur, beside the Kushtia-Khulna highway. It is located about 24 km south and 22 km north of the Kushtia and Jhenidah district-towns, respectively.

Electrical and Electronic Engineering (EEE) Department was opened in this university in 1995 as the name of “Electronics and Applied Physics” with Professor Dr. M Ekin Uddin as the founder head of the department. Academic activities were started in the session 1995-96 with 25 undergraduate students. Later, the course curriculum was upgraded and the department was renamed as the “Applied Physics, Electronics and Communication Engineering” in December, 2006. Again to meet the increasing demand of the 21st century the curriculum was updated again and the department was renamed as the “Electrical and Electronic Engineering” in August 2017.

Degrees Offered

B.Sc. (Engg.): It is a four-year (Eight Semesters) integrated undergraduate program.

M.Sc. (Engg.): (i) One year (Two Semesters) for the students of General Group (Group A) and ii) 1.5 years (Three Semesters) for the students of Thesis Group (Group B).

M.Phil.: Two years in related field.

Ph.D.: Three years in related field.

Research Areas

Electrical Power Systems, Restructured Power systems, Smart Grid Systems, Electronic Materials Technology, Nanotechnology, Computer Technology and Networks, Wireless Communication, Cellular and Satellite Communication, Optical Communication, Intelligent System Engineering, Digital Signal Processing, Digital Image Processing, Renewable Energy Technology, Biomedical Engineering, Control Engineering and Robotics etc.

Higher Study Prospects

Students graduated from this department can pursue higher studies and research in any university or institute of world in the related fields. After graduation, students can apply for Commonwealth scholarship, Monbukagakusho scholarship, DAAD scholarship, AUSAID Scholarship, ERASMUS MUNDUS scholarship, Fulbright scholarship and many other scholarship and research grants all over the world.

Extracurricular Activities

Inter-department football, Inter-department volleyball, Inter-department cricket, and many other types of games are arranged by this Department. Faculty members and students regularly participate in Study tour, Seminars, Club activities, Picnic, Indoor games and Cultural programs.

COURSES OFFERED TO THE UNDERGRADUATE STUDENTS OF ELECTRICAL AND ELECTRONIC ENGINEERING DEPARTMENT

Vision of the Program:

The Department of Electrical and Electronic Engineering will provide programs of the highest quality to produce world class engineers who can address challenges of the millennium. It commits itself to impart the skills, knowledge and attitudes to create, interpret, apply and disseminate engineering to build better future for humankind. This department will endeavor to strengthen the facilities to provide solutions to relevant Electrical Engineering problems.

Mission of the Program:

The mission of the Electrical and Electronic Engineering Department are:-

- To create the environment that facilitates learning the fundamentals of Electrical Engineering.
- To impart the knowledge in Electrical Circuits, Power Systems, Electrical Machines, Power Electronics, Electrical Drives and Non-conventional Energy Systems.
- To provide premier education through dedicated teaching, innovation and research.
- To cater to practical issues by adapting to technical, economical and social trends.
- To prepare students to face challenges in the global environment.

Program Objectives:

To produce competent Electrical and Electronic Engineers with a broad knowledge of Electrical and Electronic Engineering, and its applications. More, generally, the program aims to:

- Provide a stimulating knowledge in this field to develop a sound base of understanding with particular emphasis on applications.
- Develop the skills necessary for life-long independent learning.
- Provide a supportive, challenging, stimulating and rewarding study environment.
- Develop a range of key life and employability skills through a range of opportunities provided in this field.
- Develop critical, analytical, practical, professional, problem solving, research and communication skills and prepare students for doctoral/postgraduate study and/or professional qualifications for employment.

Learning Outcomes:

Knowledge and Understanding of:

- The principles of fundamental and advanced courses of Electrical and Electronic Engineering.
- The mathematical principles and techniques necessary for the fundamental and advanced courses.
- The application of Electrical and Electronic Engineering in a variety of contexts.
- The methods of solution of problems through the design and execution of practical experimental and field investigations, and mathematical and computational models.

Cognitive skills, able to:

- Plan, conduct and report on a program of research at postgraduate level including the formulation and testing of hypotheses.

- Critically evaluate arguments, assumptions and data, make judgments and frame questions to achieve a solution to a problem or identify a range of solutions.
- Select, apply and evaluate appropriate mathematical, scientific, laboratory and computer-based methods and principles in the analysis and solution of a variety of physical problems.
- Be creative and innovative in the analysis and solution of physical problems and presentation of results.
- Generate, analyze and process data to test a hypothesis and to assess the reliability of data in order to critically assess the significance of results.
- Work with confidence to develop an understanding of physical processes in a wide variety of contexts and, on the basis of such understanding, to propose and assess solutions to critical problems.

Practical Skills, able to:

- Plan, conduct and report on practical laboratory, field or computational scientific investigations.
- Collect record and analyze data using a variety of suitable techniques comparing real systems with theoretical or computational model predictions as appropriate.
- Undertake field and laboratory investigations in a responsible and safe manner, paying due attention to risk assessment, rights of access, relevant health and safety regulations, and sensitivity to the impact of investigations on the environment and human health.
- Critically evaluate and use scientific literature appropriately and cite references correctly.
- Identify and work towards targets for personal, academic and career development including commercial awareness and opportunities for enterprise.
- Develop an adaptable and flexible approach to study and work.
- Develop the skills necessary for self-managed and lifelong learning.

Employability Skill:

Employ skills, able to:

- Communicate effectively to a variety of audiences in written, verbal and graphical forms using a variety of media.
- Critically evaluate data considering methodology, accuracy, precision and uncertainty during planning, collection, recording and analysis of data in the field and laboratory.
- Retrieve, evaluate and combine data from a variety of sources.
- Identify individual and collective goals and responsibilities and perform in a manner appropriate to these roles.
- Recognize and respect the views of others and evaluate performances as an individual and a team member.
- Solve problems using theoretical, computational and practical techniques.

Curriculum Structure:

Program: B. Sc. (Engg.) in Electrical and Electronic Engineering

1. **Admission:** Students will be admitted to the department as per university rules.
2. **Duration of the Program:** 4 years.
3. **Total Number of Semesters:** $4 \times 2 = 8$ (2 Semesters per year)

Class: 13 weeks (3 classes per week for each course)

PL: 02 weeks

Exam: 03 weeks

Results: 03 weeks

Total: 22 weeks per semester

4. **Total Number of Credits in 8 semesters (4 years): 160.0**

Non-Credit/University Course: There shall be a Non-credit course namely Islamic Studies/ Bangladesh Studies carrying 100 marks to be completed within the first semester. However, if any student failed to pass the Non-credit course (obtained less than 50% marks) in the first semester he/she must complete the Non-credit course within following academic year. Students coming from Madrasa stream (both Dakhil and Alim) and Non-Muslim students shall take the Non-credit course Bangladesh Studies. Those coming from college stream (both S.S.C. & H.S.C./ Dakhil & H.S.C.) shall take the Non-credit Course Islamic Studies.

Introduction and Course Identification:

The undergraduate students of different years of this department have to follow the course schedule given. The letter prefix in any course number indicates the department offering the courses or the discipline viz. EEE for Electrical and Electronic Engineering, CSE for Computer Science and Engineering, IPE for Industrial Management and Production Management, ME for Mechanical Engineering, CHEM for Chemistry, PHY for Physics, MATH for Mathematics and HUM for Humanities/General Education.

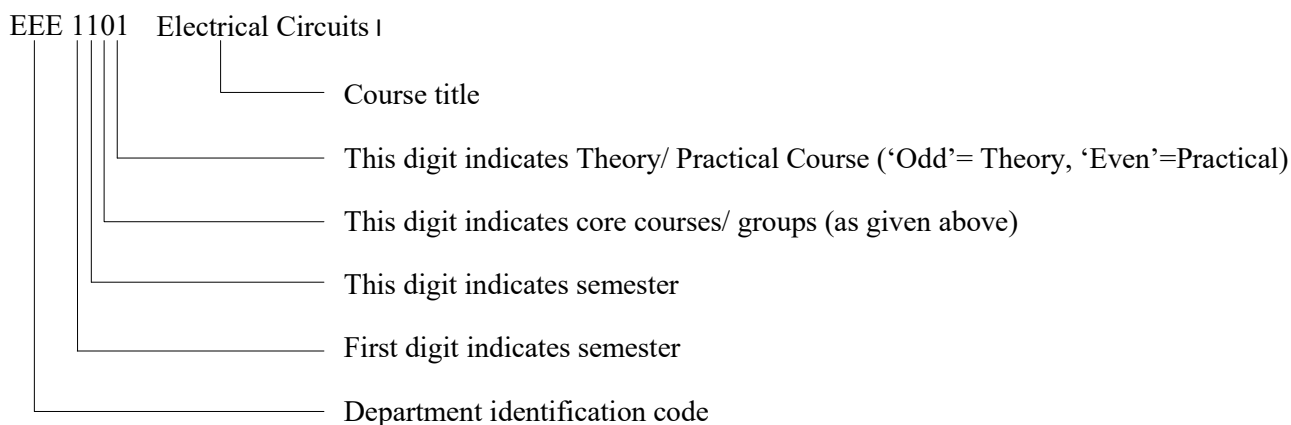
Each course is designated by a two to three letter word identifying the department (details described earlier) which offers it followed by a four digit number with the following criteria:

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

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

Digit 0 and 1 is for Core Courses
 3 for Electronics Group
 4 for Communication Group
 5 for Power Group
 6 for Computer Group
 7 and 8 for Interdisciplinary Group

The course designation system is illustrated by the following example:



The minimum credits to be completed for obtaining the degree of B.Sc.(Engg.) in Electrical and Electronic Engineering are 160.

1. Teaching of the courses:

- a. For each credit of a theory course, there will be 3class per week of 1 hour duration.
- b. Total classes in a semester for each credit of a theory course will be 13 (15x3).
- c. Total Contact Hours in a semester for each 1.0 credit theory course: 13x1=13.
- d. For each 1.0 credit lab course, there will be 1 class per week of 2 hours duration.
- e. Total classes in a semester for each 1.0 credit lab course in 13 weeks: 13x1=13.
- f. Total Contact Hours in a semester for each 1.0 credit lab course: 13x2=26.

2. Evaluation of the courses:

As per university rules.

3. Grading System: The current UGC approved grading system applies as per university rules.

Marks	Letter Grade	Grade Point
80% and Above	A+	4.00
75% to < 80%	A	3.75
70% to < 75%	A-	3.50
65% to < 70%	B+	3.25
60% to < 65%	B	3.00
55% to < 60%	B-	2.75
50% to < 55%	C+	2.50
45% to < 50%	C	2.25
40% to < 45%	D	2.00
Les s Than 40%	F	0.00

4. Marks Distribution:

(a) For Theoretical Courses:

- i) Class attendance :10%
- ii) Quiz/presentation :05%
- iii) In-course/tutorial exam/assignment :15%
- iv) Semester end final examination :70%

(b) For Practical/Laboratory Courses:

- i) Laboratory performance during lab hours :05%
- ii) Lab attendance :10 %
- iii) Lab note book on experiment :05%
- iv) Viva-voce on experiment during practical exam :10%
- v) Semester end final exam :70%

(c) For Industrial Tour/Field work/In-plant Training Courses:

- i) Report of the Industrial Tour/Field work/In-plant Training :50%
- ii) Overall performance in the Tour/Field work/ Training :30%
- iii) Viva-voce/Quiz/Presentation :20%

(d) For Thesis/Project:

- i) Presentation and Dissertation of the Thesis/Project work :70%
- ii) Final overall defense during the work :30%

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

Four Year Distribution

Year	Courses (Semester)	
Year 1	1 st Semester: Theory = 5 courses Sessional/Lab = 2 Total: 17.0 Credits	2 nd Semester: Theory = 5 courses Sessional/ Lab = 3 Viva-voce = 1 Total: 20.0 Credits
Year 2	1 st Semester: Theory = 5 courses Sessional/Lab = 3 Total: 20.5 Credits	2 nd Semester: Theory = 5 courses Sessional/ Lab = 3 Total: 19.0 Credits
Year 3	1 st Semester: Theory = 5 courses Lab = 3 Total: 21.0 Credits	2 nd Semester: Theory = 5 courses Sessional/Lab = 4 Viva-voce = 1 Total: 22.0 Credits
Year 4	1 st Semester: Theory = 5 courses Sessional/ Lab = 3 Training/Internship Project/ Thesis Total: 21.5 Credits	2 nd Semester: Theory = 4 courses Sessional/Lab = 2 Project/ Thesis Seminar Total: 19.0 Credits
Grand Total 160 Credits		

Summary of Undergraduate Course Plan

SI. No.	Course Type		No. of Courses	Credit	Percentage
1.	Departmental Courses				68.75%
	Core Courses	Theory	25	75.0	
		Lab	20	29.5	
		Training/ Internship	1	1.5	
		Thesis/ Project	1	4.0	
Sub Total			47	110.0	
2.	Related Courses				16.56%
	Basic Science	Theory	8	24.0	
		Lab	2	2.5	
	Sub Total			12	26.5
	Humanities	Theory	3	7.5	4.69%
	Islamic Studies/Bangladesh Studies	Theory	1	NCC	
	Sub Total			4	7.5
Related Engineering	Theory	3	9.0	7.50%	
	Lab	2	3.0		
	Sub Total				3
3.	Oral	Viva-voce	3	3.0	2.50%
		Seminar	1	1.0	
	Sub Total			4	
Total			70	160	100%

Semester wise Course Distribution

1st Year 1st Semester

Course No.	Course Title	Theory Hrs/Wk	Lab Hrs/Wk	Credit(C)
EEE-1101	Electrical Circuits-I	3	0	3.0
EEE-1102	Sessional on Electrical Circuits	0	3	1.5
PHY-1103	Physics-I	3	0	3.0
PHY-1104	Sessional on Physics-I	0	3	1.0
MATH-1105	Mathematics-I	3	0	3.0
ENG-1107	English	3	0	2.5
CHE-1109	Chemistry	3	0	3.0
Total		15	6	17.0

1st Year 2nd Semester

Course No.	Course Title	Theory Hrs/Wk	Lab Hrs/Wk	Credit(C)
EEE-1201	Electronics-I	3	0	3.0
EEE-1202	Sessional on Electronics-I	0	3	1.5
EEE-1203	Electrical Circuits-II	3	0	3.0
EEE-1204	Sessional on Electrical Circuits-II	0	3	1.5
HUM-1205	Economics and Accounting	3	0	2.5
CSE-1206	Programming Technique	0	2	1.5
MATH-1207	Mathematics-II	3	0	3.0
ME-1209	Fundamental of Mechanical Engineering	3	0	3.0
NCC	Islamic Studies/ Bangladesh Studies	2	0	00
Oral	Viva-voce	0	0	1.0
Total		17	8	20.0

[Total Credit in First Year (1st semester+ 2nd Semester) =17+20=37]

2nd Year 1st Semester

Course No.	Course Title	Theory Hrs/Wk	Lab Hrs/Wk	Credit(C)
EEE-2101	Electronics-II	3	0	3.0
EEE-2102	Sessional on Electronics-II	0	3	1.5
EEE-2103	Electrical circuits Analysis- III	3	0	3.0
STAT-2105	Statistics and Probability	3	0	3.0
MATH-2107	Mathematics-III	3	0	3.0
EEE-2109	Electrical Machines-I	3	0	3.0
EEE-2110	Sessional on Electrical Machines-I	0	3	1.5
IPE-2111	Industrial Management & Production Engineering	3	0	3.0
Total		15	9	21.0

2nd Year 2nd Semester

Course No.	Course Title	Theory Hrs/Wk	Lab Hrs/Wk	Credit(C)
EEE-2201	Electronics-III	3	0	3.0
EEE-2202	Sessional on Electronics-III	0	3	1.5
EEE-2203	Digital Electronics	3	0	3.0
EEE-2204	Sessional on Digital Electronics	0	3	1.5
PHY-2205	Physics-II	3	0	3.0
EEE-2207	Electrical Machines-II	3	0	3.0
EEE-2208	Sessional on Electrical Machines-II	0	3	1.5
EEE-2210	Electrical and Electronic Shop Practice	0	3	1.5
Oral	Viva-voce	0	0	1.0
Total		12	12	19.0

[Total Credit in Second Year (1st semester+ 2nd Semester) =21.0+19.0=40.0]

3rd Year 1st Semester

Course No.	Course Title	Theory Hrs/Wk	Lab Hrs/Wk	Credit(C)
EEE-3101	Measurements and Instrumentation	3	0	3.0
EEE-3102	Sessional on Measurements and Instrumentation	0	3	1.5
EEE-3103	Electromagnetic Fields & Waves	3	0	3.0
EEE-3105	Signals and Linear Systems	3	0	3.0
EEE-3106	Electrical and Electronic Circuit Simulation	0	3	1.5
MATH-3107	Numerical Methods	3	0	3.0
MATH-3108	Sessional on Numerical Methods	0	3	1.5
CSE-3109	Microprocessor, Microcontrollers and Peripherals	3	0	3.0
CSE-3110	Sessional on Microprocessor, Microcontrollers and Peripherals	0	3	1.5
Total		15	12	21.0

3rd Year 2nd Semester

Course No.	Course Title	Theory Hrs/Wk	Lab Hrs/Wk	Credit(C)
EEE-3201	Power System Analysis -I	3	0	3.0
EEE-3203	Control System Engineering	3	0	3.0
EEE-3204	Sessional on Control System Engineering	0	3	1.5
EEE-3205	Communication Engineering-I	3	0	3.0
EEE-3206	Sessional on Communication Engineering-I	0	3	1.5
EEE-3207	Electrical Engineering Materials	3	0	3.0
EEE-3209	Digital Signal Processing	3	0	3.0
EEE-3210	Sessional Digital Signal Processing	0	3	1.5
EEE-3212	Sessional on Electrical Machine Design	0	3	1.0
Oral	Viva-voce	0	0	1.0
Total		15	12	21.5

Total Credit in Third Year (1st semester+ 2nd Semester) =21+21.5=42.5]

4th Year 1st Semester

Course No.	Course Title	Theory Hrs/Wk	Lab Hrs/Wk	Credit(C)
EEE-4000	Thesis/ Project	0	3	1.0
EEE-4100	Industrial Attachment/ Training/Internship	0	3	1.5
EEE-4101	Power System Analysis-II	3	0	3.0
EEE-4102	Sessional on Power System Analysis-II	0	3	1.5
EEE-4103	Communication Engineering-II	3	0	3.0
EEE-4104	Sessional on Communication Engineering-II	0	3	1.5
EEE-4105	VLSI Design	3	0	3.0
EEE-4107	Power Electronics	3	0	3.0
EEE-4108	Sessional on Power Electronics	0	3	1.5
HUM-4109	Professional Ethics and Moral Thoughts	3	0	2.5
Total		15	12	21.5

4th Year 2nd Semester

Course No.	Course Title	Theory Hrs/Wk	Lab Hrs/Wk	Credit(C)
EEE-4000	Thesis/Project		6	3.0
EEE-4201	Switchgear and Protection	3	0	3.0
EEE-4202	Sessional on Switchgear and Protection	0	3	1.5
EEE-4203	Power Plant Engineering	3	0	3.0
EEE-4205	Cellular Mobile Communication	3	0	3.0
EEE-4206	Sessional on Cellular Mobile Communication	0	3	1.5
EEE-4207	High Voltage Engineering	3	0	3.0
EEE-4210	Technical Seminar	0	3	1.0
Total		12	15	19.0

Total Credit in Fourth Year (1st semester+ 2nd Semester) =21.5+19.0=40.5]

Courses offered by the Department of EEE

1st Year 1st Semester

EEE-1101: Electrical Circuits-I

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn basic ideas and principles of Electrical Engineering.
- Understanding of details important theorems of resistive network, series and parallel combinations of electric and magnetic circuits
- To perform quantitative analyses of basic problems in electrical circuits and a thorough grounding in the mathematical, circuit analysis and laboratory techniques required in future courses.

Course contents:

- **Electric Field and Electric Potential:** Charge, Coulomb's law, electric field lines, Torque on a dipole in uniform E-field, Gauss's law and its applications, electric potential, current density, drift velocity.
- **Circuit Variables and Elements:** Voltage, current, power, energy, independent and dependent sources, Circuit elements – resistance, inductance capacitance.
- **Basic Laws of Electrical Circuits:** Ohm's law, Series and parallel circuits, voltage and current divider circuits, Kirchoff's Current Law (KCL) and Kirchoff's Voltage Law (KVL).
- **Techniques of Circuit Analysis:** Node-voltage method and Mesh-current method, super node and super mesh, Source transformation.
- **DC Network Theorems:** Thevenin's, Norton's and superposition theorems with applications in circuits having independent and dependent sources, maximum power transfer condition and reciprocity theorem.
- **Energy Storage Elements:** Inductors and capacitors, their characteristics, series-parallel combination of inductors and capacitors, concept of transient and response of RL and RC circuits with DC source.
- **Magnetic Quantities and Variables:** Flux, permeability and reluctance, magnetic field strength, magnetic potential, flux density, magnetization curve, Laws in magnetic circuits: Ohm's law and Ampere's circuital law. Series and parallel magnetic circuits.

Learning Outcomes:

Students are able to

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Appreciate electrical network theorems.
3. Determine different network functions.
4. Appreciate and analyze DC electrical and magnetic circuits using KVL and KCL.

Text Books:

1. C.K. Alecgender & M.N.O. Sadiku, : Fundamental of Electric circuits
2. R.M. Kerchner & G.F Corcoren : Alternating current ciucuits

Reference Books

1. Robert P Ward, : Introduction to Electrical Engineering",
2. Kothari D.P. and Nagrath I.J., : Theory And Problems of Basic Electrical Engineering
3. Fitzgerald, Higginbotham and Gabel: Basic Electrical Engineering

EEE-1102: Sessional on Electrical Circuits-I

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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PHY-1103: Physics-I

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn basic ideas and principles of oscillation, acoustic and optics.
- Understanding of details oscillatory circuits, wave motion, sound wave and Nature of light.
- To know the basic construction and operation of optical instruments.

Course contents:

- **Wave and oscillations:** Wave and composition of simple harmonic motion, simple harmonic motion, average value of kinetic and potential energies of a harmonic oscillation, superposition of simple harmonic motions, uses of Lissajous figures.
- **Damped and forced harmonic oscillator:** Damped oscillatory system, damped harmonic oscillation, the LCR circuit, forced vibration, quality factor of forced oscillator, sharpness of resonance, phase of driven oscillator, power absorption.
- **Wave Motion:** Types of wave, progressive and stationary wave, Energy distribution due to progressive and stationary wave, interference of sound wave, phase velocity and group velocity.
- **Sound Wave:** Audible, ultrasonic, infrasonic and supersonic waves, Doppler's effects and its application, applications of ultrasonic sound.
- **Acoustics:** Intensity of sound, Bel, sound pressure level, phonon, acoustic intensity, architectural acoustics, Diffraction of sound, Musical sound, and noises, Speech, Characteristic's of musical Sound.
- **Building Acoustic:** Reverberation, Sabine's reverberation formula, growth intensity, decay intensity, reverberation time and absorption co-efficient, requisites for good acoustic.
- **Interference:** Nature of light, interference of light, coherent sources, young double slit experiment, energy distribution,, condition for interference, production of interference fingers, Fresnel Bi-prism, Newton's ring.
- **Optical Instrument:** Photographic camera, simple microscope, compound microscope, telescope astronomical telescope, spectrometer.

Learning Outcomes:

Students are able to

1. Understand basics different atomic models.
2. Appreciate electronic and magnetic materials.
3. Understand the principles of acoustics and applied optics

Text Books:

1. Resnic and Halliday : Physics, Part-II

Reference Books

1. N. Subrahmanyam and Brijlal : Atomic and Nuclear Physics
2. A. Beiser : Concept of Modern Physics
3. D.M. Rowe & C.M. Bhandari : Modern Thermoelectricity
4. Brijlal & Ghosh : A Text Book of Sound
5. Brijlal and Subramonium : A Text Book of Optics

EEE-1104: Sessional on Physics-I

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.0	Exam. Hours: 06
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MATH-1105: Mathematics-I

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn basic ideas and principles of algebra and trigonometry
- Understanding of details set theory, matrices, complex numbers and complex operators
- To learn functions of complex arguments, statistical curve fitting and trigonometry.

Course contents:

- **Elements of Set Theory:** Introduction to sets, Set algebra, Types of sets: Finite, Infinite, Countable and Uncountable sets, Relations and Functions.
- **Matrices:** Definition and algebra of matrices, Special types of matrices, Determinant of square matrix, Properties, Cramer's rule, Rank of a matrix, Elementary transformation and normal form, The Adjoint and Inverse of a square matrix, Matrix inversion by partitioning, Solution of system of linear equations, Gauss-Jordan method.
- **Complex Numbers, Complex operators and inequalities :** Complex j operator, Complex numbers, Basic operations with complex numbers, Graphical representation of complex number, Polar and exponential forms of complex numbers, Properties of inequalities, Graphical solution of inequalities, Algebraic solution of inequalities, inequalities involving absolute values, Graphical solution of inequalities with two variables.
- **Trigonometry:** Trigonometric functions, Graphs of Trigonometric functions, Complex number, De-Moivre's theorem and its applications, Functions of complex arguments, Gregory's series, Summation of trigonometric series, hyperbolic functions.

Learning Outcomes:

Students are able to

1. Understand the basic theory of algebra and trigonometry.
2. Understand to solve different mathematical problems of algebra and trigonometry.

Text Books:

1. Shahidullah and Bhattacharjee : Higher Algebra and Trigonometry

Reference Books:

1. Bernnarrd and Child : Higher Algebra
2. Hall and Knight : Higher Trigonometry
3. Das and Mukherjee : Higher Trigonometry
4. Allyn J. Washington : Basic Technical Mathematics with Calculus

ENG-1107: English

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 2.5	Exam. Hours: 04
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Course Objectives:

- Understanding on functional English, scientific terminology, person to person conversation technique, official and personal Email writing, Commercial correspondence and tender notice, Technical report writing; standard forms of term papers, thesis, etc.
- To develop speaking skills, listening skills and writing skills.

Course contents:

- The noun-phrase, the verb phrase, subject verb arrangement, pronouns, verb as complements, questions; affirmative agreement (too / so); negative agreement (either / neither); negation; commands; nouns functioning as adjective; enough with adjective, adverbs and nouns; cause connectors; causative verbs; subjunctive; problem verbs;

- Similar sound words; Confusing words; Synonyms and antonyms, Scientific terminology, Making questions using “Wh” and auxiliary verbs, Amplifying of simple sentences, Paragraph writing, Monologue and dialogue writing, Description of graphs, pictures, Formal and informal letter writing, Official and personal E-mail writing, Commercial correspondence and tender notice, Technical report writing; standard forms of term papers, thesis, etc., Developing speaking skills; listening skills.

Learning Outcomes:

Students are able to

1. Understand the basic functional English.
2. Understand to practice the different communication skills.

CHE-1109: Chemistry

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn the basic concept of electrochemistry, chemical equilibrium and kinetics, surface chemistry and colloids, atomic structure and periodic table.
- Understanding of details the electronic theory of valance and chemical bonding and chemistry of transition elements, lanthanides and actinides.

Course contents:

- **Atomic Properties and Binding Forces:** Atoms, Molecules and forces between them, Chemical equations and stoichiometry, Atomic structure, Molecular bonding and geometry, Periodic relationships, Gases, Liquids and solids and solutions, Forces in solids and bindings, Ionic bond, Covalent bond, Metallic bond, Hydrogen bond and Vander Waal's force.
- **Periodic Classification of Elements:** Ionization potential, Electro-negativity, Electron affinity, Atomic radius, Variation of properties along a period and down a group, Diagonal relationship, Representative elements, Transition elements, Chemical properties of s, p, d and f-block elements.
- **Oxidation and Reduction:** Analysis of oxidation and reduction, Oxidation number, Analytic reagents.
- **Chemical Kinetics:** Experimental techniques, The rates of reactions, Integrated rate laws of simple reactions, Half-lives and rate constants, Dependence of half-life on concentration.
- **Acids and Bases:** Acid-base equilibrium and pH-scale in terms of activities, Acid-base titration, Acid-base indicators, Buffers, Henderson-Hasselbach approximation useful in biology applications.
- **Electrolysis:** Electrolysis, Electrodes and electrode reactions, Standard hydrogen electrode, Reduction potential, The chemical series, Ionic equilibrium of weak electrolytes, Solubility products, Electro-chemistry, Solubility and complex formation equilibrium.
- **Equilibrium Electrochemistry:** Electrochemical cell, Equilibrium electrochemistry, Ion activities, Standard potentials, The electrochemical series, The Nernst equation. Thermodynamic functions from cell potential measurements, Solubility constants, pH and pH measurements.
- **Chemical Equilibrium:** Spontaneity of chemical reactions, Gibbs energy minimum, Perfect gas equilibrium, Gibbs free energy change for the reaction and chemical quotient, Expression for thermodynamic equilibrium constant, Equilibrium calculations, Response of equilibrium to pressure, volume and temperature.

Learning Outcomes:

Students are able to

1. Understand basics different elements and their atomic properties.
2. Appreciate chemical kinematics and equilibrium.
3. Understand the principles of electrolysis techniques.

Text Books:

1. R.D. Madan : Modern Inorganic Chemistry
2. Bhal and Tuly : Essentials of Physical Chemistry

Reference Books:

1. S. Z Haider : A textbook of Modern Inorganic Chemistry
2. M.M Haque and M.A. Nawab : Principle of Physical Chemistry

1st Year 2nd Semester

EEE-1201: Electronics-I

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn the basic concepts of semiconductors and semiconductor devices.
- Understanding of details rectifier diode, Zener diode, special diodes, transistors and FETs.

Course contents:

- **Overview of Semiconductor and Diode:** Semiconductor, Bonds in semiconductor, commonly used semiconductors, Energy band description of semiconductors, Types of semiconductors, Junction Diode, P-N Junction, Properties of P-N junction, Applying voltage of P-N junction, P-N junction diode.
- **Rectifiers and Filters:** Rectifiers, Half-wave rectifier, Full-wave rectifier, Bridge rectifier, Voltage regulation, Voltage multipliers, Clippers and Clampers, Zener diodes, Zener diode as voltage regulator, Filters, Shunt capacitor filter, Series inductor filter, L-C Filter, The C-L-C Filter.
- **The Bipolar Junction Transistor (BJT):** Introduction, Transistor construction, Transistor configuration CE, CB, CC Transistor static characteristics.
- **Transistor Bias Stabilization:** Factors contributing to thermal instability, Effect of temperature, Stability factor, Stabilization techniques, Bias compensation, Design operations, Basic design of a CE transistor amplifier; Transistor biasing, Fixed bias, Emitter stabilized bias, Voltage divider bias, DC-bias with voltage feedback, Amplifying action, Cut off and Saturation points, DC load line, AC load line.
- **Small Signal Low-Frequency BJT Models:** Transistor equivalent circuits, Hybrid parameters, Analysis of CE, CB and CC amplifiers using h-Parameters, CE amplifier with emitter resistor.
- **Field-Effect Transistors(FETs):** FET, Junction FET, Construction of JFET, Static characteristics of FET, Parameters of FET, DC-biasing of a JFET, FET application, MOSFET, Construction and characteristics of MOSFET, Depletion-type of MOSFET, Enhancement-type MOSFET.

Learning Outcomes:

Students are able to

1. Understand basics of semiconductors.
2. Appreciate concepts of electronic devices and circuits
3. Know the applications of electronic devices.

Text Books:

1. Boylestad and Nashelsky : Electronic Devices & circuit Theory, Prentice-Hall of India Pub. 1996
2. Millman & Tub : Principles of Electronics
3. B.L Theraza : A textbook of Electrical Technology (Vol. IV)

Reference Books:

1. Malvino : Principles of Electronics
2. J. Brophy : Basic Electronics for Scientists. McGraw-Hill Pub.1983
3. Bell : Electronic Devices Circuit
4. Millman and Halkias : Electronic Devices Circuit

EEE-1202: Sessional on Electronics –I

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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EEE-1203: Electrical Circuits-II

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To know the basic laws of electricity and magnetism.
- Understanding of details the electromagnetism, alternating current and thermoelectricity.

Course contents:

- **Magnetic Field and its Interaction:** Introduction to magnetic field, lines of induction, magnetic flux, magnetism from electricity, magnetic force on a free charge, charged particle motion, magnetic force on a wire, Torque on a current loop.
- **Sources of Magnetic Fields:** Biot-Savart Law and its applications, Magnetic force on parallel wires, Ampere's law and its applications, Magnetism in Matter.
- **Electromagnetic Induction:** Faraday's experiment on electromagnetism, Faraday's Law, Motional EMF, Lenz's law, Eddy Currents, self and mutual inductance, energy stored in magnetic field.
- **Alternating Current:** Equation of AC current and voltage, Reactance and Impedance, RMS value and Average value of alternating current, Form factor, Phasor diagram, use of Complex quantities in AC circuits, AC through resistance, Capacitance and inductance, Frequency response of RL, RC, RLC circuits, Power in AC Circuits, Q-factor and band width, Power factor and its improvement, AC in R-L-C circuit and Application of RLC circuit.
- **Thermoelectricity:** Seebeck Effect, Peltier Effect and Thomson effects, Thermal EMF, Laws of addition of thermal EMF, Thermoelectric power, Thermocouples.

Learning Outcomes:

Students are able to

1. Understand the basic laws of electricity and magnetism.
2. Analyze and conversion of AC circuits.
3. Understand basics of Thermoelectricity.

Text Books:

1. C.K. Alecgender & M.N.O. Sadiku, : Fundamental of Electric circuits
2. R.M. Kerchner & G.F Corcoren, : Alternating current ciucuits

Reference Books

1. Robert P Ward, : Introduction to Electrical Engineering",
2. Kothari D.P. and Nagrath I.J. : Theory And Problems of Basic Electrical Engineering
3. Fitzgerald, Higginbotham and Gabel, : Basic Electrical Engineering

EEE-1204: Sessional on Electrical Circuits-II

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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HUM-1205: Economics and Accounting

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 2.5	Exam. Hours: 04
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Course Objectives:

- To learn the basic ideas and principles of core economic and accounting.
- Understanding in details the theoretical and practical applications of economics and accounting.

Course contents:

- **Economics:**
Definition, scope and methods. Demand, supply and their elasticity's, equilibrium analysis partial and general; Consumer behavior, marginal utility; indifference curve, consumer's surplus; producer behavior; iso-quant, iso-cost line. Factors of production function; production possibility curve; fixed cost and variable

cost; short run and long run costs, total, average and marginal cost; laws of returns; internal and external economics and diseconomies; market and market forms; perfect and imperfect competition; price output determinations. Introductory ideas on GNP, GDP, perceptual income, interest, rent, saving, investment, inflation; Project approval, NPV, IRR & their application, cost benefit analysis.

➤ **Accounting:**

Introduction: Definition, advantages, objects; Nature of transaction; double-entry system of book-keeping; classification of account. *Accounting cycle:* Journal, ledger, trial balance, final account including adjustment. *Final Accounts:* Trading & manufacturing accounts, profit and loss accounts and balance sheet. *Depreciation:* methods of depreciation. *Costing:* Concept of cost, classification of cost, cost-sheet, distribution of overhead to the various cost centre/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.

Learning Outcomes:

Students are able to

1. Understand basics theories and laws in economics and accounting.
2. Analyze the social economic development on the basis of GDP.

Reference Books:

1. K.K Deweet : Modern Economic Theoty
2. H.L Ahuja : Modern Microeconomics Theory and Applications.

CSE-1206: Programming Techniques

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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Course Objectives:

- The course provides an understanding of data structures and algorithm, programming language C and C++ etc.
- The students gather fundamental knowledge of different program design with the help of Programming language C and C++.

Course contents:

- **Data Structure and Algorithm:** Data representations; data types and data structures; ways to support data structures (hardware versus software); Abstract Data Types; arrays, stacks, queues, priority queues, lists, trees, graphs and tables(Including their related algorithms); Search algorithms and structures, Sorting Techniques, Algorithm design techniques.
- **Programming in C:** Overview of C, Constants, Variable and Data Types, Operators and Expressions, Managing input and Output Operators, Decision making and branching structures; The Design Control a Case Control Structure, The Loop Control Structure, user defined functions, Recursion and Iterations Arrays 2D Array, Structures and Unions, Pointers, Searching and Sorting Techniques, Linked List using C, Playing with Bits and Bytes, File Management.
- **Object oriented programming using C++:** Introduction, classes and objects; polymorphism; function and operator overloading; inheritance.

Learning Outcomes:

Students are able to

1. Understand the different algorithm techniques.
2. Know the concepts of programming C and C++.

Reference Books:

1. Robert L. Kruse : Data Structures and Program Design.
2. Balagurushamy : Programming in ANSI C
3. Byron Gotifried : Programming With C, Schaums Outlines2nd edition, McGraw Hill, 1996.
4. E. Balagurshami : Object Oriented Programming with C++

MATH-1207: Mathematics-II

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn the basic ideas and principles of the differential and integral calculus.
- To solve the different types of differential and integral problems.

Course contents:

Differential Calculus

- **Function:** Domain, Range, Inverse function and graphs functions, Limits, Continuity, properties of continuous functions.
- **Ordinary Differentiation:** Differentiability, Differentiation of real-valued functions, Successive differentiation, Leibnitz theorem.
- **Expansion of functions:** Rolle's Theorem, Lagrange's means value theorem, Taylor's and Maclaurin's formula, Maxima and Minima
- **Partial Differentiation:** Tangent and Normal, Applications of the derivatives.

Integral Calculus

- **Indefinite Integral:** Method of substitution, Integration by parts, Integration of special trigonometric and rational functions, Fundamental theorem of calculus.
- **Definite Integral:** General properties of definite integral, Evaluation of definite integrals and reduction formula, Applications of integration.
- **Multiple Integral:** Determination of Length area and volume.
- **Mathematical Functions:** Gamma function and Beta function, Relation between beta and gamma function, Bessel's differential equation, Bessel's functions, Legendre differential equations and Legendre polynomials.

Learning Outcomes:

Students are able to

1. Understand the basic theory of differential and integral calculus.
2. Understand to solve different mathematical problems differential and integral calculus.

Text Books:

1. Das and Mukherjee : Differential Calculus
2. Das and Mukherjee : Integral Calculus
3. S. L. Ross : Differential Equations

Reference Books:

1. Edwards : Differential Calculus
2. F. Ayres : Calculus
3. H. T. H. Piaggio : An Elementary Treatise on Differential

ME-1209: Fundamental of Mechanical Engineering

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn the basic concepts of thermal engineering
- Understanding of source of heat engines, thermodynamics, refrigeration and air condition.
- To analyze, design and improve practical thermal and mechanical systems.

Course contents:

- **Introduction to the sources of Heat energy:** Renewable and non-renewable sources and their potential. Introduction to steam generation,
- **Steam generator:** Boilers and their classification; Working principle of few common and modern boiler; boiler mountings and accessories; Performance of boiler.

- **Heat engines:** Classification, working principle, applications, Fuel, lubrication and cooling systems of I.C engines.
- **Thermodynamics:** First law, Systems and surroundings, Conservation of energy, Different laws of thermodynamics processes, Energy transfer as heat for a control volume. Entropy and Second law: Reversibility and irreversibility; Definition and corollaries of second law of thermodynamics. Entropy: its transfer and change. Characteristics of some thermodynamic cycles: Analysis of different thermodynamic cycles, vapor power cycles, Representation of various cycles on PV & TS planes.
- **Basic concepts of refrigeration systems:** Vapor compression refrigeration, Absorption refrigeration, cop, refrigerants and their classifications and properties.
- **Basic concepts of air conditioning systems:** Introduction, objectives and major components of air conditioning systems; Humidity; Dew point.

Learning Outcomes:

Students are able to

1. Understand the properties of different mechanical and electrical heating system.
2. Know the concepts of thermodynamics.
3. Grasp the detail idea of effective power utilization.
4. Comprehend basic domestic electric wiring.

Text Books:

1. R.S. Khurmi & J.K Gupta : A Text Book of Thermal Engineering
2. R. K Rajput : Engineering Thermodynamics
3. R. S Khurmi & J.K Gupta : Mechanical Engineering.
4. R. S Khurmi & J.K Gupta : A Text Book of Refrigeration and Air Conditioning.

NCC Course Title: Islamic Studies/Bangladesh Studies Credit: 0.0

Oral Course Title: Viva-Voce Credit: 1.0

2nd Year 1st Semester

EEE-2101: Electronics-II

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn the ideas of high frequency effects of BJT and FETs.
- Understanding in details of feedback amplifiers, oscillators and power amplifiers.
- To design of oscillator, power amplifier, theory and operation of broadband and tuned amplifiers.

Course contents:

- **High Frequency Response of BJT and FET:** High frequency model for CE amplifier, CE short circuit current gain, High frequency current gain with resistive load, High frequency response of cascaded CE stages, Transformer coupled amplifier, Transistor noises, High frequency model for CS amplifier, High frequency model for CD amplifier, High frequency response of the FET amplifier.
- **Feedback Amplifiers:** Basic Ideas of feedback amplifiers, voltage and current, negative feedback amplifiers, Effects of feedback on bandwidth, Noise and impedance levels, Feedback connection types, Practical feedback circuits, Feedback amplifier phase and frequency considerations, Oscillation in feedback amplifiers, The Nyquist criterion for the stability of a feedback amplifier, Basic design of feedback amplifier, Practical applications.
- **Oscillators:** Basic oscillator operation, positive feedback in amplifier, Criterion of oscillation, RF

oscillators operation, RC phase-shift oscillators, Wien Bridge oscillator, Tuned oscillator circuits, Colpitts oscillators and Hartley oscillators, Crystal oscillators, Voltage controlled oscillator, Armstrong oscillator, Butler oscillator.

- **Power Amplifiers:** Untuned class A, class, AB and B amplifiers, tuned Class B and C amplifiers, Neutralization, Class B and C Push-pull amplifiers, Design of push- pull amplifiers, Complementary and symmetry amplifiers.
- **Multistage Amplifiers:** Amplifier coupling, RC coupling, Impedance coupling, Transformer coupling Two-stage amplifier, Darlington pair, emitter follower, multistage frequency effects.
- **Tuned Amplifiers:** Single tuned, Double Tuned and stagger tuned amplifier, Application of narrow band amplifier.

Learning Outcomes:

Students are able to

1. Appreciate concepts of small signal analysis.
2. Comprehend the operation of oscillators and different type amplifiers.
3. Know low and high frequency analysis.

Text Book:

1. Boylestad and Nashelsky : Electronic Devices and Circuit Theory
2. A. Mottershead : Electronic Devices & Circuits

Reference Books:

1. V. K. Mehtha : Principles of Electronics
2. Bagdi Singh : Fundamentals of Electronics
3. Gupta : Electronics Device and Circuit
4. Coomer : Electronics Circuit

EEE-2102: Sessional on Electronics-II

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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EEE-2103: Electrical Circuits Analysis-III

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn the ideas and principles of transient, ac networks, polyphase circuits and filters.
- To convert the different types of ac circuits
- To analyze and design of different types of filters.

Course contents:

- **Transients:** Transient analysis in electrical (ac & dc) circuits.
- **Series and Parallel AC Circuits:** Impedance and Phasor diagram, Series Configuration, Voltage divider rule, Admittance and Susceptance, Parallel ac Networks, Current Divider rule.
- **Methods of Analysis – AC networks:** Independent versus Dependent sources, Mesh and Nodal Analysis, Wye-Delta and Delta-Wye Conversions.
- **Network Theorems – AC networks:** Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Substitution, Reciprocity and Millman's Theorems.
- **Power – AC networks:** Average, Apparent and Reactive Power, The Power Triangle, The Total P , Q and S , Power Factor Correction
- **Poly phase Circuits:** Analysis of balanced and unbalanced poly-phase circuits,, Phase sequence, Phase sequence at load, Numbering of phases, Interconnection of three phases, Star or Wye (Y)

connection, Voltages, currents and power in Y-connections, Delta or Mesh (Δ) connection, Voltages, currents and power in Δ -connections, Balanced Y/ Δ and Δ /Y conversions, Power measurement in 3-phase circuits.

- **Two port network (TPN):** Two port networks (symmetrical & asymmetrical), determination of two port parameters, relationship between two port parameters, equivalent model for different parameters representation of TPNs, reciprocity and symmetry of TPNs.
- **Filter:** Conventional filter design and operation, elementary filter sections, fundamental equations of an ideal filter, Low-pass RC filter, Low-pass RL filter, High-pass RC filter, High-pass RL filter, R-C Pass band filter, R-C Band stop filter, filter performance.
- **Modern Filter:** Ideal transfer function, general design procedure, Butterworth and Chebyche filters, AC Bridge, Maxwell's inductance bridge, Maxwell's wien bridge, Anderson Bridge, Hay's bridge, De-Sauty Bridge.

Learning Outcomes:

Students are able to

1. Understand basics the transient of different electrical circuits.
2. Analyze and conversion of poly phase electrical circuits.
3. Understand basics of Conventional and modern filters.

Text Books:

1. D. C. Kulshreshtha, :Basic Electrical Engineering
2. S.K. Bhattacharya , :Basic Electrical and Electronics Engineering

Reference Books:

1. Van Valkenburg : Network Analysis.
2. Sudhakar, A.Shyammohan : Circuits and Network.
3. D. Roy Choudhury : Networks and systems.
4. Kelkar and Pandit : Linear Network Theory.
5. Mahmood Nahvi, Joseph A Edminister, : Schaum's Outline of Electric Circuits

STAT-2105: Statistics and Probability

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn the basic ideas and principles of modern statistics.
- Understanding in details the engineering problems solving process, the different methods of probability.

Course contents:

- **Introduction:** Modern Statistics, Statistics and Engineering.
- **Probability:** Sample Spaces and events, Counting, The Axioms of Probability, Theorems of Probability, Conditional Probability, Baye's Theorem, Mathematical Expectation and Decision Making.
- **Probability Distributions:** Random Variables, The Binomial Distribution, The Hyper geometric distribution. The Mean and Variance of a Probability Distributions, Chebyshev's theorem, the Poisson approximation to the Binomial Distribution, Poisson Processes, The Geometric Distribution, The Multinomial Distribution.
- **Probability Densities:** Continuous Random Variables, The Normal Distribution, The Normal Approximation to the Binomial Distribution, The Uniform Distribution. The Weibull Distribution, Joint Probability Densities.
- **Treatment of Data:** Frequency Distributions, Graphs of Frequency Distributions, Stem-and-leaf Plots, Descriptive Measures, Calculation of \bar{x} and s .
- **Sampling Distributions:** Population and Samples, The sampling distribution of the Mean (known).The Sampling Distribution of the Mean (Unknown). The sampling distribution of the Variance.

Learning Outcomes:

Students are able to

1. Know the modern statistics and engineering.
2. Understand the concept of probability and probability distribution.
3. Comprehend the basic of data treatment.

Reference Books:

1. M. Nurul Islam : An Introduction to Statistics and Probability.
2. Douglas C. Montgomery : Applied Statistics and probability for Engineers

MATH-2107: Mathematics-III

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn the basic concepts of vectors, differentials equations and linear transformation.
- Understanding in details of vectors analysis, differential equations, series solutions and linear transformation.
- To solve the different mathematical related problems.

Course contents:

- **Vector Analysis:** Definitions and examples of vectors, Theorems on vector and scalar product of vectors, Vector Differentiation, Differential operators: Gradient, Divergence and Curl of vector function, Vector integration: line, surface and volume integrals; Integral theorem: Gauss's divergence theorem, Stoke's theorem, Green's theorem and Related integral theorem.
- **Co-ordinates geometry of two dimensions:** Change of axes, system of circle, straight line and ellipse.
- **Co-ordinates geometry of three dimensions:** Straight line, Plane and sphere.
- **Differential Equations:** Classification of Differential Equation, Degree and Order of Ordinary Differential Equation, Initial Value Problem, Boundary Value Problem, First-order ordinary differential equations, exact differential equations and integrating factors, Separable equations and equations reducible to this form, Linear equations and Bernolli equations.
- **Higher Order Differential Equations:** Explicit solution of Higher-order linear differential equations, Homogeneous linear equation with constant coefficients, Method of undetermined coefficients, Variation of parameters, Cauchy-Euler equation.
- **Series solutions:** Series solutions of linear differential equations, Power series solutions about an ordinary point, Solutions about singular points, the method of Frobenious.
- **Linear transformations:** Eigen value and Eigen vectors, Cayley-Hamilton theorem.

Learning Outcomes:

Students are able to

1. Understand to solve differential equations.
2. Understand theory and application of series solution and linear transformation.
3. Know basics of Vector analysis.
4. Solve partial differential equations.

Text Books:

1. S. L. Ross : Introductory to ordinary Differential Equations
2. H.T.I Piaggio : Ordinary Differential Equations.
3. B.S Rajput : Mathematical Physics.

Reference Books:

1. M.R Spiegel : Vector Analysis and Tensor Calculus
2. Rahman & Bhattacharjee : Analytical Geometry of Conic Sections

EEE-2109: Electrical Machines-I

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To teach the design principles of Dc machines, single phase and three phase transformers and induction motor.
- Understanding of details of electrical power systems, transformers, generators and motors.
- To learn the basic operation and control of DC generators, DC motors and transformer.

Course contents:

- **DC Generators:** Description of different parts of DC generators, emf equation, principle of DC generators, Different types of winding, Winding Table, Voltage build up, Armature reaction, losses and efficiency, Parallel operation of DC generators.
- **DC Motor:** Principle of operation, classification, losses and efficiency, Starting, Separately excited DC motor, Permanent magnet DC motor, Two and four-quadrant operation of DC motors; speed control by converter and chopper, Crane, traction and hoist application of DC motor, Choice of DC motors for different applications.
- **Transformer:** Working principle, Construction and cooling, 'equivalent circuit, Vector diagram, voltage regulation, efficiency, Losses & efficiency, Parallel operation, Determination of transformer constants and polarity. Three phase operation of single-phase transformer; Open Delta and Scott connections, Harmonics in polyphase transformers, Induction voltage regulators; Autotransformers: three phase and single phase, Power transformers: bushing, Cooling, Tap Changing and parallel operation
- **Induction Motor:** General principles, construction, rotating magnetic field, equivalent circuits, squirrel cage and slip ring motors, torque developed.

Learning Outcomes:

Students are able to

1. Appreciate and understand DC Machines
2. Comprehend the operation and performance of three-phase transformer

Text Books:

1. A. E.Fitzgerald, C. Kingsley, Jr. Stephen :Electric Machinery
2. I. J. Nagrath, D. P.Kothari, :Electric Machines

Reference Books:

1. P. S. Bhimbra, "Electrical Machinery", Seventh Edition, 1995, Khanna Publishers.
2. P.S.Bhimbra, "Generalized Theory in Electrical Machines", Khanna Publishers.
3. P. K. Mukharjee, S Chakravarti, "Electric Machines", DhanpatRai& Sons.

EEE-2110: Sessional on Electrical Machines-I

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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IPE-2111: Industrial Management & Production Engineering

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To know about the various fundamental disciplines of management like personnel management, marketing management, financial management etc.
- To learn the basic knowledge to understand the working of corporate world.

Course contents:

- **Introduction:** Principles of management concepts of management, development of scientific management, principles of Fredric Taylor & functions such as planning organizing, staffing, leading motivating, communicating, controlling, decision making, span of control .

- **Personal management:** Meaning, functions of personal management, manpower planning, collective bargaining, wages & salary administration, labor welfare, training, trade unions, industrial factories Act, industrial boilers Act, Trade union act.
- **Plant management:** Plant location, plant layout, types of maintenance such as break down, predictive & preventive maintenance, stores of management, industrial safety, causes & cost of accidents, safety programs, production planning & control, job, batch & process type of production
- **Marketing management:** Definition & selling & modern concept of marketing, market research, new product development, product life cycle product launching, sales promotion, pricing, channels of distribution, advertising, market segmentation, marketing mix.
- **Material management:** Importance of material management, classification, codification, forecasting, necessity of inventory
- **Financial management:** Sources of finance, financing organizations, types of capital, elements of costs & allocation of indirect expenses, cost control, break even analysis, budgets & budgetary control, equipment replacement policy, make or buy analysis, balance sheet, ratio analysis, profit & loss statement.

Learning Outcomes:

Students are able to:

1. Understand basics of management
2. Develop understanding of personnel management
3. Appreciate marketing management
4. Demonstrate understanding of material and financial management

Text books:

1. Koontz, O Daniiall, “Principles of management”,
2. Kotler P., Stauton “William Principles of marketing management”, Prentice Hall, 1985.

Reference Books

1. S.C. Kuchal, “Financial Management”, Chaitanya Publishing House
2. T.R., Sharma S.C., “Industrial organization & engineering Economics”; Khanna Pub.

2nd Year 2nd Semester

EEE-2201: Electronics-III

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To introduce students with the various concepts of differential amplifiers, operational amplifiers, active filters, pulse and switching circuits.
- To know about operational amplifier operations and design different types of filters, multivibrators, power supplies etc.

Course contents:

- **Differential Amplifiers:** Differential amplifier, DC analysis, AC analysis, CMRR, Constant current bias, current mirror.
- **Operational Amplifiers:** Introduction, Block diagram, Internal circuit, Characteristics, Basic parameters of Op-amplifier, Open-loop of Op-Amp, Applications; Inverting amplifier, Non-inverting amplifier, Summing amplifier, Difference amplifier, Integrator, Differentiator, Instrumentation amplifier, Logarithmic amplifiers, Antilog amplifier, Multiplier, Divider, Voltage to current converter, Current to voltage converter.
- **Active Filters:** Types, Advantages, Filter design, Frequency scaling, First order and second order high pass and low pass filters, Band pass filters, Notch filters, Comparators.
- **Pulse and Switching:** Pulse characteristics, Bistables multivibrators, Monostable multivibrators, Astable multivibrators, Waveform generators, Square wave, Triangular wave, Sawtooth wave, Voltage controlled oscillator(VCO), Schmitt trigger, Blocking oscillator, UJT, Varactor diode, 555 timer circuit and applications.

- **Phase Locked Loops:** Operating principles, Major building blocks, Application of PLL: FM demodulation, FSK demodulation, AM detector, Frequency synthesizer.
- **Switch Capacitor Circuits:** Theory of operation, Switched capacitor interrogator, Universal filters.
- **Power Supplies:** Voltage regulators, Fixed and variable voltage regulators, Switching regulators, Transistor voltage regulators, IC voltage regulators, Shunt and series voltage regulators, Voltage dividers, Protection of equipment from low and high voltage, stabilized power supply with ICs.

Learning Outcomes:

Students are able to

1. Understand the differential amplifiers.
2. Know the concepts of pulse and switching systems.
3. Comprehend basic knowledge of power supplies.

Text Books:

1. Millman & Tub : Electronic Devices and Circuits
2. Gaykwad : Operational Amplifier

Reference Books:

1. Coughlin Driscoll : Operational Amplifier
2. Mithal and Vanswasi : Pulse and Digital Electronics
3. Allen. Motershed : Electronics Devices & Circuits
4. Millman & Halkias : Electronic Devices & Circuits
5. Gupta & Kumar : Handbook of Electronics

EEE-2202: Sessional on Electronics-III

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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EEE-2203: Digital Electronics

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- Study of various number systems and logic gates.
- Study of flip-flops, counters, encoders, decoders, multiplexers etc.

Course contents:

- **Fundamentals of Digital Circuits:** Advantages of digital systems, Number systems and codes, Boolean algebra, Postulates and theorems of Boolean algebra,, Fundamental logical operations, AND/OR/NOT/NOR/NAND/XOR/XNOR operations, Switching functions by interconnection of Gates, Shanon’s theorem, Minimization of switching Functions, Karnaugh Maps, Quine McClusky method.
- **Logic Circuit Families:** Diode Logic, Diode-Transistor Logic (DTL), Resistor-Transistor Logic (RTL), Direct Coupled Transistor Logic (DCTL), Transistor-Transistor logic (TTL), Integrated-Injection Logic (IIL), Emitter-Coupled Logic (ECL), MOSL.
- **Combinational Circuits:** Adder, Subtractor, Multipliers, Decoders, BCD to 7 segment decoder, BCD to Decimal decoder, Encoder, Switch, Encoder, Multiplexer, Demultiplexer, Applications and Comparator.
- **Sequential Circuits and Their Design:** Practical circuit considerations, Latches, Flip-Flops, R-S, J-K, T, D Flip-Flops, Synchronizing and triggering of Flip-Flops, Master-Slave Flip-Flops, Edge triggered Flip-Flops, Analysis of synchronous and asynchronous sequential circuits, Synthesis of sequential circuits, Problem formulation to circuit implementation.
- **Counters:** Synchronous and asynchronous counters, Ripple counter, Binary counter, Decade counter, Ring counter, N- Modulo, Up-down counter, Registers.

- **Semiconductor Memories:** Classification and characteristics of memory, RAM, ROM, PLA, PLD, Charge Coupled Device (CCD), Programmable Logic Array (PLA), Magnetic memories, Expansion of word size and word capacity.
- **Converters:** Digital to Analog Converter (DAC), weighted resistor DAC, R-2R ladder, Analog to Digital Converter (ADC), Ramp ADC, Successive approximation, Flash type DAC and ADC ICs.

Learning Outcomes:

Students are able to

4. Know the conversion of number system.
5. Understand the concept of combinational circuits.
6. Comprehend the basic of sequential circuits.
7. Design counters and converters.

Text Books:

1. Tocci : Digital systems
2. V. K. Jain : An Introduction to Switching Theory and Digital Electronics

Reference Books:

1. R.P. Jain : Modern Digital Electronics
2. Lutfur Rahman : Digital Electronics
3. Malvino and Leach : Digital Principles and Applications

EEE-2204: Sessional on Digital Electronics

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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PHY-2205: Physics-II

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn the fundamental ideas and principle of modern physics.
- Understanding in details atomic physics, relativistic, nuclear physics and quantum mechanics.

Course contents:

- **Atomic Physics:** Thomson's plum pudding model, Rutherford's nuclear atom model, Bohr's atomic model, and its use to energy levels and spectra, Sommerfeld's relativistic model, Different quantum numbers, Vector atom model, Electron configuration, Zeeman effect, Pauli exclusion principle
- **Relativistic Physics:** Postulates of Einstein special theory, Michelson-Morley experiment, Lorentz transformation, Length contraction and Time dilation, Twin paradox, Relativity of mass, Mass-energy equivalence, Velocity addition, General relativity.
- **Nuclear Reaction & Radioactivity:** Properties of nucleus, Nuclear shape and size, Mass defect and Binding energy, Theory of nuclear force, Meson theory, Characteristics of nuclear force. Nuclear fission and fusion, Chain reaction, Nuclear reactor, Thermonuclear reaction in star, Natural and artificial radioactivity, Radioactive decay laws, Half life and mean life, Secular and Transient equilibrium, Radioactive series, radioactive dating, Uses of radioactivity.
- **X-rays:** X-rays and their generation, Line Spectrum and Continuous Spectrum of X-rays, Bragg's law, Laue equations, Experimental methods of X-ray diffraction.
- **Wave-Particle Duality:** Blackbody radiation, Photoelectric effect, Quantum theory of light, The Compton effect, Pair production, Pair Annihilation, De Broglie waves, Phase and group velocities, Heisenberg's uncertainty principle and its applications.
- **Quantum Mechanics:** Limitations of Classical mechanics, Postulates of quantum mechanics, Linear operator, Eigen values and eigen function, Time dependent and time independent Schrodinger equations, Expectation

values, Particle in a box, Finite potential well, Tunnel effect, Harmonic oscillator, Schrodinger's equation for the hydrogen atom.

- **Statistical distribution laws:** Phase space, the probability of distribution, the most probable distribution, Maxwell-Boltzman distribution, Evaluation of constants, Molecular energies in an ideal gas, Bose-Einstein distribution, Fermi-Dirac distribution, Transition between states, Comparison of results.

Learning Outcomes:

Students are able to

1. Understand basics the solid state physics, relativistic physics and nuclear physics.
2. Appreciate quantum mechanics and statistical physics.
3. Understand the properties of X-rays.

Text Book:

1. A Beiser :Concept of Modern Physics.
2. Murugesan : Modern Physics

Reference Books:

1. N. Subrahmanyam and Brijlal : Atomic and Nuclear Physics
2. B.L. Theraja : Modern Physics

EEE-2207: Electrical Machines-II

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To imparts knowledge on construction, operation and applications of single phase motors, alternators and synchronous motors.
- Understanding in details the construction, operation and applications of special machines

Course contents:

- **Single Phase Motors:** Types of single phase motor, double field revolving theory, making self starting, Types of capacitor start motors, Repulsion motor, Universal motor, Reluctance motor, Hysteresis motor.
- **Alternators:** Basic principal, Stationary armature, Rotor, Speed and frequency, Windings, Factors affecting size, armature on load, Voltage regulation.
- **Synchronous Machines:** General outline of synchronous machine (SMS), Motors and generators, Salient pole and non-salient pole, Armature and field core of synchronous generator, Theory of operation, Motor terminal characteristics, Power and torque, Speed control, Application of SMS.
- **Electro mechanical energy conversion:** Principles of electro-mechanical energy conversion, energy balanced equation, energy in single excited magnetic systems, mechanical force and energy.
- **Special Machines:** Universal motor, reluctance motor, hysteresis motor and Pm motor.

Learning Outcomes:

Students are able to

1. Handle the induction machines for various purposes.
2. Look after and interpret the behavior of three phase synchronous machine under different conditions.
3. Appreciate working of special electrical machines

Text Books:

1. P.S. Bhimbra, : Electrical Machinery
2. I.J. Nagrath, D. P. Kothari, : Electric Machines

Reference Book:

1. E Fitzgerald, Charles Kingsley, Jr. S.D. Umans, : Electric Machinery.
2. P. K. Mukharjee, S. Chakravarti, `: Electric Machines
3. P.S. Bhimbra, : Generalized Theory in Electrical Machines

EEE-2208: Sessional on Electrical Machines-II

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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EEE-2210: Electrical and Electronic Shop Practice

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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Course Objectives:

- The objectives of this course enable the students to understand the concepts of electrical heating, welding, illumination, traction and their uses in industry.

Course contents:

- Familiarization with electric switches; Electric tools; electrical fittings and fixtures.; Wire wrapping; Soldering; Electrical symbols; Connection of tube light, staircase lighting, flickering lighting, moving lighting, simple traffic signals, calling bells, etc.
- **Wire specification:** Flexible wire: Electrical cables: T&T cables; fuse wire, etc. Safety devices: Fuse wires; MCCB; fuse distribution board (FDB); oil circuit breaker, air circuit breaker, etc., Motor winding, fans and regulator repairing, transformer winding, etc.
- **Testing:** Megger test, fan and transformer test, earthing and its testing.
- **Electrical wiring** :Illumination, House wiring, Industrial installation wiring, Estimation for electrical wiring system, Safety rules, wiring of air conditioning, designing underground cable, erection estimation, electricity rules, electricity codes, Tariff of PDB and REB.

Reference Book:

1. L. A. A. Warnes : Electronic and Electrical Engineering: Principles and Practice.

Viva Course Title: Viva-Voce

Credit: 1.0

3rd Year 1st Semester

EEE-3101: Measurements and Instrumentation

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- Understand the necessity and importance of Measurement & Instrumentation.
- To know about various kinds of measurement techniques, instruments, sensor & transducers.
- To learn to apply proper method of measurement, sensors in instrumentation

Course contents:

- **Measuring Instruments:** Absolute and secondary instrument, Principle of operation, Essentials of indicating instruments. Classification, Indicating instruments, operation principle of ammeters, voltmeters, wattmeters and watt-hour meter.
- **Introduction of instrumentation error:** Classification of error, normal law of error, guarantee of error.
- **Electrical Instruments:** Classifications, Moving Iron, Attraction and repulsion type, Errors in moving iron, Moving coil meter, Permanent magnet instrument, torque equation, Error dynamic type instrument, Operating principle, Dynamometer, Voltmeter and ammeters, Errors in dynamometer instruments, Ohmmeters, series and shunt type meter, Multi-meter, Thermal instrument, Induction instruments, Rectifier instrument, Extension of range of voltmeter and ammeter, Ammeter shunt, Voltmeter multipliers, Multi-range meters, Instrument transformer, Current and voltages transformer
- **Electronic Instruments:** Measurement fundamentals, Types of error, Voltmeter sensitivity, Loading

effect, Amplified DC meter, Chopper type, AC voltmeter, RMS voltmeter, selecting factors of meter, Digital voltmeter, Component measurement, Q Meter, Frequency Meter.

- **Oscilloscopes:** Block diagram, CRT deflections, Screens, CRT circuits, Vertical deflection system, Delay line, Multiple trace Horizontal deflection system, Probes and transducers, Storage Oscilloscopes, digital storage Oscilloscopes. Sampling Oscilloscopes.
- **Signal Generation and Analysis:** Sine wave generators, Frequency synthesized generator, Sweep frequency generator, Wave analyzers, Harmonic distortion analyzer, Spectrum analyzer, Applications.
- **Transducers:** Classifications, Selection of transducer, Microphones, Loudspeaker, Strain gages, Displacement transducers, LVDT, Temperature measurements, Thermometer, thermocouples, Flow meter, Liquid level detector.

Learning Outcomes:

Students are able to:-

1. Appreciate various aspects of the art and science of measurement and instrumentation.
2. Know about different measurement methods, sensors and transducers.
3. Apply proper method, sensors and transducers for specific applications and measurement.
4. Apply idea of digital techniques in signal processing and instrumentation etc.

Reference Books:

1. A.K. Sawhney : Electrical and Electric measurement and Instrumentation
2. C.S. Rangan : Instrumentation, Devices and Systems.
3. Alan S Morris : Measurement and instrumentation principles
3. W.D. Cooper : Electronic Instrumentation and Measurement Techniques
4. Q. K. Sawhney. : Electrical & Electronic Measurement & Measuring Instruments
5. H.S. Kalsi : Electronic Instrumentation

EEE-3102: Sessional on Measurements and Instrumentation

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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EEE-3103: Electromagnetic Fields & Waves

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn the fundamental concepts applied in Electrostatics, Magnetostatics, Time-varying fields and Electromagnetic Waves.
- To apply the principles of Electromagnetic Field Theory for the design and analysis of Power Transmission lines.

Course contents:

- **Electromagnetics:** Field equations on coulomb, Ampere, Lenz, Gauss and Faraday's law, Displacement current, Maxwell's equations, , boundary conditions, Plane wave in space, Poyinting's radiation vector.
- **Transmission Lines:** Balance, unbalanced lines, Primary Line constants, Characteristics impedance, propagation coefficient, Phase and Group velocity, standing waves, standing wave ratio, losses in transmission line, Smith Chart, Transmission line components: Stub, couplers, Balun, Slotted lines. Telephone lines and Cables, RF lines, Microstrip lines and strip transmission lines.
- **Propagation of Waves:** Electronic spectrum, propagation in free space, Tropospheric propagation, Ionospheric propagation,, Ground (surface) wave propagation, space waves, LF-VLF-ELF propagations.
- **Waveguides:** TM, TE, TEM Waves; Rectangular wave guide; modes, TEMn modes. Circular and other wave guides, Waveguide Coupling, Matching and Attenuation, Cavity resonator; Directional coupler, Isolator, Circulator, Duplexers.

- **Antenna:** Radiation current element; Antenna equivalent circuit, Elementary Doublet, Classification of Antennas, Current-voltage distribution of antenna; Resonant antenna, Radiation pattern, Length of antenna, Non-resonant antenna, Antenna gains, Radiated Power, Antenna resistance, Beamwidth, Bandwidth, Polarization, Effects of ground; Effects of Height, Antenna Coupling; Directional HF, UHF, Microwave and Helical Antenna, Discone antenna, Loop antenna.

Learning Outcomes:

Students are able to

1. Understand basics of electrostatics.
2. Grasp concepts of magnetostatics.
3. Comprehend knowledge waveguide, transmission line and antenna..
4. Appreciate basics of electromagnetic waves.

Text Books:

1. Hayt W.H. : Engineering Electromagnetics, 2013, Eighth Edition, Tata Mc-GrawHill.
2. Mathew, N.O. Sadiku : Elements of Electromagnetics, Fourth Edition, Oxford University Press.

Reference Books:

1. D. N. Narayan Rao, : Elements of Engineering Electromagnetics, Sixth Edition, 2006.
2. Roddy and Coolen : Electronic Communications
3. J.D. Ryder : Networks, Fields and Lines
4. Kennedy and Davis : Electronic Communication Systems.

EEE-3105: Signals and Linear Systems

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course objectives:

- The subject deals with various methods of analysis for continuous time and discrete time systems in time domain and frequency domain.
- Being a basic course, students need to master this subject well and associate its basic concepts in order to become competent engineers.

Course contents:

- **Introduction:** Signals, Systems and Signal Processing, Classification of Signals, Analog-to-Digital and Digital-to-Analog Conversion, Operations on signals, Properties of signals.
- **Random Variables and Processes:** Probability, Cumulative distribution function, Probability Density Function, Tchebycheff's Inequality, The Gaussian Probability Density, The Error Function, The Rayleigh Probability Density, Correlation between random variables, the central-limit theorem, Random Processes, Autocorrelation, Power Spectral Density of a Sequence of Random Pulses, Power Spectral Density of Digital Data, Effect of rudimentary filters of digital data, the complimentary error function.
- **Discrete Time Signals and Systems:** Discrete Time Signals, Discrete Time Systems, Analysis of Discrete Time Linear Time-Invariant Systems, Discrete Time Systems Described by Difference Equations, Correlation of Discrete-Time Signals, Time Domain Representations for Linear Time Invariant Systems, Convolution Properties of convolution Difference and differential equations - characterizing solutions.
- **Transformation:** Fourier Representations of Signals, Discrete time periodic signals - the discrete time Fourier series Continuous time periodic signals - the Fourier series, Discrete time nonperiodic signals - the discrete time Fourier transform Continuous time nonperiodic signals - the Fourier transform Properties of Fourier representations. Applications of Fourier Representations, Frequency response from time-domain system, descriptions Fourier transform representations for periodic signals, Convolution and modulation revisited - mixing periodic and nonperiodic signals, The Fourier transform representation for discrete-time signals, Sampling, continuous-time signals, Reconstruction of continuous-time signals from samples.

- **The Laplace transformation:** Definition Convergence Properties Inversion Solving Differential Equations Transform Analysis of Systems.

Learning Outcomes:

Students are able to

1. Know basics of signal space theory.
2. Understand convolution sum of two signals.
3. Appreciate the concepts of state space representation.
4. Apply different transform for discrete and continuous analysis

Text Books:

1. Oppenheim A.V., Willsky A.S. and Young I.T. : Signals and Systems
2. Simon Haykin and Barry Van Veen :Signals and Systems

Reference Books:

1. R.F. Ziemer, W.H Tranter and J.D.R.Fannin, :Signals and Systems - Continuous and Discrete
2. M. J. Roberts, : Signals and Systems.

EEE-3106: Electrical and Electronic Circuit Simulation

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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MATH-3107: Numerical Methods

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To study of various numerical methods.
- To learn numerical methods and their applications in the field of science and engineering.

Course contents:

- **Computer Application to Numerical Methods:** Classification of numerical methods, Errors in numerical calculations, Solution of algebraic and transcendental equations, The bisection method, The iteration method, Newton-Raphson method, The Secant method, Muller’s method.
- **Numerical Solution of Simultaneous Equations:** Elementary operations of matrices, Gauss-Jordan elimination method, Necessity of normalization, Zero diagonal elements and positioning of size, Matrix inversion, Jacobi’s method, Gauss-Seedier iterative method.
- **Polynomials:** Introduction, Errors in polynomial Interpolation, Difference operators, Expressing a polynomial in factorial notation, Finite difference interpolation, The Lagrange polynomials, Lagrange's interpolation formula for unequally spaced data.
- **Numerical Differentiation & Integration:** Numerical differentiation, Differentiation based on equal interval interpolation, Differentiation based on Lagrange’s interpolation formula, Numerical integration, General quadrature formula, Trapezoidal rules, Simpson's and Romberg's formula, Legendre polynomials, Gaussian quadrature.
- **Numerical Solution of Ordinary Differential Equations:** Introduction, Solution of Taylor’s series, Euler’s method, Runge-Kutta method, Predictor-Corrector method, Boundary-value problems.
- **Solution of Partial Differential Equations:** Introduction, Examples of Partial differential equation, the approximation of derivatives of finite differences, Laplace equation, Iterative Method, Successive Over-relaxation and Alternating and Direction Methods, Parabolic differential equation, Derivation of the elliptic differences equation.

Learning Outcomes:

Students are able to

1. Solve problems based on all types of numerical methods.
2. Study and applications of probability theory.
3. Understand basics of probability distribution function.

4. Know stochastic processes.

Text Books:

1. S. S. Sastry : Introduction Methods of Numerical Analysis.
2. Gerald and Wheatley Addison : Applied Numerical Analysis”, Seventh Edition,2003,Wesley.

Reference Books:

1. Chapra and Canale : Numerical Methods ans engineering.
2. M.R. Spiegel, “Theory and problems of Probability and statistics”, 2nd Edition, McGraw Hill Book Company.

MATH-3108: Sessional on Numerical Methods

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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CSE-3109: Microprocessor, Microcontrollers and Peripherals

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- Need and advantages of microcontrollers and microprocessors in electrical engineering should be understood.
- Students should be able to use and program microcontrollers and microprocessors.

Course contents:

- **Introduction:** Microprocessors and Microcomputer, Evolution of Microprocessor, Microprocessor instruction set and Computer language, General architecture of microprocessor and its operation, Memory, Input/Output (I/O) devices, RISC and CISC processors, Co-processors, Parallel processing.
- **Microprocessor Software Concept:** Introduction, Instruction formats, Addressing Modes, Instruction Types, Introduction to Assembly language programming.
- **Intel 8085 Microprocessor:** Introduction, Internal architecture, Register structure, Memory addressing, Addressing modes, Instruction set, 8085 programming model, Instruction classification, How to write, Assemble and execute a simple program, Memory interfacing, Interfacing output displays, Interfacing Input Devices, Memory mapped I/O, Testing and Troubleshooting I/O interface Circuits, 8085-based System Design.
- **Intel 8086:** Introduction, Architecture, Addressing modes, Instruction set, Programming model, 8086 input/output system design using 8086.
- **Microcontrollers:** Introduction, History, Microcontrollers versus microprocessors, Internal architecture, instruction set, Assembly language programming, Intel-8051, PIC24, AVR32.
- **Programmable Interface Devices:** Interrupts, Basic concepts in programmable devices, The 8155/8156 and 8355/8755 etc multipurpose programmable devices, The 8279 programmable keyboard/display interface.
- **Peripheral Interfacing:** Parallel versus serial transmission, Synchronous and asynchronous serial data Transmission, Basic concept of serial I/O, Software controlled asynchronous serial I/O, The 8085-serial I/O Lines: SID and SOD, Hardware controlled serial I/O using programmable chips, DMA controllers.

Learning Outcomes:

Students are able to:-

1. Understanding 8085/8086, microprocessor architecture
2. Learning assembly programming
3. Learning interfacing of microprocessors
4. Understanding applications of microprocessors

Text Book:

1. Ramesh S. Gaonkar : Microprocessor Architecture, Programming and Applications With the 8085
2. Rafiquzzaman : Microprocessor and Microcomputer System Design
3. Nebojsa Matic : PIC Microcontrollers

Reference Books:

- | | |
|---------------------|--|
| 1. Sheat and Hebber | : Microprocessor |
| 2. Mathure | : Microprocessor |
| 4. Hall, D. V. | : Microprocessor and interfacing, Tata McGraw Hill Pub. 1986 |

CSE-3110: Sessional on Microprocessor, Microcontrollers and Peripherals

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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3rd Year 2nd Semester**EEE-3201: Power System Analysis-I**

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course objectives:

- Modeling of transmission lines
- Appreciate use of PU quantities in power system analysis
- Obtain Steady state solution of power system using G-S Load Flow
- Study Effect of faults

Course contents:

- **Introduction to transmission lines:** Flux linkages, inductance due to external flux, inductance of single-phase two-wire line, composite conductor lines, G.M.D, 3-phase line with equilateral and with unsymmetrical spacing, parallel circuit of 3-phase line, and use of tables.
- **Capacitance of Transmission lines:** Electric field, capacitance of two wire line, three-phase lines with symmetrical & with equilateral spacing, effect of earth, parallel circuits lines, representation of lines: short, medium and long transmission lines, T and π representation, exact solutions, equivalent circuit of long transmission line.
- **Generalized line constants:** General line equations in terms of ABCD constants, relations between constants, charts of line constants, constants of combined networks measurements of line constants.
- **Power flow solutions:** Power flow problem, Gauss-Seidel method, Newton-Raphson method, Power flow studies in system design and operation, regulating transformers.
- **Symmetrical Faults:** Transients in RL series circuits, internal voltages of loaded machines under fault conditions, Fault calculations using Z_{bus} . Circuit breakers.
- **Unsymmetrical faults:** Unsymmetrical faults on power system, Single line-to-ground faults, Double line-to-ground faults, Open-conductor faults.

Learning Outcomes:

Students should be able to:

1. Calculate receiving end voltage of a given transmission line
2. Calculate currents and voltages in various parts of power system using PU concept
3. To find voltage at all buses and power flow through all lines given the loads and generation

Text Books:

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|--------------------------|--|
| 1. W.D. Stevenson Jr. | : Elements of power system analysis, McGraw-Hill publications, 3rd Edition |
| 2. V.K. Mehta & R. Mehta | : Principle of Power Systems. |

Reference Books:

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| 1. John J Grainger | : Power System Analysis, McGraw-Hill (India) Pub. , 2003 |
| 2. Prabha Kundur | :Power System Analysis and Control , TMH, 2008 |
| 3. O. I. Elgerd, | : Electric Energy Systems Theory, McGraw-Hill publications 1971 |
| 4. Hadi Saadat | : Power System Analysis , TMH , 2002 |

EEE-3203: Control System Engineering

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course objectives:

- To learn about automation systems in industries
- To learn various ways to program PLC
- To study PLC applications
- To study the applications in power controlled system

Course contents:

- **Introduction to Control System:** Conventional control system, steady state response to step, ramp, and parabolic inputs, transient response, poles and zeros, frequency response from pole-zero diagram, Routh's stability criterion; block diagrams, canonical forms, transfer functions and signal flow graph, root locus, frequency response, Nyquist's stability criterion.
- **Modern Control System:** Introduction, state variable analysis, controllability and observability, application of Eigen value, linear control system design by state feedback, pole placement.
- **Introduction to Industrial Automation and Control:** Definitions of Automation and Control, Relation between Automation and Information Technology, Role of Automation in Industry, Functional elements of Industrial Automation Systems that perform a variety of functions related to Instrumentation, Control, Supervision and Operations Management, Automation using PLC and SCADA.
- **Introduction to PLC:** Definitions & History of PLC, PLC systems, I/O modules, CPU, Memory, Power supplies, Programmer, Advantages & limitations, Selection criteria for PLC.
- **Programming of PLC:** IEC Programming Standard, Ladder Diagram, Function Block Diagram, Instruction List and Structured Text, Construction of PLC ladder diagram, Basic components & their symbols in ladder diagram, Fundamentals of ladder diagram, Boolean logic & relay logic, Analysis of rungs, Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices

Learning Outcomes:

Student will be able to:

1. Design and implement simple controllers for linear systems in continuous time
2. Design simple controller in state space representation.
3. Analyze the behavior of digital systems.

Text Books:

1. Benjamin C Kuo, "Automatic Control Systems", Prentice Hall of India.
2. M. Gopal, "Control Systems- Principle of Design", Fourth Edition, 2012, McGraw Hill.
3. I.J. Nagrath, "Control Systems Engineering", New Age International Ltd. , 2000

Reference Books:

1. D'Azzo Houpis, Logakusha, Huelsoman, "Linear System Analysis", McGraw Hill.
2. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Pearson Education Inc.
3. Norman S Nise, "Control System Engineering", John Wiley & Sons.
4. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India

EEE-3204: Sessional on Control System Engineering

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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EEE-3205: Communication Engineering-I

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To know about the fundamental concepts of communication information systems.
- To study the techniques involved in the transfer of information in the field of analog and digital communication.

Course contents:

- **Introduction of communication systems:** Basic principles, fundamental elements, system limitations.
- **Information Theory:** Information and system capacity, information transmission, entropy, channel capacity, signal transmission through linear network, filter transfer function, complex frequency spectrum, distortion less transmission.
- **Analog communication:** AM, FM, PM, DSB, SSB, VSB, ISB.
- **Radio Engineering:** AM, FM, PM transmitter & receiver, super heterodyne receiver.
- **Digital communication:** Introduction, Nyquist sampling theorem, quantization of analog system, quantization noise, PAM, PWM, PPM, PCM, LOGPCM, and systems, Digital modulations, ASK, FSK, PSK, DPSK, MSK, M-array digital modulation, QAM, QPSK, delta modulation, multi carrier modulation, line coding, frame construction, Error Probability.
- **Multiplexing:** Space division multiplexing, frequency division multiplexing, time division multiplexing, and code division multiplexing.
- **Noise:** Physical sources of noise, types of noise, calculation of noise, SNR & noise figure, and calculation of noise figure, noise temperature, equivalent noise resistance.
- **TV Engineering:** Transmission and reception of picture information, Scanning, Synchronization, Composite video signal, Vestigial side band transmission, Line of sight transmission, TV channels, Storage type camera tubes, Image orthicon, Vidicon, CCD camera, AGC circuits Fundamentals of TV receiver, Fundamentals of Color TV receiver, Matrix circuits, color pixel composite video signal, Colour picture tube, Digital Television, TV Broadcasting system.

Learning Outcomes:

Students are able to

5. Understand the basic concept of communication systems.
6. Know the information theory.
7. Appreciate the concepts of Digital communication systems.

Text Books:

1. Martin : Modern Digital & Analog Communication systems.
2. Malvino and Leach : Digital Principles and Applications

Reference Books:

1. Roddy and Coolen : Electronic Communications.
2. Kennedy and Davis : Electronic Communication Systems.
3. G.K Mithal : Radio Engineering
4. R.R Gulati : Monochromatic Colour TV.

EEE-3206: Sessional on Communication Engineering-I

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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EEE-3207: Electrical Engineering Materials

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn the basic ideas and principles of electrical materials engineering.
- To understand in depth about electrical, optical and magnetic properties of materials.
- To study properties of dielectrics and superconductor materials.

Course contents:

- **Elementary Materials Science Concepts:** Bonding and types of solids, crystalline, crystalline defects and their significance, electrical and thermal conduction in solids, scattering, classical-Drude model, Mathiessen's rule, failure of classical theory in modern devices, introduction to quantum transport theory.
- **Elementary Quantum Physics:** Photons, electron as wave, time-independent Schrodinger equation, Heisenberg's uncertainty principle, modern theory of solids, band theory of solids, E-K diagram & its physical meaning, density of state, electron effective mass from E-K diagram, direction dependent effective mass.
- **Dielectrics:** Matter polarization and relative permittivity, electron polarization- covalent solids, polarization mechanisms, polar and nonpolar dielectrics, Langevin's theory of polarization, Clausius-Mossotti equation, interaction between field and matter, frequency dependent dielectric constant and dielectric loss, Gauss's Law, dielectric strength and insulation breakdown, piezo electricity.
- **Magnetic Properties:** Magnetization, dipole and atomic moment, magnetization vector, field intensity, permeability and susceptibility, magnetic moments, diamagnetic, paramagnetic, ferrimagnetic, ferromagnetic and antiferromagnetic materials and their applications, magnetic domains polycrystalline and permanent magnetic materials, soft and hard magnetic materials magnetic recording materials.
- **Superconductivity:** Zero resistance and Meissner effect, thermodynamic of superconductors, London equations, Penetration depth, and Coherence length, BCS theory of superconductivity, Quantum theory of superconductivity, Josephson Effect, Superconducting magnet; Type-1 and Type-2 superconductors.
- **Optical properties of solids:** Interaction light with solids, refractive index, dispersion, Fresnel's equations light absorption and scattering, polarization, optical anisotropy, electro-optic effect
- **Nanotechnology:** Low dimension structures, Quantum well, Quantum wires, Quantum dots, Metal, Semiconductor and organic multilayer's, Fullerenes, Nanotubes, Porous silicon and other special nanomaterials. Electronic states in 2-D, 1-D and 0-D solids. Strong and weak confinement

Learning Outcomes:

Students are able to

1. Grasp the basics of thermal and electrical properties of material.
2. Understand the concepts of magnetic properties of material.
3. Know about semiconductor material technology.
4. Appreciate the concepts of dielectrics.

Text Books:

1. Dekkar, A.J., : Electrical Engineering Materials, Reprint Edition",2009, Prentice Hall Publications Co.
2. Kasap S.O., : Principle of Electronic Materials and Devices", Second Edition,Tata McGraw- Hill.

Reference Books:

1. S.O Pillai., :Solid State Physics", Third Edition,New Age International Publishers.
2. R. L Sutherland : hand Book of Non-linear Optics
3. B.B Laud : Laser and Non-linear Optics.

EEE-3209: Digital Signal Processing

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- Students should be acquainted with basic concepts of DSP and its advantages.
- Applications of DSP in electrical engineering should be understood.

Course contents:

- **Introduction to Digital Signal Processing (DSP):** Digital signals and systems: Operations in digital signal processing, the scope of DSP, analog to digital conversion, frequency Domain Effects of Sampling: Periodic repetitions in frequency domain due to sampling in time domain, recovery of continuous-time signal from its samples (reconstruction), role of anti- aliasing and reconstruction filters, examples of aliased signals (show how waveform is distorted), impulse response, finite impulse response (FIR) and infinite impulse response (IIR) of discrete-time systems, difference equation.
- **Discrete Transformations:** Discrete Fourier series, the Discrete-Time Fourier Transform, discrete Fourier transform (DFT) and fast Fourier transform (FFT): Forward and inverse transforms; coefficient ordering; time and frequency resolution; periodic extension, zero padding and modulo-M reduction; properties of the DFT, circular convolution; Cooley- Tukey decomposition, recursive application, radix-2 FFTs , time and frequency decimation, computational complexity.
- **Z-Transformation:** Basic Theory: background idea behind the z-transform (solution to LTI discrete-time diff. eq.), calculation of z-transform and its inverse (briefly), regions of convergence, Properties of z-transforms: role in solution of discrete-time LTI systems, convolution property and graphical interpretation of the convolution operation, z-transforms of cascaded systems, stability and causality, Realization and frequency Response: Frequency response (Magnitude and Phase), representation of LTI systems with rational polynomials, block-form implementations of a rational polynomial transfer function
- **Digital Filters:** FIR filters- linear phase filters, specifications, design using window, optimal and frequency sampling methods; IIR filters- specifications, design using impulse invariant,bi-linear z-transformation, least-square methods, linear phase, Butterworth, Chebychev , Inverse Chebychev , Bessel and elliptic filters, finite precision effects in implementing digital filters.
- **Implementing Digital Filters:** Block-diagram representations; direct forms, cascade forms, first and second-order factors, parallel forms; feedback loops transposed forms; linear-phase FIR structures.
- **Wavelets:** Short time Fourier transform; fundamentals of wavelets, wavelet transform (continuous and discrete), time - frequency density and orthogonal bases.
- **Speech Processing:** Speech production model, Speech analysis and Synthesis aystem, Vocoder.
- **Image Processing:** Image acquisition, Storage and processing, Structure of the human eye, A simple image model, Introduction to image transforms, Restorations and compressions, Colour image processing, Morphological image processors, DSP processors.

Learning Outcomes:

Students are able to

1. Understand the concepts of signals and systems.
2. Analyze of the different transformation techniques.
3. Know about signal analysis and filtering.

Recommended Books:

- | | |
|--------------------------------------|---------------------------------|
| 1. Proakis & Manolakis | : Digital Signal Processing. |
| 2. Alan V Oppenheim & Alan S Willsky | : Signals and Systems. |
| 3. Oppenheim & Schaffer | : Digital signal Processing |
| 4. V U Ready and Suendra Prasad | : Signal Processing. |
| 5. R. C. Gonzalez | : Digital Image Processing |
| 6. J. C. Russ | : The Image Processing handbook |

EEE-3210: Sessional on Digital Signal Processing

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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EEE-3212: Sessional on Electrical Machine Design

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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Specification and design of electromagnets, solenoids, chokes transformers and induction motor.

Viva Course Title: Viva-Voce

Credit: 1.0

4th Year 1st Semester**EEE-4000: Thesis/ Project**

Full Marks 100	Course works/Research works	Credit: 1.0	
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EEE-4100: Industrial Attachment/ Training/Internship

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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EEE-4101: Power System Analysis-II

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course objectives:

- To understand the concepts of transmission lines characteristics and transmission cost and tariff.
- To learn about underground and overhead transmission lines.
- Obtain stability and economic operation of power system.

Course contents:

- **Insulators for overhead lines:** Types of insulators, their constructions and performance, potential distribution in a string of insulators, string efficiency, methods by equalizing potential distribution, special types of insulators, testing of insulators.
- **Mechanical characteristics of transmission line:** Sag and stress analysis, effect of wind and ice loading, supports at different elevation, conditions of erection, and effects of temperature changes.
- **Insulated cables:** Underground cables vs. overhead lines, insulating materials, electro static stress grading, three core cable-dielectric losses and heating, modern developments oil filled and gas filled cables, measurements of capacitance, cable testing, corona & corona power loss.
- **Economic marginal transmission cost and tariff:** energy rates and analysis, economic operation of power system.
- **Recent trends in transmission system:** Overview of flexible ac transmission system(FACTS), high voltage dc transmission system (HVDC) and SCADA.
- **Power system stability :** The stability problem of power system, distinction between steady state and transient stability, the swing equation, equal area criterion and its applications, solution of swing equation, factors affecting transient stability, improving stability.

- **Typical layout of a substation and load curves:** Demand factor, diversity factor, load duration curves, energy load curve, load factor, capacity factor, plant factor and load forecasting.

Learning Outcomes:

Students should be able to:

1. Understand the fundamental properties of insulators and overhead lines
2. Calculate the different parameters of transmission lines.
3. To find power flow through all lines given the loads and generation

Reference Books:

1. HadiSaadat : Power system Analysis
2. Charles A. Gross, John Wiley & Sons : Power system Analysis by.
3. John J. Grainger & William D. Stevenson : Power system Analysis
4. Abhijit Chakrabarti & Sunita Halder : Power system Analysis Operation and control by,
5. William D. Stevenson, Jr : Elements of Power System Analysis

EEE-4102: Sessional on Power System Analysis-II

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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EEE-4103: Communication Engineering-II

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To introduce the fundamental ideas on the telephony systems.
- To design tradeoffs and performance of communications systems.
- To understand the concepts of optical communications, microwave communication, Radar and Satellite Communication.

Course contents:

- **Telephony:** Introduction to telephone system, principles, microphone, receiver and elements of telephone.
- **Ex-change:** Introduction to switching systems, stronger and crossbar exchange, digital exchange, signaling & switching technique, traffic theory, PABX system, telephone/exchange tariff measurement.
- **Optical Communications:** Optical fiber, characteristics, sources, detectors, optical transmitters, optical receivers, repeaters.
- **Microwave communications:** Introduction, Generation of UHF by triodes and their limitation, Microwave Components, Resonator, Tees, Couplers, Circulators and isolators, Microwave transistors, Microwave tunnel diode amplifiers and oscillators, Gunn-Effect diodes, Gunn diode oscillator and amplifier, Read diode, Klystron, Reflex klystron, Magnetron, Strip lines, Microwave integrated circuits, Microwave transmitter and receiver, Microwave measurement and test equipment, Microwave link, Frequency assignment and modulation methods, Baseband repeater, Single and multi-channel RF. repeater.
- **Radar and Sonar :** Basic principles, Radar equation, Factors influencing maximum range, Type of Radar; Pulsed Radar system, Modulator, Receiver, Duplexer, Moving target indicator, Tracking Radar, Search Radar system, Antenna system, Sonar.
- **Satellite Communications:** Introduction, Satellite systems, Orbiting satellites, Satellite frequency bands, Satellite altitude, Transmission path, Satellite channel, Satellite transponder, Multiple-Access methods: Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access.

Learning Outcomes:

Students are able to

1. Understand the basic concept of telephony and ex-change systems.
2. Appreciate the concepts of optical, microwave, radar and satellite communication systems.

Reference Books:

1. Umesh Singh : Telephony system.
2. Bellamy : Digital Telephony :
3. Darma Prakash Agarwall : Introduction to Wireless and Mobile System
4. C. Y. Lee : Mobile Cellular Telecommunication
5. Saleh Faruque : Cellular Mobile System
6. Louis J. Ippolito, Jr. : Satellite Communications Systems Engineering

EEE-4104: Sessional on Communication Engineering-II

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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EEE-4105: VLSI Design

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To introduce the fundamental ideas on the MOS devices, CMOS technology.
- To perform the programmable logic devices, CMOS chip design and VLSI design.

Course contents:

- **Basic MOS Structure:** Introduction, Evolution of VLSI Device Technology, Metal Oxide Semiconductor (MOS) and VLSI Technology, Basic MOS Transistor Operation, MOS Transistor Switches, NMOS Fabrication, Basic CMOS Technology, CMOS Process Enhancements, BiCMOS Technology
- **MOS Device Characteristics:** Introduction, Static Behaviour of the MOS Transistor, Dynamic Behaviour of MOS Transistor, The Actual MOS Transistor-Secondary Effects, NMOS Inverter, Determination of Pull-up to Pull-down Ratio, Pull-up to Pull-down Ratio for an NMOS Inverter Driven Through One or More Pass Transistor, Device Models for Simulation
- **MOS Circuit Design Process:** Introduction, Why Design Rules, MOS Layers, Stick Diagrams, Design Rules and Layout, Elements of Physicals Design
- **Special Circuit Layouts:** Introduction, Tally Circuits, NAND-NAND, NOR-NOR, and AOI Logic, Exclusive-OR Structures, Barrel Shifter, Transmission Gates, Latches and Flip-flops, Fan-in and Fan-out of CMOS Logic Design
- **Programmable Logic Devices:** Introduction, NMOS PLAs, Other Programmable Logic Devices, The Finite-State Machine as a PLA Structure, Complex Programmable Gate Arrays (FPLA)
- Field Programmable Gate Arrays (FPGA)
- **CMOS Chip Design:** Introduction, Design Strategies, CMOS Chip Design Options, Verilog HDL Basic Concepts, Structural Gate-Level Modeling, Switch-Level Modeling, General VLSI System Components, Combinational Logic Designs, CMOS VLSI Latch.

Learning Outcomes:

Student will be able to:

1. Design and implement MOS and CMOS devices.
2. Testing the different type of MOS and CMOS devices.
3. Simulation of MOS and CMOS devices

Text Books:

1. Principles of CMOS VLSI Design :N. H. E. Weste, K. Eshraghian, 2nd ed., Addison-Wesley, 1994

Reference Books:

1. Physical Design Automation of VLSI Systems :B. T. Preas, M. Lorenzetti, The Benjamin- Cummings Publishing Co., 1988.
2. Digital Systems Design Using VHDL :C. H. Roth, Jr. 1st ed., Thomson Engineering, 1998

EEE-4107: Power Electronics

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To impart knowledge of recent and advanced developments in power electronics area.
- Applications of power electronics converters and power electronics devices.

Course contents:

- **Semiconductor power devices:** SCRs, Thyristors, TRIACS, BJT, power MOSFET and IGBT.
- **AC to AC Controlled converter:** On-off and phase control, single phase and three phase power controllers and cyclo-converter.
- **DC to DC converter:** Chopper, characteristics and operation of step up and step down choppers, switching converter and power regulators.
- **AC to DC Controlled converter:** Single phase and three phase half wave, full wave and semi-converter, phase control, characteristics, power factor control and converter triggering circuits.
- **Inverter:** Three phase and single phase voltage source and current source inverters, voltage, frequency and harmonic control, PWM inverters, SVM inverter.
- **Introduction to power electronic control of motors:** Scalar and vector control of poly phase induction motors, rotor power control, synchronous motor and PMSM motor control.
- **Industrial applications:** Introduction to resistance welding, saturable reactors and magnetic amplifiers, dielectric heating, induction heating.

Learning Outcomes:

Students are able to

1. Understand the basic concepts of semiconductor switches.
2. Understand operation and applications of AC-DC and cyclo converters.
3. Understand the operation and application of inverters and DC-DC converters.
4. Comprehend control techniques of various motors.

Text Books:

1. M. Rashid, "Power Electronics", Pearson Education India, 2004.
2. Ned Mohan, "Power Electronics", Third Edition, 2012, John Willey.

Reference Books:

1. M.D. Singh, K.B. Khanchandani, "Power Electronics", Tata McGraw Hill.
2. C.Y. Lander., "Power Electronics", Third Edition, 1993, McGraw Hill International.
3. B.K. Bose, "Modern Power electronics", 2003, Pearson Education India.
4. Joseph Vithyathil, "Principles of Power Electronics", First Edition, 2010, Tata McGraw Hill.

EEE-4108: Sessional on Power Electronics

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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HUM-4109: Professional Ethics and Moral Thoughts

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 2.5	Exam. Hours: 04
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Course Objectives:

- To impart knowledge of professional ethics and moral thoughts.
- To learn about good behavior and moral development.

Course contents:

- **Introduction:** Meaning of ethics, professional ethics code and psychological basis of Ethics, Religion and ethics, egoism and relativism, utilitarianism and rational utilitarianism, ethics and other branches of knowledge.
- **Concept of Moral Thoughts and Judgment:** Bases of human behavior, moral development and reasoning, morality and social institution moral rights and duties, interpersonal moral sentiment, occupational culture and ideology, occupational stress, morality and religion, organizational commitment, morality in international context.
- Engineering and professionalism, engineer ethics, the negative face of engineering ethics, the positive face of engineering ethics, facts codes of ethics, utilitarian thinking respect for persons.

Learning Outcomes:

Students are able to

1. Understand the basic concepts of professional ethics.
2. Understand moral thought and judgment.

Reference Books

1. R.S. Naagarazan : A text book on Professional ethics and Human Values.
2. Karen L. Rich : Introduction to Ethics.

4th Year 2nd Semester**EEE-4000: Thesis/Project**

Full Marks 100	Experimental/Research works	Credit: 3.0	
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EEE-4201: Switchgear and Protection

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To introductory knowledge of switchgear.
- Comprehensive exposure to philosophy and technology of protection.\

Course contents:

- **Circuit breakers:** Types, ratings, constructions and selections, arc extinction, maintenance, testing and recovery voltage.
- **Fuse:** Commercially available fuses, their constructions, characteristics and applications.
- **Relays:** Types, construction, principle and operating characteristics of over current, IDMT, reactance, directional, power and impedance relays, balanced current relaying of parallel line, ground fault relaying, pilot relaying principles, protection relay schemes for generators, transformers, lines, feeders, buses, motor, generator and power systems, reactors, lightning arrestors, surge absorbers, ground wire, generators grounding, co-ordination of over current relay.
- **Digital relaying and applications:** Bus bar system and reactors, Simple bus bar, double bus bar, ring bus bar, Reactors

Learning Outcomes:

Students are able to

1. Appreciate the philosophy of protective relaying.
2. Apply Over-Current protection for protection of various power system elements.
3. Understand Differential Protection for transformer , bus bar and motor Protection
4. Comprehend switching phenomenon and the working of various types of circuit breakers and their duties.

Text Books:

1. C.R. Mason : : Art and Science of Protective Relaying, John Wiley & Sons, New York, 1977.
2. Y. G. Paithankar, S.R. Bhide : Fundamentals of Power System Protection, PHI, 2nd edition, 2010.

Reference Books:

1. S. H. Horowitz, A. G. Phadke : Power System Relaying, 3rd ed. John Wiley & Sons, 2008.
2. J. L. Blackburn, T. J. Domin : Protective Relaying, principals and application, 3rd ed. CRC press, 2007.

EEE-4202: Sessinal on Switchgear and Protection

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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EEE-4203: Power Plant Engineering

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To introduce the fundamental ideas on the manual and automatic power plants.
- Understanding in details the generation of power with control.

Course contents:

- **Power Plants:** General layout and principles, steam turbine, gas turbine, combined cycle, hydro and nuclear. Plant performance and operation characteristics,
- **Atomic power plant:** Nuclear fission and fusion; energy release; moderation, control, cooling and shielding aspects, factor, place, utility and effects on environment and human beings.
- **Selection of Location:** Technical, economical (Efficiency, heat rate and incremental rate, load division between generating units for economy, economic conductor selection, Kelvin's law.) and environmental factors (forces on bus section in case of short circuit), load forecasting, load shearing (base load & peak load plant), Optimum load scheduling, transmission line loss ,chronological load curves to distribute load among units.
- **Graphical method for location of distribution systems:** Bus system layout, importance of current limiting reactors.
- **Generation Scheduling:** Deterministic and probabilistic generation, load curves- demand factor, diversity factor, load duration curve, energy load curves, load factor, capacity factor, plant factor, electricity tariff formulation and type.

Learning Outcomes:

Students are able to

1. Know working of conventional and nuclear power plants.
2. Understand behavior of different generating stations.
3. Comprehend operations of different power distribution systems.
4. Appreciate detail study of power station control problem.

Reference Books:

1. Leonjard L. Grigs : Electric Power Generation, Transmission and Distribution
2. Bernhardt G.A. Skrotzki : Power Station Engineering and Economy, Tata McGraw Hill
3. E.I Wakil & M.M : Power Plant Technology, McGraw-Hill 1984.
4. S.C Arora & S.Domkundwar : A course in Power Plant Engineering
5. Nag P.K, Tata : Power plant Engineering, McGraw-Hill, 1998.

EEE-4205: Cellular Mobile Communication

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- To learn the fundamental ideas on the mobile communication.
- Understanding in details networks components and data base networks.

Course contents:

- **Mobile communication:** Introduction, concept, evolution and fundamentals, analog and digital cellular systems, cellular radio system, frequency reuse, co-channel interference, cell splitting and components, Mobile radio propagation, propagation characteristics, models for radio propagation, antenna at cell site and mobile antenna, frequency management and channel assignment, fundamentals, spectrum utilization, fundamentals of channel assignment, fixed channel assignment, non-fixed channel assignment, traffic and channel assignment, handoffs and dropped calls, reasons and types, forced handoffs, mobile assisted handoffs and dropped call rate.
- **Network Components:** Switching, TRC, BCS, MSC, GMSC, HLR, VLR, ILR, AUC, EIR, Base station system, RBS, Cell antennas and Mobile antennas.
- **Introduction to networks:** ISDN, B-ISDN, LAN, MAN, WAN, BLUETOOTH, ATM, and multimedia communication, Unicast, Multicast, and Broadcast.
- **Mobile Station:** Function, Idle mode, Types, SIM, MS features, Evolution of MS, MS in Idle mode, Access to network, Roaming in cells, Detaching from network, MS in active move, Call set up from MS, Call set up and call termination.
- **Data Services and Networks:** CDPD, HSCSD, GPRS, D-AMPS+, CDMA Two, WAP, GPRS architecture, GPRS traffic case, GSM to 3G, EDGE, WCDMA and 4G.

Learning Outcomes:

Students are able to

1. Understand the fundamental knowledge of cellular mobile telephony.
2. Know the networking system of cellular mobile.
3. Appreciate the concepts of mobile station and data services.

Reference Books:

1. GSM System Survey : Ericson student text by Ericson Radio System
2. Darma Prakash Agarwall : Introduction to Wireless and Mobile System
3. C. Y. Lee : Mobile Cellular Telecommunication
4. Saleh Faruque : Cellular Mobile System

EEE-4206: Sessional on Cellular Mobile Communication

Full Marks 100	(Exam. 70, Note Book 05, Lab. Performance 05, Class Attendance 10, Viva-voce on experiment 10)	Credit: 1.5	Exam. Hours: 06
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EEE-4207: High Voltage Engineering

Full Marks 100	(Semester End Exam. 70, Tutorial/Assignment 15, Class Attendance 10, Quiz/Presentation 05)	Credit: 3.0	Exam. Hours: 04
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Course Objectives:

- Understanding the breakdown phenomenon of insulating materials used in electrical system.
- Various high voltage generation and measuring techniques.
- Electrical Apparatus Quality evaluation through testing methodologies

Course contents:

- **High voltage Supplies:** AC: Cascaded transformers, resonant circuit, DC: Rectifier circuits, cascaded generators, electrostatic generators
- **Impulse Generators:** Impulse voltage wave shapes, mathematical analysis and design consideration of impulse generators, Multistage generators, Triggering of impulse generators.
- **Measurement of High Voltage:** Measurement of high ac, dc, and impulse voltages and currents, sphere gap and uniform gap methods.
- **Corona:** Power loss calculation, corona formation voltages, corona breakdown of solid, liquid and gaseous dielectrics, insulation testing, standard specifications, high voltage DC transmission merits and demerits over AC transmission, bridge arrangement, mathematical analysis of the bridge circuit, regulation reactive power, artificial commutation.
- **Protection against lighting and insulation co-ordination:** Lighting phenomena, direct and indirect lighting, transmission line design based on direct strokes, ground wire, lighting devices, arrestors and protectors tubes, insulation co-ordination and transformer insulation protection.

Learning Outcomes:

Students are able to

1. Understand high voltage breakdown phenomena in insulating materials.
2. Design insulation scheme of electrical machines.
3. Know the generation and measurement of high voltage quantities.
4. Analyze the test procedures as per the standards.

Reference Books:

1. M.S. Naidu and V. Kamaraju, : High Voltage Engineering', Tata McGraw Hill, 3rd Edition, 2004.
2. Kuffeland, W.S. Zaengl, : High Voltage Engineering Fundamentals', Pergamon press, Oxford.

EEE-4210: Technical Seminar

Full Marks 100		Credit: 1.0	
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Student will present two technical paper/topics related to electrical or electronics engineering on two seminars.