Syllabus

Department of Electrical and Electronic Engineering
Port City International University

PORT CITY INTERNATIONAL UNIVERSITY

Syllabus

of

Bachelor of Science in Electrical and Electronic Engineering

Effective from EEE 30 to Onward

Department of Electrical and Electronic Engineering

Faculty of Science & Engineering

Table of Contents

Introduction

Department of Electrical and Electronic Engineering

The Department of Electrical Engineering under the Faculty of Science & Engineering offers Bachelor of Science in Electrical and Electronic Engineering. Electronic plays a vital and in fact, indispensable role in all fields of modem human activities. Consequently, Electrical and Electronic Engineering has established itself as one of the most important branches of engineering. The technical aspects of this branch of engineering are often categorized by terms such as power systems, power electronics, control systems, telecommunication, electronic circuits, solid state devices and computer engineering. With the increasing importance of computers, the Department of Computer Science and Engineering has been opened as a separate department, but all the students of Electrical and Electronic Engineering are requested to have a balanced knowledge of digital electronics, computers, micro-processors and programming. The new generation of electrical engineers is encouraged to undertaken research and development activities in the above areas and this department is committed to the study and analysis of fundamental as well as applied problems. Problems of national importance have consequently received great emphasis in the activities of this department. Problems in the fields of electric power generation. Transmission and distribution, high voltage transients, power system stability, economic operation of power systems, system planning, design. Throughout the study programs, considerable emphasis is placed on the development of systematic procedure for analysis and design, and on the responsible use of technology.

Electrical and Electronic engineering encompasses a wide range of disciplines linked by a common thread: the use and control of electric, electronic, or electromagnetic energy. Electrical engineers are responsible for numerous areas of technology, including television, radio, and telephony; electronic appliances and entertainment systems; medical imaging; computers; radars; robotics; remote sensing; fiber-optic and photonic networks; semiconductor devices; and integrated circuits. The electrical engineering program prepares students for careers related to these critical areas of technology, and seeks to produce graduates who have:

- ✓ A strong foundation in electrical engineering with an appropriate balance between theory and application.
- ✓ A wide repertoire of techniques and skills for the effective practice of modern electrical engineering.
- ✓ An integrated view of the sub-fields of electrical engineering.
- ✓ A broad education and ethical awareness to serve as responsible professionals.
- ✓ An ability to expand their knowledge to adapt to changes in technology etc.

Goal:

To produce a well-rounded and well-balanced graduate who can use Electrical and Electronic Engineering tools to solve real world problem.

- ✓ To encourage the students to take up industry specific projects
- ✓ To train and educate students as Global Citizens
- ✓ To use modern techniques in teaching and learning process

Overview

Degree Requirements

To earn a B. Sc. in Electrical and Electronic Engineering degree, a student must complete at least 145.5 credit hours with CGPA 2.50. The following is a description of how these credit hours are distributed among the courses:

SL.	Group	Theory	Sessional	Thesis	Total
1	General Education	18.0	-	-	18.0
2	English	6.0	-	-	6.0
3	Mathematics	15.0	-	-	15.0
4	Basic Science	6.0	3.0	-	9.0
5	Electrical and Electronic Engineering	54	16	4.5	74.5
6	Allied Engineering	6.0	1.5	-	7.5
7	Elective Course-Major	15.0	3.0	-	18.0
8	Elective Course-Minor	6.0	3.0	-	9.0
Total					157.00

Program Details

Duration	8 semesters (48 months)
Total No of credit courses	64 courses
Normal course load per semester	10-16.5 credit hours
Duration of each semester	4 months
Project & Thesis	4.5 credit hours
Total Credit Hours	157credit hours
Cumulative Grade Point Average (CGPA)/Passing Grade	2.50

Class Attendance Policy

The university expects all students to attend classes regularly. Students may not be allowed to sit for the examination if his/her percentage of class attendance falls below 70 percent.

Calculation of GPA

Grade Point Average (GPA) or Cumulative Grade Point Average (CGPA) is the average of the grade points obtained in all the courses passed/completed by a student. For example, if a student passes/completes four courses in a semester having credit hours of C1, C2, C3, & C4 and his/her grade points in these courses are G1, G2, G3, & G4 respectively then

$$GPA/CGPA = \frac{\sum C_n G_n}{\sum C_n}$$

Suppose a student got grade point "4.0" in a 3 credit hours course and 3.0 in 1.5 credit hours course then his/her GPA/CGPA will be as follows:

$$GPA/CGPA = \frac{(3\times 4)+(1.5\times 3)}{3+1.5} = 3.67$$

Marks Distribution

Particulars	**% of Marks**
Class Attendance	10
Assignment/Project/Class Participation/Presentation	10
Class Tests/Quizzes	10
Mid Term Exam	30
Final Exam	40
Total	100

Grading System (UGC approved)

Department of Electrical and Electronic Engineering follows University Grants Commission (UGC) approved grading system. This grading system is also used by the other departments of Port City International University. The performance of the students in the course work is evaluated by letter grading systems as described below:

Marks Range	**Grade**	**Grade point**	**Interpretation**
80% and above	A+	4.00	Outstanding
75% to below 80%	A	3.75	Excellent
70%to below 75 %	A-	3.50	Very Good
65% to below 70%	B+	3.25	Good
60% to below 65%	B	3.00	Satisfactory
55% to below 60%	B-	2.75	Above Average
50% to below 55%	C+	2.50	Average
45% to below 50%	C	2.25	Below Average
40% to below 45%	D	2.00	Pass
Less than 40%	F	0.00	Fail
	I	0.00	Incomplete

Applicant's Eligibility & Selection Procedures

All applicants must meet one of the following requirements to apply for admission in B. Sc. in Electrical and Electronic Engineering program:

- Minimum GPA 2.5 in both S.S.C./equivalent and H.S.C./equivalent from science background with physics, chemistry and mathematics or other fields of study.
- Minimum 5 subjects in O-Level and 2 subjects in A-Level with minimum grade of B in 4 subjects and minimum grade of C in 3 subjects from science background with mathematics, chemistry and physics or other fields of study.

Applicants will be selected for admission through admission test, which includes written exam as well as viva voce. Applicants who will score satisfactory marks in written test will be qualified for viva voce.

Credit Transfer

A student may transfer of his/her credits from an educational institution/university with a system similar to Port City International University after his/her admission. Such candidates will have to apply to Registrar of PORT CITY through the Head of the department with required documents. Credit transfer of university level courses is acceptable.

Class Hour in Credit Hour System

For 1.0 credit hour theoretical course, there will be 14 hours class in a semester. For a 1.0 credit hours lab course, there will be 28 hours class in a semester.

Semester System

Port City International University will follow semester system and, in this system, an academic year will be of 2 (two) semesters. There will be 18 weeks class in a semester.

B.Sc. in EEE (Regular)

YEAR 01 SEMESTER 01

No.	Course code	Course Title	Credit
1.	ENG 101	Composition	3.00
2.	PHY 111	Physics-I	3.00
3.	PHY 112	Physics-I Lab	1.50
4.	HIST 101	History of the Emergence of Independent Bangladesh	3.00
5.	MATH 115	Differential and Integral Calculus	3.00
6.	EEE 111	Electrical Circuit-I	3.00
7.	CSE 131	Computer programming language	3.00
8.	CEN 130	Engineering Drawing	1.50
Total			**21.00**

1. ENG 101 Composition 3.00 Cr. Hours

General discussions:

Introduction, various approaches to learn English. Grammatical Problems: Construction of sentences, grammatical errors, sentence variety and style, conditionals, vocabulary and diction.

Reading Skills:

Discussion readability, scan and skin reading, generating ideas through purposive reading, reading selective stories.

Writing Skills:

Principles of effective writing, organization, planning and development of writing, composition, précis writing, and amplification.

General Strategies for the Writing process:

Generating ideas, identifying audiences, and purposes, construction arguments, stating problems, drafting and finalizing. Listening Skills: The phonemic systems and correct English pronunciation.

Speaking Skills:

Practicing dialogue, storytelling, and effective oral presentation.

Suggested Text:

1. J. Steinbeck, "The Pearl", 1st ed., Penguin Books, 2000

Suggested References:

1. Thomas Cruisius and Carolyn Channell, "Aims of Argument", 3rd edition, Mayfield Publishing Company, 2000

2. Betty Mattix Dietsch, "Reasoning & Writing Well", McGraw-Hill, 2003

2. PHY 111 Physics-I **3.00 Cr. Hours**

Waves and Oscillation:

Differential equation of simple harmonic oscillator, total energy and average energy, combination of simple harmonic oscillation, spring mass system, torsional pendulum; two body oscillation, reduced mass, damped oscillation, forced oscillation, resonance, progressive wave, power and intensity of wave, stationary wave, group and phase velocities.

Optics:

Defects of images: spherical aberration, astigmatism, coma, distortion, curvature, chromatic aberration. Theories of light, interference of light, Young's double slit experiment, displacement of fringes and its uses, Fresnel bi-prism, interference in thin films, Newton's rings, interferometers.

Diffraction:

Diffraction by single slit, diffraction from a circular aperture, resolving power of optical instruments, diffraction at double slit and N slits, diffraction grating; polarization; production and analysis of polarized lights, Brewster's law, Malus law, polarization by double refraction, Nicol prism, optical activity, Polar meters.

Modern Physics:

Galilean relativity and Einstein's special theory of relativity; Lorentz transformation equation, Length contraction, Time dilation and mass energy relation, photoelectric effect, Compton effect, De Broglie matter waves and its success in explaining Bohr's theory, Pauli's exclusion principle. Constituents of atomic nucleus, nuclear binding energy, different types of radio activity, radioactive decay law, Nuclear reactions, nuclear fission, nuclear fusion, atomic power plant.

Suggested Books:

1. D. Halliday, R. Resnick and J. Walker, "Fundamentals of Physics", 7th ed., Wiley, 2004

2. F. W. Sears, M. W. Zemansky and H. D. Young, "University Physics", Addison Wesley Publishing Company, 1987

3. "Schaum's Outlines of Theory & Problems of Vector Analysis"

4. Dr. G. Ahmad, "Outlines of Physics Vol.1"

5. B. Lal and N. Subrahmanyam, "Properties of Matter", 6th ed., S. Chand & Company Ltd,

2001

6. B. Lal and N. Subrahmanyam, "Heat and Thermodynamics", S. Chand & Company Ltd., 2001.

7. B. Lal and N. Subrahmanyam, "A Textbook of Sound", Sangam Books, 1999

8. B. Lal and N. Subrahmanyam, "A Textbook of Optics", S. Chand & Company Ltd.,2001.

3. PHY 112 Physics-I Lab 1.50 Cr. Hours

Laboratory experiments based on PHY 111.

4. HIST 101 History of the Emergence of Independent Bangladesh 3.00 Cr. Hours

Course objective: The main objective of this course is to help the student to understand the brief history of Bangladesh; from ancient to present era. This course will focus specifically on how Bangladesh appeared as a sovereign country in world map.

Suggested Books:

1. Harun-or-Roshid, The Foreshadowing of Bangladesh: Bengal Muslim League and Muslim Politics,1906-194

2. Rounaq Jahan, Pakistan: Failure in National Integration,

3. Talukder Maniruzzaman, Radical Politics and the Emergence of Bangladesh,

4. R. C. Majumdar, History of Bengal, Vol.1

5. Shyamal Ghosh, The Awami League.

6. M. B. Nair, Politics of Bangladesh

7. A M A Muhith, Emergence of a Nation

5. MATH 115 Differential and Integral Calculus 3.00 Cr. Hours

Differential Calculus: Limits, continuity and differentiability. Successive differentiation of various types of functions. Leibnitz's theorem, Rolle's theorem, Mean value theorem, Taylor's and Maclaurin's theorems in finite and infinite forms, Lagrange's form of remainders, Cauchy's form of remainders, expansion of functions, evaluation of indeterminate forms of L' Hospital's rule. Partial differentiation. Euler's theorem. Tangent and normal subtangent and subnormal in Cartesian and polar co-ordinates, determination of maximum and minimum values of functions. Curvature asymptotes. Curve tracing.

Integral Calculus: Integration by the method of substitution. Standard integrals, integration by successive reduction, definite integrals, its properties and use in summing series. Walli's formulae, improper integrals. Beta function and Gamma function. Area under a plane curve and area of a region enclosed by two curves in Cartesian and polar coordinates, volumes and surface areas of solids of revolution.

Suggested books:

1. A Text Book on Coordinate geometry and Vector Analysis by Kosh Mohammad.

2. S. L. Loney, "The Elements of Coordinate Geometry", Nelson Thornes (out of print)

3. H. A. Anton, I. Bivens, and S. Davis Calculus, "Calculus", 7th ed., Wiley, 2004

6. EEE 111 Electrical Circuits-I 3.00 Cr. Hours

Circuit variables and elements:

Voltage, current, power, energy, independent and dependent sources, resistance.

Basic laws:

Ohm's law, Kirchoff's current and voltage laws. Simple resistive circuits: Series and parallel circuits, voltage and current division, wye-delta transformation.

Techniques of circuit analysis:

Nodal and mesh analysis including supernode and supermesh.

Network theorems:

Source transformation, 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, series parallel combination of inductors and capacitors.

Responses of RL and RC circuits:

Natural and step responses.

Magnetic quantities and variables:

Flux, permeability and reluctance, magnetic field strength, magnetic potential, flux density, magnetization curve. Laws in magnetic circuits: Ohm's law and Ampere's circuital law. Magnetic circuits: series, parallel and series-parallel circuits.

Suggested Texts:

1. W. H. Hayt, J. Kemmerly and S. M. Durbin, "Engineering Circuit Analysis", 6th ed., McGraw-Hill, 2002

2. Robert L. Boylestad, "Introductory Circuit Analysis", 10th Edition, Prentice-Hall, 2002

Suggested References:

1. J. W. Nilsson and S. Riedel, "Electric Circuits", 7th ed., Prentice Hall, 2004

2. J. D. Irwin, "Basic Engineering Circuit Analysis", 7th ed., Wiley, 2001

3. R. C. Dorf and J. A. Svoboda, "Introduction to Electric Circuits", 6th ed., Wiley, 2003

4. D. E. Johnson, J. R. Johnson, J. L. Hilburn and P. D. Scott, "Electric Circuit Analysis", 3rd ed., Wiley, 1996

5. R. E. Thomas and A. J. Rosa, "The Analysis and Design of Linear Circuits", 4th ed., Wiley, 2

7. CSE 131 Computer Programming Language 3.00 Cr. Hours

Introduction to digital computers. Nature of computers and its evolution, Generation of computers, Capabilities of computers and their applications and limitations, Computer hardware & Software components, Data recording media, Computer system software, Number systems, Data representation, Algorithms & flowcharting, Loops and Counters, Loop & Trailer values, Loops & Accumulators, Switches, Number searching.

Programming languages, algorithms and flow charts. Structured Programming using C. Variable and constants, operators, expressions, control statements, function, arrays, pointers, structure unions. User defined data types. Input output and files. Object oriented Programming using C++: introduction, classes and objects; polymorphism; function and operator overloading; inheritance.

Suggested Texts:

1. Herbert Schildt, "Java: The Complete Reference", 7th edition, McGraw-Hill Osborne Media

2. Herbert Schildt, "C++: The Complete Reference", 4th edition, McGraw-Hill Osborne Media

3. Harvey M. Deitel and Paul J. Deitel, "C How to Program", 5th edition, Prentice Hall

Suggested References:

1. Bruce Eckel, "Thinking in Java", Prentice Hall

2. www.java.sun.com and the API Specifications

3. Bjarne Stroustrope, "The C++ programming language", Addison-Welsey

4. Bruce Eckel, "Thinking in C++", Prentice Hall

5. Kernighan & Ritchie, The C Programming Language, second edition, Prentice-Hall, 1988

8. CEN 130 Engineering Drawing 1.50 Cr. Hours

Introduction- lettering, numbering and heading, instrument and their use, sectional views and isometric views of solid geometrical figures. Plan, elevation and section of multistoried buildings; building services drawings; detailed drawing of lattice towers.

Suggested Books:

1. Basant Agrawal	Engineering Drawing, Tata McGraw-Hill Education, 2008
2. Simmons & Maguire	Manual of Engineering Drawing
3. Eanna O Broin	Technical Draughtmanship

YEAR 01 SEMESTER 02

No.	Course code	Course Title	Credit
1.	MATH 125	Complex Variable & Vector Analysis	3.00
2.	EEE 121	Electrical Circuit II	3.00
3.	CHM 133	Chemistry	3.00
4.	CHM 134	Chemistry Laboratory	1.50
5.	EEE 122	Electrical Circuit Laboratory	1.50
6.	ECO100	Fundamentals of Economics	3.00
7.	BDS 139	Bangladesh Studies	3.00
8.	ENG 125	Technical English	3.00
Total			**21.00**

1. MATH 125 Complex Variable and Vector Analysis 3.00 Cr. Hours

Complex Variable: Complex number system, general functions of a complex variable, limits and continuity of a function of complex variable and related theorems, complex function differentiation and the Cauchy- Riemann equations, infinite series. Convergence and uniform convergence. Line integral of a complex function. Cauchy integral formula Liouville's theorem. Taylor's and Laurent's theorem, singular points. Residue. Cauchy's residue theorem.

Vector analysis: Multiple product of vectors. Linear dependence and independence of vectors. Differentiation and integration of vectors together with elementary applications. Line, surface, and volume integrals. Gradient of a scalar function, divergence and curl of a vector function, various formulae. Integral forms of gradient, divergence and curl. Divergence theorem. Stoke's theorem, Green's theorem and Gauss's theorem.

Suggested books:

1. J. H. Mathews and R. W. Howell, "Complex Analysis for Mathematics and Engineering", 4th ed., Jones and Barlett, 2000

2. I. Stewart and D. Tall, "Complex Analysis: (the hitchhiker's guide to the plane)", Cambridge University Press, 1983

3. J. W. Brown and R. V. Churchill "Complex Variable and Applications", 7th ed., McGraw-Hill, 2003

4. D. G. Zill, "A First Course in Differential Equations", 7th ed., Brooks Cole, 2000

5. M. R. Spiegel, "Schaum's Outline of Complex Variables", McGraw-Hill, 1968

6. M. R. Spiegel, "Schaum's Outline of Laplace Transform", McGraw-Hill, 1965

2. EEE 121 Electrical Circuits II **3.00 Cr. Hours**

Prerequisite: Electrical Circuit I

Sinusoidal functions:

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

Analysis of single-phase ac circuit:

Series and parallel RL, RC and RLC circuits, nodal and mesh analysis, application of network theorems in ac circuits, circuits with non-sinusoidal excitations, transients in ac circuits, passive filters.

Resonance in ac circuits:

Series and parallel resonance. Magnetically coupled circuits.

Analysis of three phase circuits:

Three phase supply, balanced and unbalanced circuits, power calculation.

Suggested Texts:

1. J. W. Nilsson and S. Riedel, "Electric Circuits", 7th ed., Prentice Hall, 2004

Suggested References:

1. Robert L. Boylestad, "Introductory Circuit Analysis", 10th Edition, Prentice-Hall, 2002

2. J. D. Irwin, "Basic Engineering Circuit Analysis", 7th ed., Wiley, 2001

3. R. C. Dorf and J. A. Svoboda, "Introduction to Electric Circuits", 6th ed., Wiley, 2003

4. D. E. Johnson, J. R. Johnson, J. L. Hilburn and P. D. Scott, "Electric Circuit Analysis", 3rd ed., Wiley, 1996

5. R. E. Thomas and A. J. Rosa, "The Analysis and Design of Linear Circuits", 4th ed., Wiley, 2003

3. CHM 133 Chemistry **3.00 Cr. Hours**

Atomic structure, quantum numbers, electronic configuration, periodic table, properties and uses of noble gases; Different types of chemical bonds and their properties; molecular structure of compounds; selective organic reactions, different types of solutions and their compositions; phase rule, phase diagram of mono-component system, properties of dilute solutions, thermo-

chemistry, chemical kinetics, chemical equilibria, ionization of water an pH concept, electrical properties of solution.

Suggested books:

1. D. Ebbing, "General Chemistry", Houghton Mifflin Co., London.

2. S.Z Haider, "Introduction to Modern Inorganic Chemistry", Friends International,

Dhaka.

3. M. M. Haque and M. A. Nawab, "Physical Chemistry", Student Publications, Dhaka.

4. R. H. Morrison and R. N. Boyd, "Organic Chemistry", Prentice - Hall.

4. CHM 134 Chemistry Laboratory **1.50 Cr. Hours**

Laboratory experiments based on CHM 133.

5. EEE 122 Electrical Circuits Laboratory **1.50 Cr. Hours**

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 111 and EEE 121. In the second part, students will design simple systems using the principles learned in EEE 111 and EEE 121.

6. ECO 100 Fundamentals of Economics **3.00 Cr. Hours**

Introduction to economics. Economics and engineering. Different economics systems. Fundamental economic problems. Basic elements of demand, supply and product market. Theory of utility and preferences, consumer's surplus. Theory of production and costs, Theory of the firm and market structure. Optimization.

Introducing macroeconomics. National income accounting; the simple Keynesian analysis of national income, employment and inflation. Savings, investment and decision-making. Fiscal policy and monetary policy and interest rates, income and spending. Economics of development and planning.

7. BDS 139 Bangladesh Studies **3.00 Cr. Hours**

Brief modern history of Bangladesh: colonial, pre-liberation and present. Geography and environment of Bangladesh. Social structure, population diversity, religions. Government &

political system, administrative framework & its evolution. Production: agriculture & industry. Economic development: roles of public & private sectors, NGOs, rural development. Globalization & the role of Bangladesh.

8. ENG 125 Technical English 3.00 Cr. Hours

General:

Work with adapted and authentic technical texts aimed at the study program, Development of professional communication in English, Development of perceptive and productive communication skills with professionally orientation.

Scientific terminology:

Construction of sentences and paragraphs; phrases and idioms, proverbs, punctuation, commercial correspondence and tender notice, amplification and description, Technical report writing; standard forms of term papers, thesis, etc.

YEAR 02 SEMESTER 01

No.	Course code	Course Title	Credit
1.	BUS 227	Financial & Managerial Accounting	3.00
2.	MATH 135	Differential Equations	3.00
3.	EEE 211	Electronics I	3.00
4.	EEE 224	Electronics Laboratory	1.50
5.	EEE 241	Electrical Machines I	3.00
6.	MEC 213	Fundamentals of Mechanical Engineering	3.00
7.	EEE 235	Continuous Signal and Linear System	3.00
8.	EEE 262	Computing Method and Technique for Engineering Analysis Laboratory	1.00
Total			**20.50**

1. BUS 227 Financial and Managerial Accounting 3.00 Cr. Hours

Financial Accounting: Objectives and importance of accounting, branches of accounting, accounting as an information system, computerized system and application in accounting. Recording Systems: double entry mechanism, accounts and their classification, accounting equation, accounting cycle journal, ledger, and trial balance. Preparation of financial statements considering adjusting and closing entries. Accounting concepts and conventions. Financial statements analysis and interpretation: ration analysis- tests for profitability, liquidity, solvency and overall measure.

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

2. MATH 135 Differential Equations 3.00 Cr. Hours

Ordinary Differential Equations: Degree and order of ordinary differential equations, formation of differential equations, and solution of first order differential equations by various methods. Solution of general linear equations of second and higher orders with constant coefficients, Solution of homogeneous linear equations. Solution of differential equations of the higher order when the dependent or independent variable are absent. Solution of differential equation by the method based on the factorization of the operators, Frobenius method.

Partial Differential Equations: Introduction, Linear and non-linear first order equation. Standard forms, linear equations of higher order, equations of the second order with variable coefficients. Wave equations, particular solution with boundary and initial conditions.

Suggested books:

1. D. G. Zill, "A First Course in Differential Equations", 7th ed., Brooks Cole, 2000

2. M. A. Rahman, "Mathematical Methods with Applications" (Volume 2), Computational Mechanics, 2000

3. EEE 211 Electronics I 3.00 Cr. Hours

P-N junction as a circuit element:

Intrinsic and extrinsic semiconductors, operational principle of p-n junction diode, contact potential, current-voltage characteristics of a diode, simplified dc and ac diode models, dynamic resistance and capacitance.

Diode circuits:

Half wave and full wave rectifiers, rectifiers with filter capacitor, characteristics of a zener diode, zener shunt regulator, clamping and clipping circuits.

Bipolar junction transistor (BJT) as a circuit element:

Bipolar junction transistor: current components, BJT characteristics and regions of operation, BJT as an amplifier, biasing the BJT for discrete circuits, small signal equivalent circuit models, BJT as a switch.

Single stage mid-band frequency BJT amplifier circuits:

Voltage and current gain, input and output impedance of a common base, common emitter and common collector amplifier circuits.

Metal-oxide-semiconductor field-effect-transistor (MOSFET) as circuit element:

Structure and physical operation of an enhancement MOSFET, threshold voltage, Body effect, current- voltage characteristics of an enhancement MOSFET, and biasing discrete and integrated MOS amplifier circuits, single-stage MOS amplifiers, MOSFET as a switch, CMOS inverter.

Junction field-effect-transistor (JFET):

Structure and physical operation of JFET, transistor characteristics, pinch-off voltage.

Differential and multistage amplifiers:

Description of differential amplifiers, small-signal operation, differential and common mode gains, RC coupled mid-band frequency amplifier.

Suggested Texts:

1. S. Sedra and K. C. Smith, "Microelectronic Circuits", 5th ed., Oxford University Press, 2003
Suggested References:

1. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 8th Edition, Prentice- all, 2002

2. David A. Bell, "Electronic Devices and Circuits", 5th edition, Oxford University Press, 2008

3. W. H. Hayt, J. Kemmerly and S. M. Durbin, "Engineering Circuit

4. EEE 224 Electronics Laboratory 1.50 Cr. Hours

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 211 and EEE 223. In the second part, students will design simple systems using the principles learned in EEE 211 and EEE 223.

5. EEE 241 Electrical Machines-I 3.00 Cr. Hours

Transformer:

Single Phase Transformer:
Construction And Principle Of Operation, Ideal Transformer, Transformer Ratio, Actual Transformer-Equivalent Circuit, Per Unit Systems, Phasor Diagrams, Efficiency, Regulation And Testing (Open And Short Circuit)
Three Phase Transformer:
Connections, Vector Group, Parallel Operation And Testing, Autotransformer, V- Connection.

Induction Motor:

Three Phase :
Construction, Rotating Magnetic Field, Equivalent Circuit, Vector Diagram, Torque-Speed Characteristics, Effect of Changing Rotor Resistance And Reactance On Torque-Speed Curves, Motor Torque And Developed Torque Power, No-Load Test, Blocked Rotor Test, Starting, Braking And Speed Control, Motor Classes.

Single Phase:

Theory of Operation, Equivalent Circuit, Starting Process.

6. MEC 213 Fundamentals of Mechanical Engineering 3.00 Cr. Hours

Thermodynamics:

Heat and work – the first law of thermodynamics and its applications; kinetic theory of gases – kinetic interpretation of temperature, specific heats of ideal gases, equi-partition of energy, mean free path, Maxwell's distribution of molecular speeds, reversible and irreversible processes, Carnot's cycle, second law thermodynamics, Carnot's theorem, entropy, Thermodynamic function, Maxwell relations, Clausius and Clapeyron equation.

Study of fuels:

Steam generating units with accessories and mountings; study of steam generators and turbines. Introduction to internal combustion engines and their cycles, study of SI engines, CI engines and gas turbines with their accessories.

Types of fluid machinery:

Study of impulse and reaction turbines; Pelton wheel and Kaplan turbines; study of centrifugal and axial flow machines; pumps, fans, blowers and compressors, study of reciprocating pumps.

7. EEE 235 Continuous Signal and Linear Systems 3.00 Cr. Hours

Classification of signals and systems: signals - classification, basic operation on signals, elementary signals, representation of signals using impulse function; systems – classification. Properties of Linear Time Invariant (LTI) systems: Linearity, causality, time invariance, memory, stability, invertibility. Time domain analysis of LTI systems: Differential equations - system representation, order of the system, solution techniques, zero state and zero input response, system properties; impulse response - convolution integral, determination of system properties; state variable - basic concept, state equation and time domain solution. Frequency domain analysis of LTI systems: Fourier series- properties, harmonic representation, system response, frequency response of LTI systems; Fourier transformation- properties, system transfer function, system response and distortion-less systems. Applications of time and frequency domain analyses: solution of analog electrical and mechanical systems, amplitude modulation and demodulation, time-division and frequency-division multiplexing. Laplace transformation: properties, inverse transform, solution of system equations, system transfer function, system stability and frequency response and application.

Suggested Texts:

1. A.V. Oppenheim and A. S. Willsky, "Signals and Systems", 2nd ed., Prentice-Hall, 1997

2. B. P. Lathi, "Linear Systems and Signals", 1st ed., Oxford University Press, 2001

8. EEE 262 Computing Method and Technique for Engineering Analysis Laboratory

1.00 Cr. Hours

Prerequisite: CSE 131

Numerical solution of algebraic and transcendental equation, Computer Programing and application related to the Numerical method.

YEAR 02 SEMESTER 02

No.	Course code	Course Title	Credit
1.	EEE 251	Electrical Machines II	3.00
2.	EEE 252	Electrical Machines Laboratory	1.50
3.	EEE 221	Electronics II	3.00
4.	BUS 217	Professional Ethics	3.00
5.	EEE 243	Electromagnetic Fields and Waves	3.00
6.	EEE 316	Machine Design	0.75
7.	MATH 215	Linear Algebra	3.00
8.	EEE 325	Digital Signal Processing I	3.00
9.	EEE 326	Digital Signal Processing Laboratory	0.75
Total			**21.00**

1. **EEE 251 Electrical Machines-II** **3.00 Cr. Hours**

DC Generator:

Construction, Principle of operation, classification, armature winding, no-load voltage characteristics, build up process of a self-excited shunt generator, critical field resistance, load voltage characteristics, effect of speed on no-load and load characteristics, voltage regulation, armature reaction and commutation, testing.

DC Motor:

Operation, types, speed-torque characteristics, starting, speed, control braking

Synchronous Generator:

Construction, excitation systems, equivalent circuit, armature reaction, vector diagram at different load, factor affecting voltage regulation, synchronous impedance, synchronous impedance method of predicting voltage regulation and its limitations.
Parallel Operation: Necessary Conditions, synchronization, circulating current and vector diagram, effect of change in parameters (voltage, steam supply, excitation).

Synchronous Motor:

Construction, operation, effect of loading under different excitation condition, effect of changing excitation, V- Curves and starting.

2. **EEE 252 Electrical Machines Laboratory** **1.50 Cr. Hours**

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 241 and EEE 251. In the second part, students will design simple systems using the principles learned in EEE 241 and EEE 251.

3. EEE 223 Electronics II **3.00 Cr. Hours**

Prerequisite: Electronics I

Frequency response of amplifiers:

Poles, zeros and Bode plots, amplifier transfer function, techniques of determining 3 dB frequencies of amplifier circuits, frequency response of single-stage and cascode amplifiers, frequency response of differential amplifiers.

Operational amplifiers (Op-Amp):

Properties of ideal Op-Amps, non-inverting and inverting amplifiers, inverting integrators, differentiator, weighted summer and other applications of Op-Amp circuits, effects of finite open loop gain and bandwidth on circuit performance, logic signal operation of Op-Amp, dc imperfections.

General purpose Op-Amp:

DC analysis, small-signal analysis of different stages, gain and frequency response of 741 Op-Amp. Negative feedback: properties, basic topologies, feedback amplifiers with different topologies, stability, frequency compensation.

Active filters: Different types of filters and specifications, transfer functions, realization of first and second order low, high and bandpass filters using Op-Amps.

Signal generators:

Basic principle of sinusoidal oscillation, Op-Amp RC oscillators, LC and crystal oscillators.

Power Amplifiers:

Classification of output stages, class A, B and AB output stages.

Suggested Texts:

1. S. Sedra and K. C. Smith, "Microelectronic Circuits", 5th ed., Oxford University Press, 2003

2. P. Malvino and J. A. Brown, "Digital Computer Electronics", 3rd ed., McGraw-Hill, 1992

3. W. H. Hayt, J. Kemmerly and S. M. Durbin, "Engineering Circuit Analysis", 6th ed., McGraw-Hill, 2002

4. BUS 217 Professional Ethics 3.00 Cr. Hours

Definition and scopes of Ethics. Different branches of ethics. Social change and the emergence of new technologies. History and development of engineering ethics. Science and technology-necessity and application. Study of ethics in engineering. Applied ethics in engineering. Human qualities of an engineer. Obligation of an engineer to the clients. Attitude of an engineer to other engineers. Measures to be taken in order to improve the quality of engineering profession. Ethical expectation: Employers and employees; inter-professional relationship: Professional organization – maintaining a commitment of ethical standards. Desired characteristics of a professional code. Institutionalization of ethical conduct.

Suggested Text:

D. B. Ingram and J. A. Parks, "Understanding Ethics", Alpha, 2002

Suggested References:

1. John R. Boatright, "Ethics and the Conduct of Business", 4th edition, Pearson Education, New Delhi, 2003

2. Manuel G. Velasquez, "Business Ethics: Concepts and Cases", 5th Edition, Pearson Education, New Delhi, 2002

3. William Lillie, "An Introduction to Ethics", 3rd Edition, Methuen & Co. Ltd. London, 1964

4. Donald C. Abel, "Fifty Readings in Philosophy", 2nd Edition, McGraw-Hill, New York, 2004

5. Nigel Warburton, "Philosophy Basics", 3rd Edition, Routledge, 1999

6. Peter Singer, "Practical Ethics", 2nd Edition, The Press Syndicate of the University of Cambridge, 2000

5. EEE 243Electromagnetic Fields and Waves 3.00 Cr. Hours

Static electric field:

Postulates of electrostatics, Coulomb's law for discrete and continuously distributed charges, Gauss's law and its application, electric potential due to charge distribution, conductors and dielectrics in static electric field, flux density - boundary conditions; capacitance - electrostatic energy and forces, energy in terms of field equations, capacitance calculation of different geometries; boundary value problems – Poisson's and Laplace's equations in different co-ordinate systems.

Steady electric current:

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

Time varying fields and Maxwell's equations:

Faraday's law of electromagnetic induction, Maxwell's equations - differential and integral forms, boundary conditions, potential functions; time harmonic fields and Poynting theorem.

Plane electromagnetic wave:

Plane wave in loss less media - Doppler effect, transverse electromagnetic wave, polarization of plane wave; plane wave in lossy media – low-loss dielectrics, good conductors; group velocity, instantaneous and average power densities, normal and oblique incidence of plane waves at plane boundaries for different polarization.

Suggested Texts:

1. D. M. Pozar, "Microwave Engineering", 3rd ed., Wiley, 2000

Suggested References:

1. S. Ramo, J. R. Whinnery and T. V. Duzer, "Fields and Waves in Communication Electronics", 3rd ed., Wiley, 1994

2. A. Das and S. K. Das, "Microwave Engineering", McGraw-Hill, 2001.

3. J. D. Krauss and R. J. Marhefka, "Antennas", 3rd ed., McGraw-Hill, 2001

4. C. A. Balanis "Antenna Theory: Analysis and Design Technology", 3rd ed., Wiley, 2005

5. P. E. Collins, "Antennas and Radio Propagation", McGraw-Hill, 1985

6. E. C. Jordan and K. G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall, 1993

6. EEE 316 Machine Design 0.75 Cr. Hours

General design principle of electrical apparatus involving electrical and magnetic circuit, specification design of electromagnetics solenoids, chokes, starters etc, design of rotating machines and transformers.

7. MATH 215 Linear Algebra 3.00 Cr. Hours

Introduction to systems of linear equations, Gaussian elimination, definition of matrices, algebra of matrices, transpose of a matrix and inverse of matrix, factorization, determinants, quadratic forms, matrix polynomials. Euclidean n-space, Linear transformation IR^n to IR^m. Properties of linear transformation from IRn to IRm . Real vector spaces and subspaces. Basis and dimension. Rank and nullity. Inner product spaces. Gram- Schmidt process and QR-decomposition. Eigen values and Eigen vectors. Diagonalization linear transformation: Kernel and Range. Application of linear algebra to electric networks.

Suggested books:

1. H. A. Anton and C. Rorres, "Elementary Linear Algebra", 8th ed., Wiley, 2004

2. H. A. Anton, I. Bivens, and S. Davis Calculus, "Calculus", 7th ed., Wiley, 2004

3. B. Kolman and D. R. Hill, "Introductory Linear Algebra with Applications", 7th ed., Prentice Hall, 2001

4. P. B. Bhattacharya, S. K. Jain and S. R. Nagpaul, "First Course in Linear Algebra", New Age Press, 1995

5. M. A. Rahman, "Mathematical Methods with Applications" (Volume 2), Computational Mechanics, 2000

8. EEE 325 Digital Signal Processing-I 3.00 Cr. Hours

Prerequisite: EEE 235

Introduction to digital signal processing (DSP):

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

Discrete transformations:

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

Correlation:

Circular convolution, auto-correlation and cross correlation.

Digital Filters:

FIR filters - linear phase filters, specifications, design using window, optimal and frequency sampling methods; IIR filters – specifications, design using impulse invariant, bi-linear Z transformation, least-square methods and finite precision effects.

9. EEE 326 Digital Signal Processing Laboratory 0.75 Cr. Hours

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 325 and. In the second part, students will design simple systems using the principles learned in EEE 325.

YEAR 03 SEMESTER 01

No.	Course code	Course Title	Credit
1.	EEE 313	Digital Electronics	3.00
2.	EEE 314	Digital Electronics Laboratory	1.50
3.	EEE 323	Communication Theory	3.00
4.	EEE 324	Communication Laboratory	1.50
5.	EEE 337	Electrical Power Transmission and Distribution	3.00
6.	EEE 320	Electrical Services Design	1.50
7.	MATH 225	Probability and statistics	3.00
8.	BUS 317	Industrial Management	3.00
Total			**19.50**

1. **EEE 313 Digital Electronics** **3.00 Cr. Hours**

Analysis and Synthesis of Digital Logic Circuits:

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

Programmable Logic Devices:

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

Sequential Circuits:

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

Suggested Text:

1. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design", McGraw-Hill, 2002

Suggested Reference:

1. M. Morris Mano, "Digital Logic and Computer Design", Prentice Hall, 2003

2. EEE 314 Digital Electronics Laboratory 1.50 Cr. Hours

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 313. In the second part, students will design simple systems using the principles learned in EEE 313.

3. EEE 323 Communication Theory 3.00 Cr. Hours
Prerequisite: EEE 235
Overview of communication systems:

Basic principles, fundamental elements, system limitations, message source, bandwidth requirements, transmission media types, bandwidth and transmission capacity. Noise: Source, characteristics of various types of noise and signal to noise ratio.

Information theory:

Measure of information, source encoding, error free communication over a noisy channel, channel capacity of a continuous system and channel capacity of a discrete memory less system.

Communication systems:

Analog and digital. Continuous wave modulation: Transmission types – base-band transmission, carrier transmission; amplitude modulation – introduction, double side band, single side band, vestigial side band, quadrature; spectral analysis of each type, envelope and synchronous detection; angle modulation – instantaneous frequency, frequency modulation (FM) and phase modulation (PM), spectral analysis,

Demodulation of FM and PM. Pulse modulation:

Sampling – sampling theorem, Nyquist criterion, aliasing, instantaneous and natural sampling; pulse amplitude modulation - principle, bandwidth requirements; pulse code modulation (PCM) - quantization principle, quantization noise, non-uniform quantization, signal to quantization error ratio, differential PCM, demodulation of PCM; delta modulation (DM) - principle, adaptive DM; line coding – formats and bandwidths.

Digital modulation:

Amplitude-shift keying - principle, ON-OFF keying, bandwidth requirements, detection, noise performance; phase-shift keying (PSK) - principle, bandwidth requirements, detection,

differential PSK, quadrature PSK, noise performance; frequency-shift Keying (FSK) - principle, continuous and discontinuous phase FSK, minimum-shift keying, bandwidth requirements, detection of FSK.

Multiplexing:

Time- division multiplexing (TDM) - principle, receiver synchronization, frame synchronization, TDM of multiple bit rate systems; frequency-division multiplexing - principle, de-multiplexing; wavelength-division multiplexing, multiple-access network – time-division multiple-access, frequency-division multiple access; code-division multiple- access (CDMA) - spread spectrum multiplexing, coding techniques and constraints of CDMA. Communication system design: design parameters, channel selection criteria and performance simulation.

Suggested Texts:

1. S. Haykin, "Communication Systems", 3rd ed., Wiley, 1995.

Suggested References:

1. G. Kennedy, "Electronic Communication Systems", McGraw-Hill, 4th Edition, 1987

2. Taub and Schilling, "Principles of Communication Systems", 2nd ed., McGraw-Hill, 1987

3. B. Carlson, "A Communication Systems", 3rd Edition, McGraw-Hill, 1986

4. Roody and Coolen, "Electronic Communication", 4th ed., Prentice Hall, 1999

4. EEE 324 Communication Laboratory 1.50 Cr. Hours

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 323. In the second part, students will design simple systems using the principles learned in EEE 323.

5. EEE 337 Electrical Power Transmission and Distribution 3.00 Cr. Hours

Transmission System:

Types of conductors, resistance, definition of inductance, inductance of conductor due to internal flux, flux linkages between two points external to an isolated conductor, inductance of a single-phase two-wire line.

Capacitance of Transmission Line:

Capacitance of a three phase with equilateral spacing and unsymmetrical spacing, effect of earth on the capacitance of three phase transmission lines, bundled conductors, parallel circuit three phase lines.

Load Flow Solution and Control:

Classification of buses, specification of bus voltage-power etc, Gauss-Seidal method and Newton-Raphson method of load flow solutions, some principles of load control.

Current and voltage relations on a transmission line:

Representation of lines, the short transmission line, the medium transmission line, the long transmission line, hyperbolic form of the equations, the equivalent circuit of a long line, direct current transmission. General line equation in terms of ABCD constants, relations between constants, charts of line constants, constants of combined networks, measurement and advantages of generalized line constants.

Power circle diagram:

Receiving and sending end power circle diagrams, transmitted maximum power, universal power circle diagrams, and use of circle diagrams.

Voltage and Power Factor Control in Transmission Systems:

Tap changing transformer, induction regulators, moving coil regulators, booster transformer, power factor control, static condensers in series or parallel, synchronous condensers, ferranti effect.

Insulated Cables:

Cables versus overhead lines, insulating materials, electrostatic stress grading, three core cables, dielectric losses and heating, modern developments, oil filled and gas filled cables, measurement of capacitance, cable testing.

Insulator of Overhead Lines:

Types of insulators, their constructions and performances, potential distribution, special types of insulators, testing of insulators.

Distribution:

Distributor calculation, copper efficiencies, radial ring mains and interconnections.

Mechanical Characteristics of Transmission Lines:

Sag and stress analysis, ice and wind loading, supports at different elevations, conditions of erection, effect of temperature changes.

6. EEE 320 Electrical Services Design (Sessional) 1.50 Cr. Hours

Wiring system design, drafting, and estimation. Design for illumination and lighting. Electrical installations system design: substation, BBT and protection, air-conditioning, heating and lifts. Design for intercom, public address systems, telephone system and LAN. Design of security systems including CCTV, fire Alarm, smoke detector, burglar alarm, and sprinkler system. A design problem on a multi-storied building.

7. MATH 225 Probability and Statistics 3.00 Cr. Hours

Introduction. Sets and probability. Random variable and its probability distribution. Treatment of grouped sampled data. Some discrete probability distribution. Normal distribution. Sampling theory. Estimation theory. Tests of hypothesis. Regression and correlation. Analysis of variance.

8. BUS 317 Industrial Management 3.00 Cr. Hours

Management Functions and Organization: evolution, management function: organization, theory and structure, span of control, authority delegation, manpower planning. Personal Management: importance, need hierarchy, motivation, leadership, wage incentives, performance appraisal, participative management. Operation Management: production planning and control (PPC) functions, quantitative methods applied in production, quality management, location and layout planning safety and loss management. Cost and Financial Management: elements of cost products, cost analysis, investment analysis, benefit cost analysis, risk analysis. Management Accounting: cost planning and control, budget and budgetary control. Marketing Management: concepts, strategy, sales promotion, patent laws. Technology Management: management of innovation and changes, technology life cycle. Case studies.

YEAR 03 SEMESTER 02

No.	Course code	Course Title	Credit
1.	EEE 361	Power System Analysis	3.00
2.	EEE 322	Power System Laboratory	1.50
3.	EEE 339	Semiconductor Physics and Devices	3.00
4.	EEE 311	Measurement and Instrumentation	3.00
5.	EEE 312	Measurement and Instrumentation Laboratory	0.75
6.	EEE 467	Renewable Energy Conversion	3.00
7.	EEE 333	Control System	3.00
8.	EEE 334	Control System Laboratory	1.50
Total			**18.75**

1. **EEE 361 Power System Analysis** **3.00 Cr. Hours**

System Modeling:

Review of synchronous machine, the effect of synchronous machine excitation, per unit quantities, changing the base of per unit quantities, per unit impedance in single phase transformer and three phase transformer circuits, per unit impedance of three winding transformers, one-line diagram, impedance and reactance diagram, per unit and percentage method of calculations, advantages and disadvantages of per unit computations.

Network Calculations:

Node equation, matrix partitioning, node elimination by matrix algebra, bus admittance and impedance matrices, modification of an existing bus impedance matrix, direct determination of a bus impedance matrix.

Load Flow Solution and Control:

Classification of buses, specification of bus voltage-power etc, Gauss-Seidal method and Newton-Raphson method of load flow solutions, some principles of load control.

Symmetrical Three Phase Faults:

Short circuit currents and the reactance of synchronous machines, internal voltages of loaded machines under transient conditions, bus impedance matrix in fault calculations, bus impedance matrix equivalent network, percentage reactance and short-circuit MVA, reactor control of short-circuit currents and location of reactors and their advantages and disadvantages.

Symmetrical Components:

Symmetrical components of unsymmetrical phasors, sequence impedance and sequence networks, sequence network of unloaded generators, positive and negative sequence networks, and zero-sequence networks.

Unsymmetrical Faults:

Unsymmetrical short-circuits on an unloaded generator, single line to ground fault, line to line fault, double line to ground fault, unsymmetrical faults of power systems, faults through impedance, unsymmetrical open circuits and series impedances.

Power System Stability:

The stability problem of power system, swing equation, power-angle equation, equal area criterion of stability.

Multi-Machine Stability Studies:

Classical representation, step-by-step solution of the swing curve, factors affecting stability, techniques for improving stability.

2. **EEE 322 Power System Laboratory 1.50 Cr. Hours**

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 361. In the second part, students will design simple systems using the principles learned in EEE 361.

3. **EEE 339 Semiconductor Physics and Devices 3.00 Cr. Hours**

Atoms and Aggregates of Atoms:

Bohr atomic model, shell model.

Bonding and Types of Solids:

Primary bonding, secondary bonding, mixed bonding.

Crystal Structures:

Types of crystals, lattice and basis, Bravais lattice and Millerindices.

Classical Theory of Electrical and Thermal Conduction:

Scattering, mobility and resistivity, temperature dependence of metal resistivity, Mathiessen's rule, Hall Effect and thermal conductivity.

Modern Theory of Metals:

Determination of Fermi energy and average energy of electrons, classical and quantum mechanical calculation of specific heat.

Dielectric Properties of Materials:

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

Magnetic Properties of Materials:

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

Band Theory of Solids:

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

Quantum Mechanics:

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

Carrier Statistics:

Maxwell-Boltzmann and Fermi-Dirac distributions, Fermi energy.

Semiconductors in equilibrium: Energy bands, intrinsic and extrinsic semiconductors, Fermi levels, electron and hole concentrations, temperature dependence of carrier concentrations and invariance of Fermi level.

Carrier transport processes and excess carriers:

Drift and diffusion, generation and recombination of excess carriers, built-in-field, Einstein relations, continuity and diffusion equations for holes and electrons and quasi-Fermi level.

PN junction: Basic structure, equilibrium conditions, contact potential, equilibrium Fermi level, space charge, non-equilibrium condition, forward and reverse bias, carrier injection, minority and majority carrier currents, transient and ac conditions, time variation of stored charge, reverse recovery transient and capacitance.

Bipolar junction transistor: Basic principle of pnp and npn transistors, emitter efficiency, base transport factor and current gain, diffusion equation in the base, terminal currents, coupled-diode model and charge control analysis, Ebers-Moll equations and circuit synthesis.

Metal-semiconductor junction: Energy band diagram of metal semiconductor junctions, rectifying and ohmic contacts.

MOS structure: MOS capacitor, energy band diagrams and flat band voltage, threshold voltage and control of threshold voltage, static C-V characteristics, qualitative theory of MOSFET operation, body effect and current-voltage relationship of a MOSFET.

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

Suggested Texts:

1. B. G. Streetman, "Solid State Electronic Devices", 4th ed., Prentice-Hall, 1995

Suggested References:

1. P. A. Tipler and R. A. Llewellyn, "Modern Physics", 5th ed., Freeman, 2008

2. R. F. Pierret, "Semiconductor Fundamentals", Modular Series on Solid State Devices, Addison-Wesley, 1990

3. D. K. Ferry and J. P. Bird, "Electronics Materials and Devices", Academic Press, 2001

4. EEE 311 Measurement and Instrumentation 3.00 Cr. Hours

Introduction:

Applications, functional elements of a measurement system and classification of instruments. Measurement of electrical quantities: Current and voltage, power and energy measurement. Current and potential transformer. Transducers: mechanical, electrical and optical.

Measurement of non-electrical quantities: Temperature, pressure, flow, level, strain, force and torque.

Basic elements of dc and ac signal conditioning:

Instrumentation amplifier, noise and source of noise, noise elimination compensation, function generation and linearization, A/D and D/A converters, sample and hold circuits.

Data Transmission and Telemetry:

Methods of data transmission, dc/ac telemetry system and digital data transmission. Recording and display devices. Data acquisition system and microprocessor applications in instrumentation

5. EEE 312 Measurement and Instrumentation Laboratory 0.75 Cr. Hours

Experiment based on syllabus of EEE 311.

6. EEE 467 Renewable Energy Conversion 3.00 Cr. Hours

Importance of Renewable Energy Sources, Statistics Regarding Solar Radiation and Wind Speed

Insulation:

Geographical distribution, atmospheric factors, measurements.

Solar Cell:

Principle of operation, spectral response, factors effecting conversion efficiency, I-V characteristics, maximum power output.

PV Modules and Arrays:

Stationary and tracking.

PV Systems:

Standalone, battery storage, inverter interfaces with grid..

Wind Turbine Generators:

Types, operational characteristics, cut-in and cut-out speed control, grid interfacing, AC-DC-AC link.

Tidal Power, Biomass, Geothermal:

General Discussion on Tidal, Biomass and geothermal power.

7. EEE 333 Control System **3.00 Cr. Hours**

Prerequisite: EEE 235

Introduction to control systems.

Linear system models: transfer function, block diagram and signal flow graph (SFG).

State variables:

SFG to state variables, transfer function to state variable and state variable to transfer function.

Feedback control system:

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

Analysis of feedback control system:

Root locus method and frequency response method. Design of feedback control system: Controllability and observability, root locus, frequency response and state variable methods.

Digital control systems:

Introduction, sampled data systems, stability analysis in Z-domain.

Suggested Texts:

1. K. Ogata, "Modern Control Engineering", 4th ed., Prentice Hall, 2001

Suggested References:

1. G. E. Franklin, J. D. Powell, and A. Emami-Naeni, "Feedback Control of Dynamic Systems", 4th ed., Addison-Wesley, 2002

8. EEE 334 Control System Laboratory **1.50 Cr. Hours**

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 333. In the second part, students will design simple systems using the principles learned in EEE 333.

YEAR 04 SEMESTER 01

No.	Course code	Course Title	Credit
1.	EEE 400	Thesis/project	1.50
2.	EEE 331	Microprocessor & Interfacing	3.00
3.	EEE 332	Microprocessor & Interfacing Laboratory	1.50
4.	EEE 445	Biomedical Electronics	3.00
5.	EEE 363	Power System Protection	3.00
6.	EEE 413	Microwave Engineering	3.00
7.	EEE 416	Microwave Engineering Laboratory	0.75
8.	EEE 463	High Voltage Engineering	3.00
9.	EEE 419	Mobile Cellular Communication	3.00
Total			**21.75**

1. **EEE 400 Thesis /Thesis 1.50 Cr. Hours**

The duration of thesis/project work will be two/three semesters. A student must undertake a research work on an Electrical and Electronic Engineering topic under the guidance of a supervisor. The student is required to prepare and submit the report within the time specified. The report will be graded and a student must get at least a C grade, which is the passing grade for this course.

2. **EEE 331 Microprocessor and Interfacing 3.00 Cr. Hours**

Prerequisite: CSE 132

Introduction to microprocessors. Intel 8086 microprocessor:

Architecture, addressing modes, instruction sets, assembly language programming, system design and interrupt.

Interfacing:

Programmable peripheral interface, programmable timer, serial communication interface, programmable interrupt controller, direct memory access, keyboard and display interface. Introduction to micro-controllers.

Suggested Texts:

1. Y. Liu and G. A. Gibson, "Microcomputer Systems: The 8086/8088 Family Architecture, Programming Design", 2nd ed., Prentice-Hall, 1986

2. M. Rafiquzzaman, "Microprocessors: Theory and Applications: Intel and Motorola", Revised ed., Prentice Hall, 1992

3. Douglas V. Hall, "Microprocessors and Interfacing: Programming and Hardware" 2nd ed., Gloence McGraw Hill, 1991.

3. EEE 332 Microprocessor and Interfacing Laboratory 1.50 Cr. Hours

Course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 315. In the second part, students will design simple systems using the principles learned in EEE 315.

4. EEE 445 Biomedical Electronics 3.00 Cr. Hours

Human body:

Cells and physiological systems.

Bioelectricity:

Genesis and characteristics. Measurement of bio-signals: Ethical issues, transducers, amplifiers and filters.

Electrocardiogram:

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

Blood pressure:

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

Blood flow measurement:

Plethysmographyand electromagnetic flow meter.

Measurement and interpretation:

Electroencephalogram, cerebral angiograph and cronical X-ray. Brain scans. Electromyogram (EMG).

Tomography:

Positron emission tomography and computer tomography. Magnetic resonance imaging. Ultra sonogram. Patient monitoring system and medical telemetry. Effect of electromagnetic fields on human body.

Suggested Books:

1. Joseph Dubovy, Introduction to Biomedical Electronics, Glencoe/Mcgraw-Hill

2. Edward J. Bukstein, Introduction to Biomedical Electronics, Bobbs-Merrill Co.

5. EEE 363 Power System Protection 1.50 Cr. Hours

Introduction:

Purpose of power system protection, introduction to circuit interruption and protection. Terminologies and general characteristics of relays and breakers.

Circuit Breakers:

Control systems, arc extinction, and recovery voltage. Air, oil, air blast, vacuum, SF6 and high voltage DC circuit breakers. Selection criteria, testing of circuit breakers.

Fuses:

Introduction, advantages and disadvantages, desirable characteristics of fuse element, fuse element materials, fusing current, fusing factor, prospective current, cut-off current, pre-arcing time, arcing time, total operating time, breaking capacity, types of fuses and description, current rating of fuse element.

Relays:

Over current, directional, differential, distance, sequence, pilot-wire and carrier current protection. Bus bar arrangement, grounding.

Unit Protection:

Generator, motor, transformer, bus and line protection.

Static Relays:

Introduction to Analogue and digital static relays. Static over current, differential and distance protection. Microprocessor Based Relays

SCADA System:

Introduction, Basic Knowledge.

6. EEE 413 Microwave Engineering 3.00 Cr. Hours

Transmission lines:

Voltage and current in ideal transmission lines, reflection, transmission, standing wave, impedance transformation, Smith chart, impedance matching and lossy transmission lines.

Waveguides:

General formulation, modes of propagation and losses in parallel plate, rectangular and circular waveguides.

Micro strips:

Structures and characteristics.

Rectangular resonant cavities:

Energy storage, losses and Q. Radiation: Small current element, radiation resistance, radiation pattern and properties, Hertzian and halfwave dipoles.

Antennas:

Monopole, horn, rhombic and parabolic reflector, array, and Yagi-Uda antenna.

Suggested Texts:

1. D. M. Pozar, "Microwave Engineering", 3rd ed., Wiley, 2000

Suggested References:

1. S. Ramo, J. R. Whinnery and T. V. Duzer, "Fields and Waves in Communication Electronics", 3rd ed., Wiley, 1994

2. A. Das and S. K. Das, "Microwave Engineering", McGraw-Hill, 2001

3. J. D. Krauss and R. J. Marhefka, "Antennas", 3rd ed., McGraw-Hill, 2001

4. C. A. Balanis "Antenna Theory: Analysis and Design Technology", 3rd ed., Wiley, 2005

5. P. E. Collins, "Antennas and Radio Propagation", McGraw-Hill, 1985

6. E. C. Jordan and K. G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall, 1993

7. EEE 416 Microwave Engineering Laboratory 0.75 Cr. Hours

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 413. In the second part, students will design simple systems using the principles learned in EEE 413.

8. EEE 463 High Voltage Engineering 3.00 Cr. Hours

High voltage dc:
Rectifier circuits, voltage multipliers, Van-de-Graaf and electrostatic generators. High voltage ac: Cascaded transformers and Tesla coils.

Impulse voltage:
Shapes, mathematical analysis, codes and standards, single and multi-stage impulse generators, tripping and control of impulse generators. Breakdown in gas, liquid and solid dielectric materials. Corona. High voltage measurements and testing. Over-voltage phenomenon and insulation coordination. Lightning and switching surges, basic insulation level, surge diverters and arresters.

Suggested Texts:

1. M.S. Naidu, "High Voltage Engineering", McGraw-Hill Professional, 1999

Suggested References:

1. E. Kuffel, W S Zaengl, and J. Kuffel, "High Voltage Engineering Fundamentals", Newnes, 2000

9. EEE 419 Mobile Cellular Communication 3.00 Cr. Hours

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.

Diversity Techniques:

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

Digital cellular systems:

Global system for mobile, time division multiple access and code division multiple access.

Suggested Books:

1. Theodor S. Rappaport Wireless Communications; Principle and Practice

2. WCY Lee Cellular communication

3. Schiller Mobile Communication

YEAR 04 SEMESTER 02

No.	Course code	Course Title	Credit Hours
1.	EEE 400	Thesis/project	3.00
2.	EEE 469	Power Electronics	3.00
3.	EEE 470	Power Electronics Laboratory	0.75
4.	EEE 447	VLSI I	3.00
5.	EEE 448	VLSI I Laboratory	0.75
6.	EEE 455	Power Plant Engineering	3.00
Total			**13.50**

1. EEE 400 Thesis **3.00 Cr. Hours**

The duration of thesis/project work will be three semesters. A student must undertake a research work on an Electrical and Electronic Engineering topic under the guidance of a supervisor. The student is required to prepare and submit the report within the time specified. The report will be graded and a student must get at least a C grade, which is the passing grade for this course.

2. EEE 469 Power Electronics **3.00 Cr. Hours**

Power semiconductor switches and triggering devices:

BJT, MOSFET, SCR, IGBT, GTO, TRIAC, UJT and DIAC.

Rectifiers:

Uncontrolled and controlled single phase and three phase. Regulated power supplies: Linear-series and shunt, switching buck, buckboost, boost and Cuk regulators.

AC voltage controllers:

Single and three phase. Choppers. DC motor control. Single phase cycloconverter.

Inverters:

Single phase and three phase voltage and current source. AC motor control. Stepper motor control. Resonance inverters. Pulse width modulation control of static converters.

Suggested Texts:

1. Muhamed H. Rashid, "Power Electronics: Circuits, Devices and Application", 3rd ed., Prentice Hall, 2003

Suggested References:

1. M. D.Singh, K. B. Khanchandani, "Power Electronics", McGraw-Hill, 1998

2. N. Mohan, T. M.Undeland, W. P.Robbins, "Power Electronics: Converters, Applications and Design", 3rd Bk&Cdr ed., Wiley, 2002

3. B. K.Bose, "Modern Power Electronics", Prentice Hall, 2001

4. Sen, "Power Electronics", McGraw-Hill, 1987

3. EEE 470 Power Electronics Laboratory 0.75 Cr. Hours

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 453. In the second part, students will design simple systems using the principles learned in EEE 453.

4. EEE 447 VLSI I 3.00 Cr. Hours

VLSI technology:

Top down design approach, technology trends and design styles.

Review of MOS transistor theory: Threshold voltage, body effect, I-V equations and characteristics, latch-up problems, NMOS inverter, CMOS inverter, pass-transistor and transmission gates.

CMOS circuit characteristics and performance estimation: Resistance, capacitance, rise and fall times, delay, gate transistor sizing and power consumption. CMOS circuit and logic design: Layout design rules and physical design of simple logic gates.

CMOS subsystem design: Adders, multiplier and memory system, arithmetic logic unit. Programmable logic arrays. I/O systems. VLSI testing.

Suggested Texts:

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

Suggested References:

1. B. T. Preas, M. Lorenzetti, "Physical Design Automation of VLSI Systems", The Benjamin-Cummings Publishing Co., 1988

2. C. H. Roth, Jr., "Digital Systems Design Using VHDL", 1st ed., Thomson Engineering, 1998

5. EEE 448 VLSI I Laboratory 0.75 Cr. Hours

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 433. In the second part, students will design simple systems using the principles learned in EEE 433.

6. EEE 455 Power Plant Engineering3.00 Cr. Hours

Energy Sources:

Fossil fuels, nuclear fission, renewable energy sources-hydro, biomass, solar, wind, geothermal, pumped storage hydro.

Power Station Performance:

Connected load, demand factor, diversity factor, load factor, plant factor, and utilization factor.

Plant Performance and Operating Characteristics:

Efficiency, heat rate, incremental rate method, station performance characteristics, station incremental rate, capacity scheduling, base load and peak load, load division between steam and hydro stations, choice of power stations and units.

Interconnected System:

Capacity saving, power sharing among units for economic allocation.

Private Generation:

Industrial co-generation, capacity generation. Site selection of power station.

Energy Tariff:

Description, types and tariff in Bangladesh.

Hydro Power Stations:

Equipment, plant auxiliaries, plant operation.

Nuclear Power Stations:

Chain reactions moderator types of reactors, shielding...

Thermal Power Stations:

Equipment, plant auxiliaries and operation.

B.Sc. in EEE (Diploma)

LEVEL 01 SEMESTER 01

No.	Course code	Course Title	Credit
1.	ENG 101	Composition	3.00
2.	PHY 111	Physics-I	3.00
3.	PHY 112	Physics-I Lab	1.50
4.	HIST 101	History of the Emergence of Independent Bangladesh	3.00
5.	MATH 115	Differential and Integral Calculus	3.00
6.	EEE 111	Electrical Circuit-I	3.00
7.	CSE 131	Computer programming language	3.00
8.	CEN 130	Engineering Drawing	1.50
Total			**21.00**

1. ENG 101 English Composition 3.00 Cr. Hours

General discussions: introduction, various approaches to learn English. Grammatical Problems: Construction of sentences, grammatical errors, sentence variety and style, conditionals, vocabulary and diction. Reading Skills: Discussion readability, scan and skin reading, generating ideas through purposive reading, reading selective stories. Writing Skills: Principles of effective writing, organization, planning and development of writing, composition, précis writing, and amplification. General Strategies for the Writing process: Generating ideas, identifying audiences, and purposes, construction arguments, stating problems, drafting and finalizing. Listening Skills: The phonemic systems and correct English pronunciation. Speaking Skills: Practicing dialogue, storytelling, effective oral presentation.

Suggested Text:

1. J. Steinbeck, "The Pearl", 1st ed., Penguin Books, 2000

Suggested References:

1. Thomas Cruisius and Carolyn Channell, "Aims of Argument", 3rd edition, Mayfield Publishing Company, 2000

2. Betty Mattix Dietsch, "Reasoning & Writing Well", McGraw-Hill, 2003

2. PHY 111 Physics 3.00 Cr. Hours

Waves and Oscillation: differential equation of simple harmonic oscillator, total energy and average energy, combination of simple harmonic oscillation, spring mass system, torsional

pendulum; two body oscillation, reduced mass, damped oscillation, forced oscillation, resonance, progressive wave, power and intensity of wave, stationary wave, group and phase velocities.

Optics: Defects of images: spherical aberration, astigmatism, coma, distortion, curvature, chromatic aberration. Theories of light, interference of light, Young's double slit experiment, displacement of fringes and its uses, Fresnel bi-prism, interference in thin films, Newton's rings, interferometers, Diffraction: diffraction by single slit, diffraction from a circular aperture, resolving power of optical instruments, diffraction at double slit and N slits, diffraction grating; polarization; production and analysis of polarized lights, Brewster's law, Malus law, polarization by double refraction, Nicol prism, optical activity, Polar meters.

Modern Physics: Galilean relativity and Einstein's special theory of relativity; Lorentz transformation equation, Length contraction, Time dilation and mass energy relation, photoelectric effect, Compton effect, De Broglie matter waves and its success in explaining Bohr's theory, Pauli's exclusion principle. Constituents of atomic nucleus, nuclear binding energy, different types of radio activity, radioactive decay law, Nuclear reactions, nuclear fission, nuclear fusion, atomic power plant.

Suggested Books:

1. D. Halliday, R. Resnick and J. Walker, "Fundamentals of Physics", 7th ed., Wiley, 2004

2. F. W. Sears, M. W. Zemansky and H. D. Young, "University Physics", Addison Wesley Publishing Company, 1987

3. "Schaum's Outlines of Theory & Problems of Vector Analysis"

4. Dr. G. Ahmad, "Outlines of Physics Vol.1"

5. B. Lal and N. Subrahmanyam, "Properties of Matter", 6th ed., S. Chand & Company Ltd,

2001

6. B. Lal and N. Subrahmanyam, "Heat and Thermodynamics", S. Chand & Company Ltd., 2001.

7. B. Lal and N. Subrahmanyam, "A Textbook of Sound", Sangam Books, 1999

8. B. Lal and N. Subrahmanyam, "A Textbook of Optics", S. Chand & Company Ltd.,2001.

3. PHY 112 Physics-I Laboratory 1.50 Cr. Hours

Laboratory experiments based on PHY 113.

4. HIST 101 History of the Emergence of Independent Bangladesh 3.00 Cr. Hours

Course objective: The main objective of this course is to help the student to understand the

brief history of Bangladesh; from ancient to present era. This course will focus specifically on how Bangladesh appeared as a sovereign country in world map.

Suggested Books:

1. Harun-or-Roshid, The Foreshadowing of Bangladesh: Bengal Muslim League and Muslim Politics, 1906-1947,
2. Rounaq Jahan, Pakistan: Failure in National Integration,
3. Talukder Maniruzzaman, Radical Politics and the Emergence of Bangladesh,
4. R. C. Majumdar, History of Bengal, Vol.1
5. Shyamal Ghosh, The Awami League.
6. M. B. Nair, Politics ofBangladesh
7. A M A Muhith, Emergence of aNation

5. MATH 115 Differential and Integral Calculus 3.00 Cr. Hours

Differential Calculus: Limits, continuity and differentiability. Successive differentiation of various types of functions. Leibnitz's theorem, Rolle's theorem, Mean value theorem, Taylor's and Maclaurin's theorems in finite and infinite forms, Lagrange's form of remainders, Cauchy's form of remainders, expansion of functions, evaluation of indeterminate forms of L' Hospital's rule. Partial differentiation. Euler's theorem. Tangent and normal subtangent and subnormal in Cartesian and polar co-ordinates, determination of maximum and minimum values of functions. Curvature asymptotes. Curve tracing.

Integral Calculus: Integration by the method of substitution. Standard integrals, integration by successive reduction, definite integrals, its properties and use in summing series. Walli's formulae, improper integrals. Beta function and Gamma function. Area under a plane curve and area of a region enclosed by two curves in Cartesian and polar coordinates, volumes and surface areas of solids of revolution.

Suggested books:

1. A Text Book on Coordinate geometry and Vector Analysis by Kosh Mohammad.

2. S. L. Loney, "The Elements of Coordinate Geometry", Nelson Thornes (out of print)

3. H. A. Anton, I. Bivens, and S. Davis Calculus, "Calculus", 7th ed., Wiley, 2004

6. EEE 111 Electrical Circuits-I 3.00 Cr. Hours

Circuit variables and elements:

Voltage, current, power, energy, independent and dependent sources, resistance.

Basic laws:

Ohm's law, Kirchoff's current and voltage laws. Simple resistive circuits: Series and parallel circuits, voltage and current division, wye-delta transformation.

Techniques of circuit analysis:

Nodal and mesh analysis including supernode and supermesh.

Network theorems:

Source transformation, 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, series parallel combination of inductors and capacitors.

Responses of RL and RC circuits:

Natural and step responses.

Magnetic quantities and variables:

Flux, permeability and reluctance, magnetic field strength, magnetic potential, flux density, magnetization curve. Laws in magnetic circuits: Ohm's law and Ampere's circuital law. Magnetic circuits: series, parallel and series-parallel circuits.

Suggested Texts:

1. W. H. Hayt, J. Kemmerly and S. M. Durbin, "Engineering Circuit Analysis", 6th ed., McGraw-Hill, 2002

2. Robert L. Boylestad, "Introductory Circuit Analysis", 10th Edition, Prentice-Hall, 2002

Suggested References:

1. J. W. Nilsson and S. Riedel, "Electric Circuits", 7th ed., Prentice Hall, 2004

2. J. D. Irwin, "Basic Engineering Circuit Analysis", 7th ed., Wiley, 2001

3. R. C. Dorf and J. A. Svoboda, "Introduction to Electric Circuits", 6th ed., Wiley, 2003

4. D. E. Johnson, J. R. Johnson, J. L. Hilburn and P. D. Scott, "Electric Circuit Analysis", 3rd ed., Wiley, 1996

5. R. E. Thomas and A. J. Rosa, "The Analysis and Design of Linear Circuits", 4th ed., Wiley, 2003

7. CSE 131 Computer Programming Language 3.00 Cr. Hours

Introduction to digital computers. Nature of computers and its evolution, Generation of computers, Capabilities of computers and their applications and limitations, Computer hardware & Software components, Data recording media, Computer system software, Number systems, Data representation, Algorithms & flowcharting, Loops and Counters, Loop & Trailer values, Loops & Accumulators, Switches, Number searching.

Programming languages, algorithms and flow charts. Structured Programming using C. Variable and constants, operators, expressions, control statements, function, arrays, pointers, structure unions. User defined data types. Input output and files. Object oriented Programming using C++: introduction, classes and objects; polymorphism; function and operator overloading; inheritance.

Suggested Texts:

1. Herbert Schildt, "Java: The Complete Reference", 7th edition, McGraw-Hill Osborne Media

2. Herbert Schildt, "C++: The Complete Reference", 4th edition, McGraw-Hill Osborne Media

3. Harvey M. Deitel and Paul J. Deitel, "C How to Program", 5th edition, Prentice Hall

Suggested References:

1. Bruce Eckel, "Thinking in Java", Prentice Hall

2. www.java.sun.com and the API Specifications

3. Bjarne Stroustrope, "The C++ programming language", Addison-Welsey

4. Bruce Eckel, "Thinking in C++", Prentice Hall

5. Kernighan & Ritchie, The C Programming Language, second edition, Prentice-Hall, 1988

8. CEN 130 Engineering Drawing 1.50 Cr. Hours

Introduction- lettering, numbering and heading, instrument and their use, sectional views and isometric views of solid geometrical figures. Plan, elevation and section of multistoried buildings; building services drawings; detailed drawing of lattice towers.

Suggested Books:

1. Basant Agrawal Engineering Drawing, Tata McGraw-Hill Education, 2008
2. Simmons & Maguire Manual of Engineering Drawing
3. Eanna O Broin Technical Draughtmanship

LEVEL 01 SEMESTER 02

No.	Course code	Course Title	Credit
1.	MATH 125	Complex Variable & Vector Analysis	3.00
2.	EEE 121	Electrical Circuit II	3.00
3.	EEE 211	Electronics I	3.00
4.	EEE 224	Electronics Laboratory	1.50
5.	EEE 122	Electrical Circuit Laboratory	1.50
6.	ECO 100	Fundamentals of Economics	3.00
7.	ENG 125	Technical English	3.00
8.	BUS 217	Professional Ethics	3.00
Total			**21.00**

1. MATH 125 Complex Variable and Vector Analysis 3.00 Cr. Hours

Complex Variable: Complex number system, general functions of a complex variable, limits and continuity of a function of complex variable and related theorems, complex function differentiation and the Cauchy- Riemann equations, infinite series. Convergence and uniform convergence. Line integral of a complex function. Cauchy integral formula Liouville's theorem. Taylor's and Laurent's theorem, singular points. Residue. Cauchy's residue theorem.

Vector analysis: Multiple product of vectors. Linear dependence and independence of vectors. Differentiation and integration of vectors together with elementary applications. Line, surface, and volume integrals. Gradient of a scalar function, divergence and curl of a vector function,

various formulae. Integral forms of gradient, divergence and curl. Divergence theorem. Stoke's theorem, Green's theorem and Gauss's theorem.

Suggested books:

1. J. H. Mathews and R. W. Howell, "Complex Analysis for Mathematics and Engineering", 4th ed., Jones and Barlett, 2000

2. I. Stewart and D. Tall, "Complex Analysis: (the hitchhiker's guide to the plane)", Cambridge University Press, 1983

3. J. W. Brown and R. V. Churchill "Complex Variable and Applications", 7th ed., McGraw-Hill, 2003

4. D. G. Zill, "A First Course in Differential Equations", 7th ed., Brooks Cole, 2000

5. M. R. Spiegel, "Schaum's Outline of Complex Variables", McGraw-Hill, 1968

6. M. R. Spiegel, "Schaum's Outline of Laplace Transform", McGraw-Hill, 1965

2. EEE 121 Electrical Circuits II 3.00 Cr. Hours

Sinusoidal functions:

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

Analysis of single phase ac circuit:

Series and parallel RL, RC and RLC circuits, nodal and mesh analysis, application of network theorems in ac circuits, circuits with non-sinusoidal excitations, transients in ac circuits, passive filters.

Resonance in ac circuits:

Series and parallel resonance. Magnetically coupled circuits.

Analysis of three phase circuits:

Three phase supply, balanced and unbalanced circuits, power calculation.

Suggested Texts:

1. J. W. Nilsson and S. Riedel, "Electric Circuits", 7th ed., Prentice Hall, 2004

Suggested References:

1. Robert L. Boylestad, "Introductory Circuit Analysis", 10th Edition, Prentice-Hall, 2002

2. J. D. Irwin, "Basic Engineering Circuit Analysis", 7th ed., Wiley, 2001

3. R. C. Dorf and J. A. Svoboda, "Introduction to Electric Circuits", 6th ed., Wiley, 2003

4. D. E. Johnson, J. R. Johnson, J. L. Hilburn and P. D. Scott, "Electric Circuit Analysis", 3rd ed., Wiley, 1996

5. R. E. Thomas and A. J. Rosa, "The Analysis and Design of Linear Circuits", 4th ed., Wiley, 2003

3. EEE 211 Electronics I **3.00 Cr. Hours**

P-N junction as a circuit element:

Intrinsic and extrinsic semiconductors, operational principle of p-n junction diode, contact potential, current-voltage characteristics of a diode, simplified dc and ac diode models, dynamic resistance and capacitance.

Diode circuits:

Half wave and full wave rectifiers, rectifiers with filter capacitor, characteristics of a zener diode, zener shunt regulator, clamping and clipping circuits.

Bipolar junction transistor (BJT) as a circuit element:

Bipolar junction transistor: current components, BJT characteristics and regions of operation, BJT as an amplifier, biasing the BJT for discrete circuits, small signal equivalent circuit models, BJT as a switch.

Single stage mid-band frequency BJT amplifier circuits:

Voltage and current gain, input and output impedance of a common base, common emitter and common collector amplifier circuits.

Metal-oxide-semiconductor field-effect-transistor (MOSFET) as circuit element:

Structure and physical operation of an enhancement MOSFET, threshold voltage, Body effect, current- voltage characteristics of an enhancement MOSFET, and biasing discrete and integrated MOS amplifier circuits, single-stage MOS amplifiers, MOSFET as a switch, CMOS inverter.

Junction field-effect-transistor (JFET):

Structure and physical operation of JFET, transistor characteristics, pinch-off voltage.

Differential and multistage amplifiers:

Description of differential amplifiers, small-signal operation, differential and common mode gains, RC coupled mid-band frequency amplifier.

Suggested Texts:

1. S. Sedra and K. C. Smith, "Microelectronic Circuits", 5th ed., Oxford University Press, 2003
Suggested References:

1. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 8th Edition, Prentice- all, 2002

2. David A. Bell, "Electronic Devices and Circuits", 5th edition, Oxford University Press, 2008

3. W. H. Hayt, J. Kemmerly and S. M. Durbin, "Engineering Circuit

4. EEE 224 Electronics Laboratory 1.50 Cr. Hours

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 211 and EEE 223. In the second part, students will design simple systems using the principles learned in EEE 211 and EEE 223.

5. EEE 122 Electrical Circuits Laboratory 1.50 Cr. Hours

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 111 and EEE 121. In the second part, students will design simple systems using the principles learned in EEE 111 and EEE 121.

6. ECO 100 Fundamentals of Economics 3.00 Cr. Hours

Introduction to economics. Economics and engineering. Different economics systems. Fundamental economic problems. Basic elements of demand, supply and product market. Theory of utility and preferences, consumer’s surplus. Theory of production and costs, Theory of the firm and market structure. Optimization.

Introducing macroeconomics. National income accounting; the simple Keynesian analysis of national income, employment and inflation. Savings, investment and decision-making. Fiscal policy and monetary policy and interest rates, income and spending. Economics of development and planning.

7. ENG 125 Technical English 3.00 Cr. Hours

General:

Work with adapted and authentic technical texts aimed at the study program, Development of professional communication in English, Development of perceptive and productive communication skills with professionally orientation.

Scientific terminology:

Construction of sentences and paragraphs; phrases and idioms, proverbs, punctuation, commercial correspondence and tender notice, amplification and description, Technical report writing; standard forms of term papers, thesis, etc.

8. BUS 217 Professional Ethics 3.00 Cr. Hours

Definition and scopes of Ethics. Different branches of ethics. Social change and the emergence of new technologies. History and development of engineering ethics. Science and technology-necessity and application. Study of ethics in engineering. Applied ethics in engineering. Human qualities of an engineer. Obligation of an engineer to the clients. Attitude of an engineer to other engineers. Measures to be taken in order to improve the quality of engineering profession. Ethical expectation: Employers and employees; inter-professional relationship: Professional organization – maintaining a commitment of ethical standards. Desired characteristics of a professional code. Institutionalization of ethical conduct.

Suggested Text:

D. B. Ingram and J. A. Parks, "Understanding Ethics", Alpha, 2002

Suggested References:

1. John R. Boatright, "Ethics and the Conduct of Business", 4th edition, Pearson Education, New Delhi, 2003

2. Manuel G. Velasquez, "Business Ethics: Concepts and Cases", 5th Edition, Pearson Education, New Delhi, 2002

3. William Lillie, "An Introduction to Ethics", 3rd Edition, Methuen & Co. Ltd. London, 1964

4. Donald C. Abel, "Fifty Readings in Philosophy", 2nd Edition, McGraw-Hill, New York, 2004

5. Nigel Warburton, "Philosophy Basics", 3rd Edition, Routledge, 1999

6. Peter Singer, "Practical Ethics", 2nd Edition, The Press Syndicate of the University of Cambridge, 2000

LEVEL 02 SEMESTER 01

No.	Course code	Course Title	Credit
1.	BUS 227	Financial & Managerial Accounting	3.00
2.	MATH 135	Differential Equations	3.00
3.	EEE 223	Electronics II	3.00
4.	MEC 213	Fundamentals of Mechanical Engineering	3.00
5.	EEE 235	Continuous Signal and Linear System	3.00
6.	EEE 262	Computing Method and Technique for Engineering Analysis Laboratory	1.00
7.	EEE 251	Electrical Machines II	3.00
Total			**19.00**

1. BUS 227 Financial and Managerial Accounting 3.00 Cr. Hours

Financial Accounting: Objectives and importance of accounting, branches of accounting, accounting as an information system, computerized system and application in accounting. Recording Systems: double entry mechanism, accounts and their classification, accounting equation, accounting cycle journal, ledger, trial balance. Preparation of financial statements considering adjusting and closing entries. Accounting concepts and conventions. Financial statements analysis and interpretation: ration analysis- tests for profitability, liquidity, solvency and overall measure.

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

Suggested Text:

1. Financial Accounting - Robert F. Meigs & Mary A. Meigs

Suggested References:

1. Introduction to Accounting: An Integrated Approach- Worth Penne et. al.

2. Financial Accounting - Belverd E. Needles, Jr.

3. Computerised Accounts- P. Basset

2. MATH 135 Differential Equations **3.00 Cr. Hours**

Ordinary Differential Equations: Degree and order of ordinary differential equations, formation of differential equations, and solution of first order differential equations by various methods. Solution of general linear equations of second and higher orders with constant coefficients, Solution of homogeneous linear equations. Solution of differential equations of the higher order when the dependent or independent variable are absent. Solution of differential equation by the method based on the factorization of the operators, Frobenius method.

Partial Differential Equations: Introduction, Linear and non-linear first order equation. Standard forms, linear equations of higher order, equations of the second order with variable coefficients. Wave equations, particular solution with boundary and initial conditions.

Suggested books:

1. D. G. Zill, "A First Course in Differential Equations", 7th ed., Brooks Cole, 2000

2. M. A. Rahman, "Mathematical Methods with Applications" (Volume 2), Computational Mechanics, 2000

3. EEE 223 Electronics II **3.00 Cr. Hours**

Frequency response of amplifiers:

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

Operational amplifiers (Op-Amp):

Properties of ideal Op-Amps, non-inverting and inverting amplifiers, inverting integrators, differentiator, weighted summer and other applications of Op-Amp circuits, effects of finite open loop gain and bandwidth on circuit performance, logic signal operation of Op-Amp, dc imperfections.

General purpose Op-Amp:

DC analysis, small-signal analysis of different stages, gain and frequency response of 741 Op-Amp. Negative feedback: properties, basic topologies, feedback amplifiers with different topologies, stability, frequency compensation.

Active filters: Different types of filters and specifications, transfer functions, realization of first and second order low, high and bandpass filters using Op-Amps.

Signal generators:

Basic principle of sinusoidal oscillation, Op-Amp RC oscillators, LC and crystal oscillators.

Power Amplifiers:

Classification of output stages, class A, B and AB output stages.

Suggested Texts:

1. S. Sedra and K. C. Smith, "Microelectronic Circuits", 5th ed., Oxford University Press, 2003

2. P. Malvino and J. A. Brown, "Digital Computer Electronics", 3rd ed., McGraw-Hill, 1992

3. W. H. Hayt, J. Kemmerly and S. M. Durbin, "Engineering Circuit Analysis", 6th ed., McGraw-Hill, 2002

4. MEC 213 Fundamentals of Mechanical Engineering 3.00 Cr. Hours

Thermodynamics:

Heat and work – the first law of thermodynamics and its applications; kinetic theory of gases – kinetic interpretation of temperature, specific heats of ideal gases, equi-partition of energy, mean free path, Maxwell's distribution of molecular speeds, reversible and irreversible processes, Carnot's cycle, second law thermodynamics, Carnot's theorem, entropy, Thermodynamic function, Maxwell relations, Clausius and Clapeyron equation.

Study of fuels:

Steam generating units with accessories and mountings; study of steam generators and turbines. Introduction to internal combustion engines and their cycles, study of SI engines, CI engines and gas turbines with their accessories.

Types of fluid machinery:

Study of impulse and reaction turbines; Pelton wheel and Kaplan turbines; study of centrifugal and axial flow machines; pumps, fans, blowers and compressors, study of reciprocating pumps.

5. EEE 235 Continuous Signal and Linear Systems 3.00 Cr. Hours

Classification of signals and systems: signals - classification, basic operation on signals, elementary signals, representation of signals using impulse function; systems – classification. Properties of Linear Time Invariant (LTI) systems: Linearity, causality, time invariance, memory, stability, invertibility. Time domain analysis of LTI systems: Differential equations -

system representation, order of the system, solution techniques, zero state and zero input response, system properties; impulse response - convolution integral, determination of system properties; state variable - basic concept, state equation and time domain solution. Frequency domain analysis of LTI systems: Fourier series- properties, harmonic representation, system response, frequency response of LTI systems; Fourier transformation- properties, system transfer function, system response and distortion-less systems. Applications of time and frequency domain analyses: solution of analog electrical and mechanical systems, amplitude modulation and demodulation, time-division and frequency-division multiplexing. Laplace transformation: properties, inverse transform, solution of system equations, system transfer function, system stability and frequency response and application.

Suggested Texts:

1. A.V. Oppenheim and A. S. Willsky, "Signals and Systems", 2nd ed., Prentice-Hall, 1997

2. B. P. Lathi, "Linear Systems and Signals", 1st ed., Oxford University Press, 2001

6. EEE 262 Computing Method and Technique for Engineering Analysis Laboratory
Prerequisite: CSE 131 **1.00 Cr. Hours**

Numerical solution of algebraic and transcendental equation, Computer Programing and application related to the Numerical method.

7. EEE 251 Electrical Machines-II **3.00 Cr. Hours**

DC Generator:

Construction, Principle of operation, classification, armature winding, no-load voltage characteristics, build up process of a self-excited shunt generator, critical field resistance, load voltage characteristics, effect of speed on no-load and load characteristics, voltage regulation, armature reaction and commutation, testing.

DC Motor:

Operation, types, speed-torque characteristics, starting, speed, control braking

Synchronous Generator:

Construction, excitation systems, equivalent circuit, armature reaction, vector diagram at different load, factor affecting voltage regulation, synchronous impedance, synchronous impedance method of predicting voltage regulation and its limitations.

Parallel Operation: Necessary Conditions, synchronization, circulating current and vector diagram, effect of change in parameters (voltage, steam supply, excitation).

Synchronous Motor:

Construction, operation, effect of loading under different excitation condition, effect of changing excitation, V- Curves and starting.

LEVEL 02 SEMESTER 02

No.	Course code	Course Title	Credit
1.	EEE 337	Electrical Power Transmission and Distribution	3.00
2.	EEE 313	Digital Electronics	3.00
3.	EEE 314	Digital Electronics Laboratory	1.50
4.	EEE 243	Electromagnetic Fields and Waves	3.00
5.	EEE 316	Machine Design	0.75
6.	MATH 215	Linear Algebra	3.00
7.	EEE 325	Digital Signal Processing I	3.00
8.	EEE 326	Digital Signal Processing Laboratory	0.75
9.	EEE 339	Semiconductor Physics and Devices	3.00
Total			**21.00**

1. EEE 337 Electrical Power Transmission and Distribution 3.00 Cr. Hours

Transmission System:

Types of conductors, resistance, definition of inductance, inductance of conductor due to internal flux, flux linkages between two points external to an isolated conductor, inductance of a single-phase two-wire line.

Capacitance of Transmission Line:

Capacitance of a three phase with equilateral spacing and unsymmetrical spacing, effect of earth on the capacitance of three phase transmission lines, bundled conductors, parallel circuit three phase lines.

Load Flow Solution and Control:

Classification of buses, specification of bus voltage-power etc, Gauss-Seidal method and Newton-Raphson method of load flow solutions, some principles of load control.

Current and voltage relations on a transmission line:

Representation of lines, the short transmission line, the medium transmission line, the long transmission line, hyperbolic form of the equations, the equivalent circuit of a long line, direct current transmission. General line equation in terms of ABCD constants, relations between constants, charts of line constants, constants of combined networks, measurement and advantages of generalized line constants.

Power circle diagram:

Receiving and sending end power circle diagrams, transmitted maximum power, universal power circle diagrams, and use of circle diagrams.

Voltage and Power Factor Control in Transmission Systems:

Tap changing transformer, induction regulators, moving coil regulators, booster transformer, power factor control, static condensers in series or parallel, synchronous condensers, ferranti effect.

Insulated Cables:

Cables versus overhead lines, insulating materials, electrostatic stress grading, three core cables, dielectric losses and heating, modern developments, oil filled and gas filled cables, measurement of capacitance, cable testing.

Insulator of Overhead Lines:

Types of insulators, their constructions and performances, potential distribution, special types of insulators, testing of insulators.

Distribution:

Distributor calculation, copper efficiencies, radial ring mains and interconnections.

Mechanical Characteristics of Transmission Lines:

Sag and stress analysis, ice and wind loading, supports at different elevations, conditions of erection, effect of temperature changes.

2. EEE 313 Digital Electronics 3.00 Cr. Hours

Analysis and Synthesis of Digital Logic Circuits:

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

Programmable Logic Devices:

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

Sequential Circuits:

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

Suggested Text:

1. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design", McGraw-Hill, 2002

Suggested Reference:
1. M. Morris Mano, "Digital Logic and Computer Design", Prentice Hall, 2003

3. EEE 314 Digital Electronics Laboratory 1.50 Cr. Hours

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 313. In the second part, students will design simple systems using the principles learned in EEE 313.

4. EEE 243 Electromagnetic Fields and Waves 3.00 Cr. Hours

Static electric field:

Postulates of electrostatics, Coulomb's law for discrete and continuously distributed charges, Gauss's law and its application, electric potential due to charge distribution, conductors and dielectrics in static electric field, flux density - boundary conditions; capacitance - electrostatic energy and forces, energy in terms of field equations, capacitance calculation of different geometries; boundary value problems – Poisson's and Laplace's equations in different co-ordinate systems.

Steady electric current:

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

Time varying fields and Maxwell's equations:

Faraday's law of electromagnetic induction, Maxwell's equations - differential and integral forms, boundary conditions, potential functions; time harmonic fields and Poynting theorem.

Plane electromagnetic wave:

Plane wave in loss less media - Doppler effect, transverse electromagnetic wave, polarization of plane wave; plane wave in lossy media – low-loss dielectrics, good conductors; group velocity, instantaneous and average power densities, normal and oblique incidence of plane waves at plane boundaries for different polarization.

Suggested Texts:

1. D. M. Pozar, "Microwave Engineering", 3rd ed., Wiley, 2000

Suggested References:
1. S. Ramo, J. R. Whinnery and T. V. Duzer, "Fields and Waves in Communication Electronics", 3rd ed., Wiley, 1994

2. A. Das and S. K. Das, "Microwave Engineering", McGraw-Hill, 2001.

3. J. D. Krauss and R. J. Marhefka, "Antennas", 3rd ed., McGraw-Hill, 2001

4. C. A. Balanis "Antenna Theory: Analysis and Design Technology", 3rd ed., Wiley, 2005

5. P. E. Collins, "Antennas and Radio Propagation", McGraw-Hill, 1985

6. E. C. Jordan and K. G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall, 1993.

5. EEE 316 Machine Design **0.75 Cr. Hours**

General design principle of electrical apparatus involving electrical and magnetic circuit, specification design of electromagnetics solenoids, chokes, starters etc, design of rotating machines and transformers.

6. MATH 215 Linear Algebra **3.00 Cr. Hours**

Introduction to systems of linear equations, Gaussian elimination, definition of matrices, algebra of matrices, transpose of a matrix and inverse of matrix, factorization, determinants, quadratic forms, matrix polynomials. Euclidean n-space, Linear transformation IR^n to IR^m. Properties of linear transformation from IRn to IRm . Real vector spaces an subspaces. Basis and dimension. Rank and nullity. Inner product spaces. Gram- Schmidt process and QR-decomposition. Eigen values and eigen vectors. Diagonalization linear transformation: Kernel and Range. Application of linear algebra to electric networks.

Suggested books:

1. H. A. Anton and C. Rorres, "Elementary Linear Algebra", 8th ed., Wiley, 2004

2. H. A. Anton, I. Bivens, and S. Davis Calculus, "Calculus", 7th ed., Wiley, 2004

3. B. Kolman and D. R. Hill, "Introductory Linear Algebra with Applications", 7th ed., Prentice Hall, 2001

4. P. B. Bhattacharya, S. K. Jain and S. R. Nagpaul, "First Course in Linear Algebra", New Age Press, 1995

5. M. A. Rahman, "Mathematical Methods with Applications" (Volume 2), Computational Mechanics, 2000

7. EEE 325 Digital Signal Processing I **3.00 Cr. Hours**
Prerequisite: EEE 235

Introduction to digital signal processing (DSP):

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

Discrete transformations:

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

Correlation:

Circular convolution, auto-correlation and cross correlation.

Digital Filters:

FIR filters - linear phase filters, specifications, design using window, optimal and frequency sampling methods; IIR filters – specifications, design using impulse invariant, bi-linear Z transformation, least-square methods and finite precision effects.

8. EEE 326 Digital Signal Processing Laboratory **0.75 Cr. Hours**

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 325 and. In the second part, students will design simple systems using the principles learned in EEE 325.

9. EEE 339 Semiconductor Physics and Devices **3.00 Cr. Hours**

Atoms and Aggregates of Atoms:

Bohr atomic model, shell model.

Bonding and Types of Solids:

Primary bonding, secondary bonding, mixed bonding.

Crystal Structures:

Types of crystals, lattice and basis, Bravais lattice and Miller indices.

Classical Theory of Electrical and Thermal Conduction:

Scattering, mobility and resistivity, temperature dependence of metal resistivity, Mathiessen's rule, Hall Effect and thermal conductivity.

Modern Theory of Metals:

Determination of Fermi energy and average energy of electrons, classical and quantum mechanical calculation of specific heat.

Dielectric Properties of Materials:

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

Semiconductors in equilibrium: Energy bands, intrinsic and extrinsic semiconductors, Fermi levels, electron and hole concentrations, temperature dependence of carrier concentrations and invariance of Fermi level.

Carrier transport processes and excess carriers:

Drift and diffusion, generation and recombination of excess carriers, built-in-field, Einstein relations, continuity and diffusion equations for holes and electrons and quasi-Fermi level.

PN junction: Basic structure, equilibrium conditions, contact potential, equilibrium Fermi level, space charge, non-equilibrium condition, forward and reverse bias, carrier injection, minority and majority carrier currents, transient and ac conditions, time variation of stored charge, reverse recovery transient and capacitance.

Bipolar junction transistor: Basic principle of pnp and npn transistors, emitter efficiency, base transport factor and current gain, diffusion equation in the base, terminal currents, coupled-diode model and charge control analysis, Ebers-Moll equations and circuit synthesis.

Metal-semiconductor junction: Energy band diagram of metal semiconductor junctions, rectifying and ohmic contacts.

MOS structure: MOS capacitor, energy band diagrams and flat band voltage, threshold voltage and control of threshold voltage, static C-V characteristics, qualitative theory of MOSFET operation, body effect and current-voltage relationship of a MOSFET.

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

Suggested Texts:

1. B. G. Streetman, "Solid State Electronic Devices", 4th ed., Prentice-Hall, 1995

Suggested References:

1. P. A. Tipler and R. A. Llewellyn, "Modern Physics", 5th ed., Freeman, 2008

2. R. F. Pierret, "Semiconductor Fundamentals", Modular Series on Solid State Devices, Addison-Wesley, 1990

3. D. K. Ferry and J. P. Bird, "Electronics Materials and Devices", Academic Press, 2001

LEVEL 03 SEMESTER 01

No.	Course code	Course Title	Credit
1.	EEE 311	Measurement and Instrumentation	3.00
2.	EEE 312	Measurement and Instrumentation Laboratory	0.75
3.	EEE 361	Power System Analysis	3.00
4.	EEE 322	Power System Laboratory	1.50
5.	MATH 225	Probability and statistics	3.00
6.	EEE 323	Communication Theory	3.00
7.	EEE 324	Communication Laboratory	1.50
8.	EEE 320	Electrical Services Design	1.50
9.	EEE 331	Microprocessor & Interfacing	3.00
10.	EEE 332	Microprocessor & Interfacing Laboratory	1.50
Total			**21.75**

1. **EEE 311 Measurement and Instrumentation** **3.00 Cr. Hours**

Introduction:

Applications, functional elements of a measurement system and classification of instruments. Measurement of electrical quantities: Current and voltage, power and energy measurement. Current and potential transformer. Transducers: mechanical, electrical and optical.

Measurement of non-electrical quantities: Temperature, pressure, flow, level, strain, force and torque.

Basic elements of dc and ac signal conditioning:

Instrumentation amplifier, noise and source of noise, noise elimination compensation, function generation and linearization, A/D and D/A converters, sample and hold circuits.

Data Transmission and Telemetry:

Methods of data transmission, dc/ac telemetry system and digital data transmission. Recording and display devices. Data acquisition system and microprocessor applications in instrumentation

2. EEE 312 Measurement and Instrumentation Lab 0.75 Cr. Hours

Experiment based on syllabus of EEE 311.

3. EEE 361 Power System Analysis 3.00 Cr. Hours

System Modeling:

Review of synchronous machine, the effect of synchronous machine excitation, per unit quantities, changing the base of per unit quantities, per unit impedance in single phase transformer and three phase transformer circuits, per unit impedance of three winding transformers, one-line diagram, impedance and reactance diagram, per unit and percentage method of calculations, advantages and disadvantages of per unit computations.

Network Calculations:

Node equation, matrix partitioning, node elimination by matrix algebra, bus admittance and impedance matrices, modification of an existing bus impedance matrix, direct determination of a bus impedance matrix.

Load Flow Solution and Control:

Classification of buses, specification of bus voltage-power etc, Gauss-Seidal method and Newton-Raphson method of load flow solutions, some principles of load control.

Symmetrical Three phase Faults:

Short circuit currents and the reactance of synchronous machines, internal voltages of loaded machines under transient conditions, bus impedance matrix in fault calculations, bus impedance

matrix equivalent network, percentage reactance and short-circuit MVA, reactor control of short-circuit currents and location of reactors and their advantages and disadvantages.

Symmetrical Components:

Symmetrical components of unsymmetrical phasors, sequence impedance and sequence networks, sequence network of unloaded generators, positive and negative sequence networks, and zero-sequence networks.

Unsymmetrical Faults:

Unsymmetrical short-circuits on an unloaded generator, single line to ground fault, line to line fault, double line to ground fault, unsymmetrical faults of power systems, faults through impedance, unsymmetrical open circuits and series impedances.

Power System Stability:

The stability problem of power system, swing equation, power-angle equation, equal area criterion of stability.

Multi-Machine Stability Studies:

Classical representation, step-by-step solution of the swing curve, factors affecting stability, techniques for improving stability.

4. EEE 322 Power System 1 Laboratory 1.50 Cr. Hours

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 361. In the second part, students will design simple systems using the principles learned in EEE 361.

5. MATH 225 Probability and Statistics 3.00 Cr. Hours

Introduction. Sets and probability. Random variable and its probability distribution. Treatment of grouped sampled data. Some discrete probability distribution. Normal distribution. Sampling theory. Estimation theory. Tests of hypothesis. Regression and correlation. Analysis of variance

6. EEE 323 Communication Theory 3.00 Cr. Hours

Overview of communication systems:

Basic principles, fundamental elements, system limitations, message source, bandwidth requirements, transmission media types, bandwidth and transmission capacity. Noise: Source, characteristics of various types of noise and signal to noise ratio.

Information theory:

Measure of information, source encoding, error free communication over a noisy channel, channel capacity of a continuous system and channel capacity of a discrete memory less system.

Communication systems:

Analog and digital. Continuous wave modulation: Transmission types – base-band transmission, carrier transmission; amplitude modulation – introduction, double side band, single side band, vestigial side band, quadrature; spectral analysis of each type, envelope and synchronous detection; angle modulation – instantaneous frequency, frequency modulation (FM) and phase modulation (PM), spectral analysis,

Demodulation of FM and PM. Pulse modulation:

Sampling – sampling theorem, Nyquist criterion, aliasing, instantaneous and natural sampling; pulse amplitude modulation - principle, bandwidth requirements; pulse code modulation (PCM) - quantization principle, quantization noise, non-uniform quantization, signal to quantization error ratio, differential PCM, demodulation of PCM; delta modulation (DM) - principle, adaptive DM; line coding – formats and bandwidths.

Digital modulation:

Amplitude-shift keying - principle, ON-OFF keying, bandwidth requirements, detection, noise performance; phase-shift keying (PSK) - principle, bandwidth requirements, detection, differential PSK, quadrature PSK, noise performance; frequency-shift Keying (FSK) - principle, continuous and discontinuous phase FSK, minimum-shift keying, bandwidth requirements, detection of FSK.

Multiplexing:

Time- division multiplexing (TDM) - principle, receiver synchronization, frame synchronization, TDM of multiple bit rate systems; frequency-division multiplexing - principle, de-multiplexing; wavelength-division multiplexing, multiple-access network – time-division multiple-access, frequency-division multiple access; code-division multiple- access (CDMA) - spread spectrum multiplexing, coding techniques and constraints of CDMA. Communication system design: design parameters, channel selection criteria and performance simulation.

Suggested Texts:

1. S. Haykin, "Communication Systems", 3rd ed., Wiley, 1995.

Suggested References:

1. G. Kennedy, "Electronic Communication Systems", McGraw-Hill, 4th Edition, 1987

2. Taub and Schilling, "Principles of Communication Systems", 2nd ed., McGraw-Hill, 1987

3. B. Carlson, "A Communication Systems", 3rd Edition, McGraw-Hill, 1986

4. Roody and Coolen, "Electronic Communication", 4th ed., Prentice Hall, 1999

7. EEE 324 Communication Laboratory 1.50 Cr. Hours

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 323. In the second part, students will design simple systems using the principles learned in EEE 323.

8. EEE 320 Electrical Services Design (Sessional) 1.50 Cr. Hours

Wiring system design, drafting, and estimation. Design for illumination and lighting. Electrical installations system design: substation, BBT and protection, air-conditioning, heating and lifts. Design for intercom, public address systems, telephone system and LAN. Design of security systems including CCTV, fire Alarm, smoke detector, burglar alarm, and sprinkler system. A design problem on a multi-storied building.

9. EEE 331 Microprocessor and Interfacing 3.00 Cr. Hours
Prerequisite: CSE 132

Introduction to microprocessors. Intel 8086 microprocessor:

Architecture, addressing modes, instruction sets, assembly language programming, system design and interrupt.

Interfacing:

Programmable peripheral interface, programmable timer, serial communication interface, programmable interrupt controller, direct memory access, keyboard and display interface. Introduction to micro-controllers.

Suggested Texts:

1. Y. Liu and G. A. Gibson, "Microcomputer Systems: The 8086/8088 Family Architecture, Programming Design", 2nd ed., Prentice-Hall, 1986

2. M. Rafiquzzaman, "Microprocessors: Theory and Applications: Intel and Motorola", Revised ed., Prentice Hall, 1992

3. Douglas V. Hall, "Microprocessors and Interfacing: Programming and Hardware" 2nd ed., Gloence McGraw Hill, 1991.

10. EEE 332 Microprocessor and Interfacing Laboratory 1.50 Cr. Hours

Course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 315. In the second part, students will design simple systems using the principles learned in EEE 315.

LEVEL 03 SEMESTER 02

No.	Course code	Course Title	Credit
1.	EEE 400	Thesis/project	1.50
2.	EEE 455	Power Plant Engineering	3.00
3.	EEE 467	Renewable Energy Conversion	3.00
4.	EEE 333	Control System	3.00
5.	EEE 334	Control System Laboratory	1.50
6.	EEE 413	Microwave Engineering	3.00
7.	EEE 416	Microwave Engineering Laboratory	0.75
8.	EEE 419	Mobile Cellular Communication	3.00
9.	EEE 463	High Voltage Engineering	3.00
Total			**21.75**

1. EEE 400 Thesis 1.50 Cr. Hours

The duration of thesis/project work will be two/three semesters. A student must undertake a research work on an Electrical and Electronic Engineering topic under the guidance of a supervisor. The student is required to prepare and submit the report within the time specified. The report will be graded and a student must get at least a C grade, which is the passing grade for this course.

2. EEE 455 Power Plant Engineering 3.00 Cr. Hours

Energy Sources:

Fossil fuels, nuclear fission, renewable energy sources-hydro, biomass, solar, wind, geothermal, pumped storage hydro.

Power Station Performance:

Connected load, demand factor, diversity factor, load factor, plant factor, and utilization factor.

Plant Performance and Operating Characteristics:

Efficiency, heat rate, incremental rate method, station performance characteristics, station incremental rate, capacity scheduling, base load and peak load, load division between steam and hydro stations, choice of power stations and units.

Interconnected System:

Capacity saving, power sharing among units for economic allocation.

Private Generation:

Industrial co-generation, capacity generation. Site selection of power station.

Energy Tariff:

Description, types and tariff in Bangladesh.

Hydro Power Stations:

Equipment, plant auxiliaries, plant operation.

Nuclear Power Stations:

Chain reactions moderator types of reactors, shielding...

Thermal Power Stations:

Equipment, plant auxiliaries and operation.

3. EEE 467 Renewable Energy Conversion 3.00 Cr. Hours

Importance of Renewable Energy Sources, Statistics Regarding Solar Radiation and Wind Speed

Introduction:

Geographical distribution, atmospheric factors, measurements.

Solar Cell:

Principle of operation, spectral response, factors effecting conversion efficiency, I-V characteristics, maximum power output.

PV Modules and Arrays:

Stationary and tracking.

PV Systems:

Standalone, battery storage, inverter interfaces with grid.

Wind Turbine Generators:

Types, operational characteristics, cut-in and cut-out speed control, grid interfacing, AC-DC-AC link.

4. EEE 333 Control System **3.00 Cr. Hours**
Prerequisite: EEE 235

Introduction to control systems.

Linear system models: transfer function, block diagram and signal flow graph (SFG).

State variables:

SFG to state variables, transfer function to state variable and state variable to transfer function.

Feedback control system:

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

Analysis of feedback control system:

Root locus method and frequency response method. Design of feedback control system: Controllability and observability, root locus, frequency response and state variable methods.

Digital control systems:

Introduction, sampled data systems, stability analysis in Z-domain.

Suggested Texts:

1. K. Ogata, "Modern Control Engineering", 4th ed., Prentice Hall, 2001

Suggested References:

1. G. E. Franklin, J. D. Powell, and A. Emami-Naeni, "Feedback Control of Dynamic Systems", 4th ed., Addison-Wesley, 2002

5. EEE 334 Control System Laboratory **1.50 Cr. Hours**

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 333. In the second part, students will design simple systems using the principles learned in EEE 333.

6. EEE 413 Microwave Engineering 3.00 Cr. Hours

Transmission lines:

Voltage and current in ideal transmission lines, reflection, transmission, standing wave, impedance transformation, Smith chart, impedance matching and lossy transmission lines.

Waveguides:

General formulation, modes of propagation and losses in parallel plate, rectangular and circular waveguides.

Micro strips:

Structures and characteristics.

Rectangular resonant cavities:

Energy storage, losses and Q. Radiation: Small current element, radiation resistance, radiation pattern and properties, Hertzian and halfwave dipoles.

Antennas:

Monopole, horn, rhombic and parabolic reflector, array, and Yagi-Uda antenna.

Suggested Texts:

1. D. M. Pozar, "Microwave Engineering", 3rd ed., Wiley, 2000

Suggested References:

1. S. Ramo, J. R. Whinnery and T. V. Duzer, "Fields and Waves in Communication Electronics", 3rd ed., Wiley, 1994

2. A. Das and S. K. Das, "Microwave Engineering", McGraw-Hill, 2001

3. J. D. Krauss and R. J. Marhefka, "Antennas", 3rd ed., McGraw-Hill, 2001

4. C. A. Balanis "Antenna Theory: Analysis and Design Technology", 3rd ed., Wiley, 2005

5. P. E. Collins, "Antennas and Radio Propagation", McGraw-Hill, 1985

6. E. C. Jordan and K. G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall, 1993

7. EEE 416 Microwave Engineering Laboratory 0.75 Cr. Hours

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 413. In the second part, students will design simple systems using the principles learned in EEE 413.

8. EEE 419 Mobile Cellular Communication 3.00 Cr. Hours

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.

Diversity Techniques:

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

Digital cellular systems:

Global system for mobile, time division multiple access and code division multiple access.

Suggested Books:

1. Theodor S. Rappaport Wireless Communications; Principle and Practice
2. WCY Lee Cellular communication
3. Schiller Mobile Communication

9. EEE 463 High Voltage Engineering 3.00 Cr. Hours

High voltage dc:

Rectifier circuits, voltage multipliers, Van-de-Graaf and electrostatic generators. High voltage ac: Cascaded transformers and Tesla coils.

Impulse voltage:

Shapes, mathematical analysis, codes and standards, single and multi-stage impulse generators, tripping and control of impulse generators. Breakdown in gas, liquid and solid dielectric materials. Corona. High voltage measurements and testing. Over-voltage phenomenon and insulation coordination. Lightning and switching surges, basic insulation level, surge diverters and arresters.

Suggested Texts:

1. M.S. Naidu, "High Voltage Engineering", McGraw-Hill Professional, 1999

Suggested References:

1. E. Kuffel, W S Zaengl, and J. Kuffel, "High Voltage Engineering Fundamentals", Newnes, 2000

LEVEL 04 SEMESTER 01

No.	Course code	Course Title	Credit
1.	EEE 400	Thesis/project	3.00
2.	EEE 469	Power Electronics	3.00
3.	EEE 470	Power Electronics Laboratory	0.75
4.	EEE 445	Biomedical Electronics	3.00
5.	EEE 363	Power System Protection	3.00
6.	EEE 447	VLSI I	3.00
7.	EEE 448	VLSI I Laboratory	0.75
Total			**16.50**

1. EEE 400 Thesis **3.00 Cr. Hours**

The duration of thesis/project work will be three semesters. A student must undertake a research work on an Electrical and Electronic Engineering topic under the guidance of a supervisor. The student is required to prepare and submit the report within the time specified. The report will be graded and a student must get at least a C grade, which is the passing grade for this course.

2. EEE 469 Power Electronics **3.00 Cr. Hours**

Power semiconductor switches and triggering devices:

BJT, MOSFET, SCR, IGBT, GTO, TRIAC, UJT and DIAC.

Rectifiers:

Uncontrolled and controlled single phase and three phase. Regulated power supplies: Linear-series and shunt, switching buck, buckboost, boost and Cuk regulators.

AC voltage controllers:

Single and three phase. Choppers. DC motor control. Single phase cycloconverter.

Inverters:

Single phase and three phase voltage and current source. AC motor control. Stepper motor control. Resonance inverters. Pulse width modulation control of static converters.

Suggested Texts:

1. Muhamed H. Rashid, "Power Electronics: Circuits, Devices and Application", 3rd ed., Prentice Hall, 2003

Suggested References:

1. M. D.Singh, K. B. Khanchandani, "Power Electronics", McGraw-Hill, 1998

2. N. Mohan, T. M.Undeland, W. P.Robbins, "Power Electronics: Converters, Applications and Design", 3rd Bk&Cdr ed., Wiley, 2002

3. B. K.Bose, "Modern Power Electronics", Prentice Hall, 2001

4. Sen, "Power Electronics", McGraw-Hill, 1987

3. EEE 470 Power Electronics Laboratory **0.75 Cr. Hours**

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 469. In the second part, students will design simple systems using the principles learned in EEE 469.

4. EEE 445 Biomedical Electronics 3.00 Cr. Hours

Human body:

Cells and physiological systems.

Bioelectricity:

Genesis and characteristics. Measurement of bio-signals: Ethical issues, transducers, amplifiers and filters.

Electrocardiogram:

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

Blood pressure:

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

Blood flow measurement:

Plethysmography and electromagnetic flow meter.

Measurement and interpretation:

Electroencephalogram, cerebral angiograph and cronical X-ray. Brain scans. Electromayogram (EMG).

Tomography:

Positron emission tomography and computer tomography. Magnetic resonance imaging. Ultra sonogram. Patient monitoring system and medical telemetry. Effect of electromagnetic fields on human body.

Suggested Books:

1. Joseph Dubovy, Introduction to Biomedical Electronics, Glencoe/Mcgraw-Hill

2. Edward J. Bukstein, Introduction to Biomedical Electronics, Bobbs-Merrill Co.

5. EEE 363 Power System Protection 1.50 Cr. Hours

Introduction:

Purpose of power system protection, introduction to circuit interruption and protection. Terminologies and general characteristics of relays and breakers.

Circuit Breakers:

Control systems, arc extinction, and recovery voltage. Air, oil, air blast, vacuum, SF6 and high voltage DC circuit breakers. Selection criteria, testing of circuit breakers.

Fuses:

Introduction, advantages and disadvantages, desirable characteristics of fuse element, fuse element materials, fusing current, fusing factor, prospective current, cut-off current, pre-arcing time, arcing time, total operating time, breaking capacity, types of fuses and description, current rating of fuse element.

Relays:

Over current, directional, differential, distance, sequence, pilot-wire and carrier current protection. Bus bar arrangement, grounding.

Unit Protection:

Generator, motor, transformer, bus and line protection.

Static Relays:

Introduction to Analogue and digital static relays. Static over current, differential and distance protection. Microprocessor Based Relays

SCADA System:

Introduction, Basic Knowledge.

6. EEE 447 VLSI I **3.00 Cr. Hours**

VLSI technology:

Top down design approach, technology trends and design styles.

Review of MOS transistor theory: Threshold voltage, body effect, I-V equations and characteristics, latch-up problems, NMOS inverter, CMOS inverter, pass-transistor and transmission gates.

CMOS circuit characteristics and performance estimation: Resistance, capacitance, rise and fall times, delay, gate transistor sizing and power consumption. CMOS circuit and logic design: Layout design rules and physical design of simple logic gates.

CMOS subsystem design: Adders, multiplier and memory system, arithmetic logic unit. Programmable logic arrays. I/O systems. VLSI testing.

Suggested Texts:

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

Suggested References:

1. B. T. Preas, M. Lorenzetti, "Physical Design Automation of VLSI Systems", The Benjamin-Cummings Publishing Co., 1988

2. C. H. Roth, Jr., "Digital Systems Design Using VHDL", 1st ed., Thomson Engineering, 1998

7. EEE 448 VLSI I Laboratory 0.75 Cr. Hours

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 433. In the second part, students will design simple systems using the principles learned in EEE 433.

LEVEL 04 SEMESTER 02

No.	Course code	Course Title	Credit
1.	BDS 139	Bangladesh Studies	3.00
2.	CHM 133	Chemistry	3.00
3.	CHM 134	Chemistry Laboratory	1.50
4.	EEE 241	Electrical Machines I	3.00
5.	EEE 252	Electrical Machines Laboratory	1.50
6.	BUS 317	Industrial Management	3.00
Total			**15.00**

1. BDS 139 Bangladesh Studies 3.00 Cr. Hours

Brief modern history of Bangladesh: colonial, pre-liberation and present. Geography and environment of Bangladesh. Social structure, population diversity, religions. Government &political system, administrative framework & its evolution. Production: agriculture & industry. Economic development: roles of public & private sectors, NGOs, rural development. Globalization & the role of Bangladesh.

2. CHM 133 Chemistry 3.00 Cr. Hours

Atomic structure, quantum numbers, electronic configuration, periodic table, properties and uses of noble gases; Different types of chemical bonds and their properties; molecular structure of compounds; selective organic reactions, different types of solutions and their compositions; phase rule, phase diagram of mono-component system, properties of dilute solutions, thermo-chemistry, chemical kinetics, chemical equilibria, ionization of water an pH concept, electrical properties of solution.

Suggested books:

1. D. Ebbing, "General Chemistry", Houghton Mifflin Co., London.

2. S.Z Haider, "Introduction to Modern Inorganic Chemistry", Friends International,

Dhaka.

3. M. M. Haque and M. A. Nawab, "Physical Chemistry", Student Publications, Dhaka.

4. R. H. Morrison and R. N. Boyd, "Organic Chemistry", Prentice - Hall.

3. CHM 134 Chemistry Lab **1.50 Cr. Hours**

Laboratory experiments based on CHM 133.

4. EEE 241 Electrical Machines-I **3.00 Cr. Hours**

Transformer:

Single Phase Transformer:
Construction and Principle of Operation, Ideal Transformer, Transformer Ratio, Actual Transformer-Equivalent Circuit, Per Unit Systems, Phasor Diagrams, Efficiency, Regulation and Testing (Open and Short Circuit)
Three Phase Transformer:
Connections, Vector Group, Parallel Operation And Testing, Autotransformer, V- Connection.

Induction Motor:

Three Phase :
Construction, Rotating Magnetic Field, Equivalent Circuit, Vector Diagram, Torque-Speed Characteristics, Effect of Changing Rotor Resistance And Reactance On Torque-Speed Curves, Motor Torque And Developed Torque Power, No-Load Test, Blocked Rotor Test, Starting, Braking And Speed Control, Motor Classes.

Single Phase:

Theory of Operation, Equivalent Circuit, Starting Process.
Induction generator.

5. EEE 252 Electrical Machines Laboratory **1.50 Cr. Hours**

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 241 and EEE 251. In the second part, students will design simple systems using the principles learned in EEE 241 and EEE 251.

6. BUS 317 Industrial Management **3.00 Cr. Hours**

Management Functions and Organization: evolution, management function: organization, theory and structure, span of control, authority delegation, manpower planning. Personal Management: importance, need hierarchy, motivation, leadership, wage incentives, performance appraisal, participative management. Operation Management: production planning and control (PPC) functions, quantitative methods applied in production, quality management, location and layout planning safety and loss management. Cost and Financial Management: elements of cost products, cost analysis, investment analysis, and benefit cost analysis, risk analysis. Management Accounting: cost planning and control, budget and budgetary control. Marketing Management: concepts, strategy, sales promotion, patent laws. Technology Management: management of innovation and changes, technology life cycle. Case studies.