Department of Electrical and Electronic Engineering (EEE)

Syllabus

B.Sc. in Electrical and Electronic Engineering

Varendra University
Rajshahi
Text Book:
1. Programming with C: Byron Gottfried

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

CSE 134 Computer Programming Lab Credit: 1.50
In this course students will perform experiments to verify practically the theories and concepts learned in CSE 133.

ME 231 Basic Mechanical Engineering Credit: 3.00
Energy: Forms and sources of energy, renewable and non-renewable energy sources and their potential, energy conservation and environmental pollution.
Thermodynamics: Thermodynamic laws and corollaries, heat and work, different thermodynamic processes, reversibility and irreversibility, enthalpy, entropy. Analysis of different thermodynamic cycles, representation of various cycles on PV and TS planes.
Refrigeration and air conditioning: Refrigeration and air conditioning with their equipment and applications.
Turbomachineries: Pelton wheel, Francis turbine, Kaplan turbine, centrifugal and reciprocating pumps, fans, blowers and compressors.

Text Book:
Fundamentals of Mechanical Engineering: R. L. Timings

Reference Book:
Mechanical Engineering Fundamentals and Problem Solving: Arvid Eide, Roland Jenison, Larry Northup, and Steven Mickelson

ME 232 Basic Mechanical Engineering Lab Credit: 1.50
In this course students will perform experiments to verify practically the theories and concepts learned in ME 231.
handoffs and dropped calls, reasons and types, forced handoffs, mobile assisted
handoffs and dropped call rate.

Introduction to networks: ISDN, B-ISDN, LAN, MAN, WAN, BLUETOOTH,
ATM, and multimedia communication, Unicast, Multicast, and Broadcast.
Introduction to optical fiber communication, satellite and radar communication.

Text Book:
1. Mobile Communications Engineering: Theory and Applications by W. Lee

Reference Book:

EEE 468 Communication Engineering II Lab Credit: 1.50
In this course students will perform experiments to verify practically the theories
and concepts learned in EEE 467.

Inter-disciplinary Courses:

CE 112 Engineering Drawing Lab Credit: 1.50
Lettering, numbering and heading; instrument and their use; sectional views and
isometric views of solid geometrical figures. Plan, elevation and section of
multistoried building; building services drawings; detailed drawing of lattice
towers. Use of Auto-CAD software.

CSE 133 Computer Programming Credit: 3.00
Introduction to C programming: Programming concepts; structured programming
language: Data types, operators, expressions, control structures; functions and
program structures: Function basics, parameter passing conventions, scope rules
and storage classes, recursion; header files; preprocessor; arrays and pointers;
user defined data type: Structures, unions, enumeration; input and output:
Standard input and output, formatted input and output, file access; variable length
argument list; command line parameters; error handling

Preface

The Department of Electrical and Electronic Engineering at Varendra University
(VU) offers four-year undergraduate degree program in Electrical and Electronic
Engineering. The bachelor degree program requires 151 credits and is spread
over 12 semesters with 3 semesters per year.

The aim of the degree program is to make the students well equipped with the
theoretical and practical knowledge of electrical and electronic Engineering. The
program is designed to produce engineering graduates capable of in the following
broad areas: Power systems, Communications, Control Systems and Power
Electronics. In particular, they will be able to define and diagnose problems,
provide and implement electrical engineering solutions in the industry, business
and government; observe engineering ethics; communicate effectively with
technically diverse audiences; collaborate with others as a member or as a leader
in an engineering team; develop their knowledge and keep abreast of the
advancements in electrical, electronic and telecommunication engineering.

The department has already developed its own laboratories in Electrical Circuits,
Analog and Digital Electronics, Electrical Machines, Instrumentation and
Measurement. The department will be developing, in due course, the laboratories
in Power systems, Microwaves and Microprocessors, Switchgear and Protection,
Communication Engineering and Control Systems.
The Credit Hour System:
The procedure of Credit Hour Semester System which will be practiced in the academic program at the Varendra University involves 13 weeks of class room instructions in each semester. For all 3 credit theory and 1.50 credit Lab courses, contact hour is 3 period/week. Each class period of theory/Lab courses will have a minimum duration of 50 minutes.

The Semester System and Semester Schedule:
An academic year comprises three semesters, each semester spanning 4 months: 13 weeks for instruction and 3 weeks for registration and examinations. Semester starts at January (Spring Semester), May (Summer Semester) and September (Fall Semester).

Type of Courses:
The courses of the undergraduate curricula are divided into several groups:

1. General Education Courses
2. Basic Science Courses
3. Mathematics Courses
4. EEE Core Courses
5. Interdisciplinary Courses
6. Technical Elective Courses
7. 

Earned Credits:
The course in which a student obtains ‘D’ or higher grade will be counted as credit earned by the student. ‘F’ grade is not counted towards a student’s earned credits. A student who obtains an ‘F’ grade in any core course has to repeat the course. If a student obtains an ‘F’ grade in an optional course, he/she may choose to repeat the course or take a substitute course if available. ‘F’ grade is not counted towards earned credits but will show on the Grade Sheet and Transcript.

EEE 465 Microwave Engineering Credit: 3.00
Microwave Tubes: Transit time effects. Velocity modulation, Klystron amplifier, multicavity Klystron amplifier, reflex Klystron oscillator, magnetron, 51 test wave tube (TWT) amplifier, backward Wave Oscillator (BWO).
Transmission lines: High frequency transmission lines, smith chart, impedance matching techniques and applications.
Antennas: Antennas & radiation, Hertzian dipole, long antennas analysis, antenna arrays, introduction to antenna array design, rhombic & slot antenna, frequency independent and log-periodic antennas, V-antenna, introduction to microstrip antenna.

Text Book:
Microwave Engineering: D. M. Pozar

Reference Book:
Fields and Waves in Communication Electronics: S. Ramo, J. Whinnery and T. V. Duzer

EEE 466 Microwave Engineering Lab Credit: 1.50
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 465.

EEE 467 Communication Engineering II Credit: 3.00
Mobile communication: Introduction, concept, evolution and fundamentals, analog and digital cellular systems, cellular radio system, frequency reuse, co-channel interference, cell splitting and components, Mobile radio propagation, propagation characteristics, models for radio propagation, antenna at cell site and mobile antenna, frequency management and channel assignment, fundamentals, spectrum utilization, fundamentals of channel assignment, fixed channel assignment, non-fixed channel assignment, traffic and channel assignment,
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 461.

**EEE 463 Data Communication & Computer Networks  Credit: 3.00**

*Basic Concepts:* Network hardware and software, Network topologies and categories, Reference models and standards.

*Principles of Computer Communications:* Physical layer: signal analysis, bandwidth and data rate, transmission media, encoding, transmission, Data link layer: framing, error control, flow control, multiple access protocols, Network layer: circuit switching, packet switching, routing, congestion control.

*Standardized Networks:* Ethernet, Fast Ethernet, Gigabit Ethernet, WiFi.


**Text Book:**
- Data and Computer Communication: W. Stallings

**Reference Book:**
- Data Communication and Networking: B. A. Forouzan

**EEE 464 Data Communication & Computer Networks Lab  Credit: 1.50**
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 463.

**The Evaluation Procedures:**
Evaluation of students’ performance will be based on final examination, midterm examination, class-test/assignments and attendance. Classroom evaluation including attendance, class tests and assignments will cover 25% of the total marks and the remaining 75% are reserved for the midterm and final examinations. For Lab courses, evaluation will be based on attendance, Lab assessment, Lab report, Quiz and Viva. The distribution of marks is as follows:

**Theory course:**
- Attendance 5%
- Class test 10%
- Assignment 5%
- Presentation 5%
- Midterm Examination 30%
- Final Examination 45%

**Lab course:**
- Attendance 10%
- Lab Assessment 20%
- Report 20%
- Quiz/Project 30%
- Viva 20%

**Grading and Point System:**

<table>
<thead>
<tr>
<th>Numerical Grade</th>
<th>Letter Grade</th>
<th>Grade Point</th>
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</thead>
<tbody>
<tr>
<td>80 % and above</td>
<td>A+ (A Plus)</td>
<td>4.00</td>
</tr>
<tr>
<td>75% to less than 80%</td>
<td>A (A Regular)</td>
<td>3.75</td>
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<tr>
<td>70% to less than 75%</td>
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<tr>
<td>40% to less than 45%</td>
<td>D</td>
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<tr>
<td>Less than 40%</td>
<td>F</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Note: If Letter Grade ‘I’ (Incomplete) is awarded to any student in any course, it will indicate that he/she has attended the course but did not appear in the semester midterm/final examination. Letter Grade ‘W’ indicates withdrawn from the course.

**Cumulative Grade Point Average:**

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

The CGPA will be computed in the following manner:

\[
\text{CGPA} = \frac{\sum \text{Grade Points} \times \text{Credits}}{\sum \text{Credits}}
\]

**Admission Requirements:**

The minimum qualifications for admission into the undergraduate program are:

1. **Academic Qualifications:**
   - At least second division in both SSC and HSC (No third division is acceptable) or Minimum 2.5 GPA out of 5.00 in both S.S.C. and H.S.C. Student should be from Science background with Math and Physics.
   - O-Level and A-Level:
     - Five subjects in University of London GCE O-level and three major subjects (Math, Physics and Chemistry) in A-level are required.
     - Minimum average GPA of combined O-level and A-level is 3 (Grade C), according to the VU scale: A=5, B=4, C=3, D=2 & E=1
   - A US high school diploma or equivalent.
   - Acceptable scores in VU VIVA Test.

2. **Degree Requirements:**
   - Completion of 151 credit hour courses


**Optical receivers and design techniques:** Basic theory of optical detection, quantum efficiency and responsively of optical detectors. Semiconductor photodiodes-PIN and APD photo detectors. Detector noise sources, the quantum limit. Detector bandwidth. Comparison PIN vs. APD. Optical receiver design principles. Low impedance high impedance and Tran impedance front-end receiver models.

**Optical fiber data transmission:** The characteristics of optical transmitters-transmitted optical power, linearity, response time and optical spectral line width. The interactive effects of the transmitter and optical fiber characteristics on the system bandwidth-length (e.g. material dispersion model noise). Optical inter symbol interference and equalization. Receiver noise, receiver sensitivity and the probability of error analysis. System performance and the bit error rate BER evaluations.

**Optical networks, interfaces and protocols:** The need for a optical data communication network in the presence of conventional data communication system. Conventional data communication systems. Optical fiber LANS and physical layer designs. Synchronous optical NET (SONET). The Fiber Distributed Data Interfaces (FDDI-1 and FDDI-2). FDDI topology, standards, protocols, construction and performance analysis. The role of FDDI in an extended LAN environment.

**Advanced OFC systems and technologies:** Coherent light wave communication systems WDM systems, multi access optical fiber networks, optical amplifiers and optical switching.

**Text Book:**

Optical fiber communications: John M Senior

**Reference Book:**

Optical Fiber Communication: G. Keiser

**EEE 462 Optical Fibre Communication Lab Credit: 1.50**

Ultrasound imaging: Transducers, Absorption and attenuation of ultrasound, scan mode and scanning system, Transcutaneous Doppler flow detector, flow meter, Ultrasonic blood pressure measurement.

X-ray: X-ray production, x-ray image formation and contrast, contrast types, Effects of photon energy, Area contrast, fluoroscopic imaging system, and computed tomography.

Nuclear magnetic resonance imaging: Nuclear magnetic resonance, Image characteristics, Gamma camera.

Analytical instruments: Colorimeter, pH meter, Chromatograph, Spectrophotometer, flow measurement.

Text Book:
Biophysics concept and mechanism: C. J. Casey

Reference Book:
Introduction to Biomedical equipment technology: J. J Carr & J. M Brown

Elective Course III:

EEE 461 Optical Fibre Communication Credit: 3.00

Optical communication channel: Definition of an optical communication channel for data transmission. The concept of intensity modulation of the light carrier by baseband digital information signal. Advantage and disadvantages of optical fiber compared with metallic medium. Basic theory of light transmission in optical fiber waveguide. Types of optical fibers currently used for communication systems. Optical fiber propagating modes, power loss and various dispersive phenomena. Dispersion and its effect on the available fiber bandwidth. Special advanced optical fibers.

Optical transmitters and design techniques: Basic theory of optical energy and optical energy sources. Quantum efficiency of optical sources. Semiconductor optical sources-light emitting diode(LED) and LASER diode .Device

2. Completion of a dissertation with at least a ‘C’ grade (6.0 credit hours)
3. Passing of all courses individually and maintaining a minimum CGPA of 2.50

List of Courses:

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

   No. of Courses: 5 (Theory: 5, Lab: 0)
   Total Credits: 13 (Theory: 13, Lab: 0)

<table>
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<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
<th>Pre-requisite</th>
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<tr>
<td>01</td>
<td>ENG 111</td>
<td>General English</td>
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<tr>
<td>02</td>
<td>ENG 121</td>
<td>Technical English</td>
<td>2.00</td>
<td>ENG 111</td>
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<tr>
<td>03</td>
<td>HUM 211</td>
<td>Economics and Accountancy</td>
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<tr>
<td>04</td>
<td>BCH 231</td>
<td>Bangladesh Cultural &amp; Heritage Studies</td>
<td>3.00</td>
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<tr>
<td>05</td>
<td>HUM 311</td>
<td>Industrial Management</td>
<td>3.00</td>
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</table>

2. Basic Science: (All the courses must be taken)

   No. of Courses: 2 (Theory: 1, Lab: 1)
   Total Credits: 4.50 (Theory: 3, Lab: 1.5)

<table>
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<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
<th>Pre-requisite</th>
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<tbody>
<tr>
<td>01</td>
<td>PHY 111</td>
<td>Physics I</td>
<td>3.00</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>PHY 112</td>
<td>Physics I Lab</td>
<td>1.50</td>
<td></td>
</tr>
</tbody>
</table>

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

   No. of Courses: 5 (Theory: 5, Lab: 0)
   Total Credits: 15 (Theory: 15, Lab: 0)
### Sl. No | Course Code | Course Title                              | Credit | Pre-requisite
---|---|---|---|---
01 | MAT 111 | Differential and Integral Calculus       | 3.00   |   
02 | MAT 121 | Coordinate Geometry & Vector Analysis    | 3.00   | MAT 111
03 | MAT 131 | Differential Equations and Matrices      | 3.00   | MAT 121
04 | MAT 211 | Fourier and Laplace Analysis             | 3.00   | MAT 121
05 | MAT 221 | Complex Variables and Statistical Analysis| 3.00   |   

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

| No. of Courses: 40 (Theory: 21, Lab: 19) | Total Credits: 91.5 (Theory: 63, Lab: 28.5) |

| Sl. No | Course Code | Course Title        | Credit | Pre-requisite |
---|---|---|---|---|
01 | EEE 111 | Electrical Circuits I | 3.00   |   
02 | EEE 112 | Electrical Circuits I Lab | 1.50   |   
03 | EEE 121 | Electrical Circuits II | 3.00   | EEE 111
04 | EEE 122 | Electrical Circuits II Lab | 1.50 |   
05 | EEE 123 | Electronics I        | 3.00   |   
06 | EEE 124 | Electronics I Lab     | 1.50   |   
07 | EEE 131 | Electronics II        | 3.00   | EEE 123
08 | EEE 132 | Electronics II Lab    | 1.50   |   
09 | EEE 213 | Electrical Machines I | 3.00   |   
10 | EEE 214 | Electrical Machines I Lab | 1.50   |   
11 | EEE 216 | Circuit Simulation Lab | 1.50   |   
12 | EEE 221 | Electrical Machines II | 3.00   | EEE 213
13 | EEE 222 | Electrical Machines II Lab | 1.50   |   
14 | EEE 223 | Numerical Technique   | 3.00   |   
15 | EEE 224 | Numerical Technique Lab | 1.50   |   
16 | EEE 233 | Digital Electronics   | 3.00   | EEE - 123
17 | EEE 234 | Digital Electronics Lab | 1.50   |   

### Light emitting diode (LED): Principles, materials for visible and infrared LED, internal and external efficiency, loss mechanism, structure and coupling to optical fibers. Stimulated emission and light amplification: Spontaneous and stimulated emission, Einstein relations, population inversion, absorption of radiation, optical feedback and threshold conditions.


### Text Book:
Optoelectronics and Photonics Principles and Practices: Kasap

### Reference Book:
Semiconductor Optoelectronic Devices: P. Bhattacharya

### EEE 457 Biomedical Engineering Credit: 3.00

**Physics of human body:** The cell, Body fluid, Musculo-skeletal system, Respiratory system, nervous system, The circulatory system, The body as a control system, The heart, Bioelectricity, Work done by heart, blood pressure and its measurements, Membrane potentials, molecular basis of muscle contraction, basic electrical signals from the muscles.

**Interaction of wave and radiation with human body:** Body’s detector and matter wave, speech noise, physiological effects of intense matter waves, Interaction of electromagnetic radiation on living matter, penetration of ray’s into tissue.

**Biological effects of ionizing radiation:** Dosimetry, primary effects, Biophysical effects of whole body irradiation, radiation measurement and protection.
Electronics Materials and Devices: D. K. Ferry and J. P. Bird

EEE 453 VLSI Design Credit: 3.00

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 and 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. Basic design methodologies: full custom and semi-custom design. Programmable logic arrays (PLAs), Field programmable gate arrays (FPGA), I/O systems. VLSI testing: objectives and strategies. Introduction to VHDL Hardware description Language.

Text Book:
1. Design of VLSI System – A Practical Introduction: Linda E. M. Brackenbury
2. Basic VLSI Design: D. A. Pucknell & K. Eshraghian

Reference Book:

EEE 455 Optoelectronics Credit: 3.00

Optical properties in semiconductor: Direct and indirect band-gap materials, radiative and non-radiative recombination, optical absorption, photo-generated excess carriers, minority carrier life time, luminescence and quantum efficiency

<table>
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<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
<th>Pre-requisite</th>
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<tr>
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<td>Signals and Systems</td>
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<td>19</td>
<td>EEE 313</td>
<td>Electrical &amp; Electronic Measurement</td>
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<td>EEE 316</td>
<td>Electrical Services Design Lab</td>
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<td>CE - 124</td>
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<td>22</td>
<td>EEE 321</td>
<td>Transmission &amp; Distribution of Electrical Power</td>
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<td>EEE 323</td>
<td>Power Electronics</td>
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<td>EEE 331</td>
<td>Electromagnetic Fields &amp; Waves</td>
<td>3.00</td>
<td>PHY - 111</td>
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<td>28</td>
<td>EEE 333</td>
<td>Communication Engineering I</td>
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<td>EEE 334</td>
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<tr>
<td>30</td>
<td>EEE 335</td>
<td>Microprocessors &amp; Interfacing</td>
<td>3.00</td>
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<td>EEE 411</td>
<td>Power System Analysis</td>
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<td>34</td>
<td>EEE 413</td>
<td>Switch Gear &amp; Protection</td>
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<td>EEE 421</td>
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<td>EEE 422</td>
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<td>40</td>
<td>EEE 425</td>
<td>Power Plant Engineering</td>
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5. Technical Elective Theory Courses: (One course must be taken from each group)
   No. of Courses: 4 (Theory: 3, Lab: 1.50)
   Total Credits: 10.50 (Theory: 9, Lab: 1.50)
**Elective Course I:**

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<th>Course Title</th>
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<tbody>
<tr>
<td>01</td>
<td>EEE 441</td>
<td>High Voltage Engineering</td>
<td>3.00</td>
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<tr>
<td>02</td>
<td>EEE 443</td>
<td>Power System Operation &amp; Control</td>
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<tr>
<td>03</td>
<td>EEE 445</td>
<td>Power System Protection</td>
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<tr>
<td>04</td>
<td>EEE 447</td>
<td>Power System Reliability</td>
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<tr>
<td>05</td>
<td>EEE 449</td>
<td>Electrical Machines III</td>
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**Elective Course II:**

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<th>Course Title</th>
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<tr>
<td>06</td>
<td>EEE 451</td>
<td>Solid State Devices</td>
<td>3.00</td>
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<tr>
<td>07</td>
<td>EEE 453</td>
<td>VLSI Design</td>
<td>3.00</td>
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<tr>
<td>08</td>
<td>EEE 455</td>
<td>Optoelectronics</td>
<td>3.00</td>
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<tr>
<td>09</td>
<td>EEE 457</td>
<td>Biomedical Engineering</td>
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**Elective Course III:**

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<tr>
<td>10</td>
<td>EEE 461</td>
<td>Optical Fibre Communication</td>
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<td>12</td>
<td>EEE 463</td>
<td>Data Communication &amp; Computer Networks</td>
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<td>Data Communication &amp; Computer Networks Lab</td>
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<td>17</td>
<td>EEE 468</td>
<td>Communication Engineering II Lab</td>
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</tbody>
</table>

6. **Inter-disciplinary Courses:**

No. of Courses: 5 (Theory: 2, Lab: 3)
Total Credits: 10.50 (Theory: 6, Lab: 4.50)

---

**Generalized Energy Conversion Process:** General principles of electromechanical energy conversion, Energy storage, transformation and conversion, Methods of formulation of motion equations and coordinate information, Interpretation of generalized machines from field concepts.

**Special Machines:** Universal motor, Repulsion motor, Reluctance motor, Electrostatic motor, Permanent magnet motor, Hysteresis motor, Stepper motor and Power modulators, Power rectifiers and Frequency multipliers.

**Elective Course II:**

**EEE 451 Solid State Devices**

*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.

**Text Book:**

Solid State Electronic Devices: B. G. Streetman

**Reference Book:**
EEE 445  Power System Protection        Credit: 3.00

Purpose of power system protection: Criteria for detecting faults, over current, differential current, difference of phase angles, over and under voltages, power direction, symmetrical components of current and voltages, impedance, frequency and temperature.


Unit protection schemes: Generator, transformer, motor, bus bar, transmission and distribution lines.

Circuit breakers: Principle of arc extinction, selection criteria and ratings of circuit breakers, types - air, oil, SF6 and vacuum, Miniature circuit breakers and fuses.

Text Book:

Reference Book:
2. Power System Protection and Switchgear: Badri Ram, D. N. Vishwakarma

EEE 447  Power System Reliability        Credit: 3.00


Text Book: Power system reliability, safety, and management: Balbir S. Dhillon

EEE 449  Electrical Machines III        Credit: 3.00

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<td>02</td>
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7. Thesis / Project (EEE 400, credit: 6)

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

Total Credits: 151 (Theory: 109, Lab: 42 including Thesis/Project)

Ratio between Theory and Lab: 2.60:1

Percentage of Lab Credits with Theory Credits: 38.53 %

Percentage of Lab Credits with Total Credits: 27.81 %
# Twelve Semester Course Sequence

## 1st Year 1st Semester

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<td>MAT 111</td>
<td>Differential and Integral Calculus</td>
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<tr>
<td>ENG 111</td>
<td>General English</td>
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<td>PHY 111</td>
<td>Physics I</td>
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<td>Electrical Circuits I</td>
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## 1st Year 2nd Semester

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<td>MAT 131</td>
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**Modern Power Station Practice: System Operation** by E.A. Wallis

**Elective Course I:**

EE 441  High Voltage Engineering  Credit: 3.00


**Text Book:**


**Reference Book:**

1. High Voltage Engineering: Theory and Practice by Abdel Salam

EE 443  Power System Operation & Control  Credit: 3.00

*Principles of power system operation:* SCADA, conventional and competitive environment. Unit commitment, static security analysis, state estimation, optimal power flow, automatic generation control and dynamic security analysis, state estimation, voltage security analysis, optimal power flow, generation control, supervisory control and data acquisition, optimal power now, generation control, dynamic security analysis and ancillary services.

**Text Book:**


**Reference Book:**

Power System Stability and Control: L. L. Grigsby

EEE 422  Electronics III  Lab  Credit: 1.50
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 421.

EEE 425  Power Plant Engineering  Credit: 3.00

Introduction with power plant: Introduction to thermal, hydro, nuclear and magneto-hydrodynamic power stations. Nuclear reactor, reactor construction and control, power reactors, central station reactors, nuclear hazards.
Variable load problems, plotting and analysis of load curves, chronological load curves and load duration curve, energy load curve and its use, load factor, capacity factor, demand factor, utilization factor, diversity factor etc. and their impact over the cost analysis of power generation and utilization, load forecasting, selection of units and plant location.
Load sharing: Base load and peak load plants, use of chronological load curves to distribute load among units.
Power plant economics: Economic operation of power plants, input-output curve, heat rate curve, incremental rate curve, use of incremental rate curve for optimum load scheduling. Transmission line loss, determination of loss co-efficient, economic conductor selection, Kelvin’s law, graphical method for location of distribution systems. Tariff and tariff design, bus system, importance of power control, current limiting reactors, different types of bus system layout, forces on bus selection in case of short circuit.

Text Book:
1. Modern Power Station Practice: Station Planning and Design by P.C. Martin and I.W. Hannah
2. Modern Power Station: Station Operation and Maintenance by L.C. White

Reference Book:

2nd Year 1st Semester

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<td>HUM 211</td>
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2nd Year 2nd Semester

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2nd Year 3rd Semester

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<td>BCH 231</td>
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<td>Signals and Systems</td>
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### 3rd Year 3rd Semester

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In this course students will perform experiments to verify practically the theories and concepts learned in EEE 415.

**EEE 421 Electronics III Credit: 3.00**

*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.*

*Power Amplifiers: Classification of power amplifiers, Collector efficiency, Transformer coupled class A amplifier; Class-B push-pull amplifier, Class-C amplifier, Tuned amplifier, class D, E & S amplifier.*

*Negative Resistance Devices and Switching Circuits: General Characteristics of negative resistance devices, Tunnel Diode, Two terminal and three terminal negative resistance devices, Negative resistance switching circuits.*

*Multivibrators: Introduction to the multivibrator, Bi-stable multivibrator, Monostable multivibrator, Astable and other forms of multivibrator, Uses of multivibrator.*


*Active filters: Filter fundamentals, Different types of filters and specifications, Active filters, transfer functions, realization of first and second order low, high and band pass filters using Op-Amps.*

**Text Book:**

1. Handbook of Electronics: Electronic Principles: Albert Malvino
2. Jacob Millman and Herbert Taub: Pulse, Digital and Switching Waveforms
3. J. Millman and C.C. Halkias: Electronic Devices and Circuits

**Reference Book:**

1. Solid state pulse circuit: David. A. Bell
2. Jacob Millman and Herbert Taub: Pulse, Digital and Switching Waveforms
3. J. Millman and C.C. Halkias: Electronic Devices and Circuits
Reference Book:

Protection of Industrial Power Systems: T. Davies

EEE 414  Switchgear & Protection Lab  Credit: 1.50
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 413.

EEE 415  Control System  Credit: 3.00

Introduction to control system: Conventional control systems, open loop versus closed loop feedback control system, input output relationship, Mathematical modeling of physical systems, block diagrams, DC machine dynamics, transient response, performance criteria, steady state response to step, ramp, and parabolic inputs, poles and zeros, frequency response from pole-zero diagram, Routh’s stability criterion; canonical forms, transfer functions and signal flow graph.

Modern control system: Introduction, state variable analysis, controllability and observability, application of Eigen value, linear control system design by state feedback, SFG to state variable, transfer function to state variable and state variable to transfer function.


Controller design: On-off, fuzzy, P, PI, PD and PID types, microprocessor control, introduction to programmable logic controllers (PLC), temperature control system, position control system.

Text Book:

Modern Control Systems: Richard Dorf

Reference Book:

Feedback Control Systems: D’Azzo & Houpis

EEE 416  Control System Lab  Credit: 1.50

4th Year 1st Semester

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<td>EEE 413</td>
<td>Switch Gear &amp; Protection</td>
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4th Year 3rd Semester

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**Detailed Syllabus**

1. General Education:

**ENG 111: General English**  
Credit: 2.00

*General Discussion*: Introduction, various approaches to learning English.

*Grammatical Problems*: Construction of sentences, grammatical errors, sentence variety and style, conditionals, vocabulary and diction.

*Reading Skill*: Discussion readability, scan and skin reading, generating ideas through purposive reading, reading of selected stories.

*Writing Skill*: Principles of effective writing; Organization, planning and development of writing; Composition, précis writing, amplification.

*General Strategies for the writing process*: Generating ideas, identifying audiences and purposes, construction arguments, stating problems, drafting and finalizing.

*Approaches to Communication*: Communication today, business communication, different types of business communication.

*Listening Skill*: The phonemic systems and correct English pronunciation.

*Speaking Skill*: Practicing dialogue; Story telling; Effective oral presentation.

**Text Book:**

1. English Grammar in Use: Raymond Murphy

**Reference Book:**

1. A Practical English Grammar: Thomson and Martinet

**ENG 121: Technical English**  
Credit: 2.00

Classification of reports, structure of a report, writing of technical report, commercial correspondence and tender notice, standard forms of term papers, thesis, etc. layout of business correspondence, voluntary offers and inquiries,

Power System Analysis: J. Grainger, W. Stevenson

Power System Analysis: Hadi Sadat

**Reference Book:**

Power Systems Analysis: A. R. Bergen and V. Vittal

**EEE 412  Power System Analysis Lab**  
Credit: 1.50

In this course students will perform experiments to verify practically the theories and concepts learned in EEE 411.

**EEE 413  Switchgear & Protection**  
Credit: 3.00

*Circuit Breaker*: Philosophy of switchgear and protection, circuit breakers, principle of arc extinction in DC and AC circuit breakers, recovery voltage, rate of rise of recovery voltage and their transient phenomena, switching surges, disconnection of unloaded transformer and transmission line, speed of circuit breaker. Construction, operation, rating, testing and maintenance of bulk oil and minimum oil circuit breakers, SF₆ circuit breaker, Vacuum circuit breakers, Air circuit breakers and Air blast circuit breakers. Rating, selection and testing of circuit breakers.

*Fuse*: Commercially available fuses, their constructions, characteristics and applications.

*Relays*: Types, construction, principle, operating characteristics and application of over current, overvoltage, distance, positive sequence, negative sequence, zero sequence, differential, IDMT, reactance, directional, power and impedance relays, balanced current relaying of parallel line, ground fault relaying, pilot relaying principles, protection relay schemes for generators, transformers, line feeders, buses, motor, generator and power systems, reactors, lightning arrestors, surge absorbers, ground wire, generators grounding, co-ordination of over current relay. Solid state devices in the construction of static relays, types of static relays.

**Text Book:**

Switchgear and protection: Theory, practice and solved problems by S. S Rao
Introduction to Networking: Network architectures, Introduction to ISO reference model.

Introduction to operating system and Memory management:

Microcontroller and embedded system: Introduction to AT89C52.

Text Book:
Microprocessors and Interfacing: Programming and Hardware by Douglas V. Hall

Reference Book:

EEE 336 Microprocessors & Interfacing Lab Credit: 1.50
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 335.

EEE 411 Power System Analysis Credit: 3.00

Power network representations: P.U method of performance calculation, P.U. impedance of three winding transformers, Power flow in simple systems, Load flow studies of large systems using the Gauss-Seidel methods; Control of voltage, power and reactive power; Symmetrical three phase faults on synchronous machine. Symmetrical Components: Sequence impedance and sequence networks of generators, transformers and lines, sequence network of systems. Unsymmetrical Faults: Single line to ground fault, line to line fault, double line to ground fault.

Recent trends in transmission system: Overview of flexible ac transmission system (FACTS), high voltage dc transmission system (HVDC) and SCADA.

Power system stability: The stability problem of power system, distinction between steady state and transient stability, the swing equation, equal area criterion and its applications, solution of swing equation, factors affecting transient stability, improving stability.

Text Book:

EEE 211: Economics and Accountancy Credit: 3.00

Economics: Definition, scope and methods. Demand, supply and their elasticity; equilibrium analysis—partial and general; Consumer behavior, marginal utility; indifference curve, consumer’s surplus; producer behavior; iso-quant, iso-cost line. Factors of production function; production possibility curve; fixed cost and variable cost; short run and long run costs, total, average and marginal cost; laws of returns; internal and external economics and diseconomies; market and market forms; perfect and imperfect competition; price output determinations. Introductory ideas on GNP, GDP, perceptual income, interest, rent, saving, investment, inflation; Project approval, NPV, IRR & their application, cost benefit analysis.

of cost, cost-sheet, distribution of overhead to the various cost
centre/departments, calculation of departmental overhead rate and machine hour
rate; job costing: preparation of job cost-sheet & quotation. Marginal costing &
profit volume/ratio, operating cost.

Text Book:
2. Principle of Accounting: Needles & Anderson

Reference Book:
1. Macro Economics: Shaum’s
2. Financial Accounting: Weggandt & Kieso

BCH 231: Bangladesh Cultural & Heritage Studies            Credit: 3.00
Main events in the history of South Asia. Importance of culture and heritage for a
nation’s integration. History of Bengal – main features and important changes
Economic, cultural and political differences between Pakistan and Bangladesh

Main socio-economic and cultural changes in Bangladesh since 1971 until now.
Importance of Bangla language in local culture, society and political system.
Main aspects of the society and culture in Bangladesh. Diversity of language and
cultures – importance of small ethnic minorities in Bangladesh and their cultural
uniqueness.

Main aspects of art and literature of Bangladesh, Important features of physical
aspects of Bangladesh, Major economic activities – agriculture as a component of
culture. Sectors of environmental degradation in Bangladesh, Climate change and
Bangladesh’s strategy on mitigation and adaptation.

Books recommended:
1. History of India – Vincent I Smith, Oxford Press Ltd.
2. Geography of Bangladesh – Harun ur Rashid, University Press Ltd.
3. Bangladesh Environment Facing the Twenty First Century – SEHD,
    Philip Gain, Edt.)

modulation, QAM, QPSK, delta modulation, multi carrier modulation, line
coding, frame construction, Error Probability.

Multiplexing: Space division multiplexing, frequency division multiplexing, time
division multiplexing, and code division multiplexing.

Noise: Physical sources of noise, types of noise, calculation of noise, SNR &
noise figure and calculation of noise figure, noise temperature, equivalent noise
resistance.

Text Book:
Communication Systems: S. Haykin
Data communication and Networking: Behrouz A Forouzan

Reference Book:
Principles of Communication Systems: Taub and Schilling
Wireless Communication Principles and Practise: Theodore S Rappaport

EEE 334 Communication Engineering I Lab            Credit: 1.50
In this course students will perform experiments to verify practically the theories
and concepts learned in EEE 333.

EEE 335 Microprocessors & Interfacing            Credit: 3.00

Introduction to different types of Microprocessors: 8 bit, 16 bit, 32 bit and their
architectures, Pin diagrams and junctions, Pentium microprocessors and Co-
processors, RISK & CISC processor. EPROM and RAM (2764 and 6264),
Instruction sets and assembly language programming.

Microprocessor peripherals and their interfacing: Introduction to some available
microprocessor peripherals IC’s and their applications such as 8251, 8253, 8254,
8255, 8257, 8259, 8279. A/D and D/A converter interfacing.

Standard for bus architectures and ports: ISA, EISA, MCA, PCI, VESA,
Accelerated Graphics Port (AGP), Universal Serial Bus (USB), RS-232C, RS-
422A, RS-449 and RS-366, IEEE-488 BUS and Bus system in a Multiprocessor
System.
Electromagnetic fields and its radiation: Introduction to displacement current, Derivation of Maxwell’s equation in different co-ordinate systems and its application. Boundary conditions for time varying systems, Retarded potentials.

The electrostatics of circuits: Circuit concepts and its derivation from the field equations. High frequency circuit concepts, Circuit impedance’s, Concepts of good and perfect conductors, Depth of penetration, internal impedance, Power loss calculation, Skin effect of practical conductors.

Propagation and reflection of electromagnetic wave in unbounded media: Plane wave propagation, Polarization, Power flow and poynting theorem, Transmission line analogy, Reflection from conductor and conducting dielectric boundary.

Radio wave propagation: Plane wave propagation in free space, Plane wave propagation through ionosphere and ground wave propagation. Effect of earth curvature on propagation.

Text Book:
Introduction to Electromagnetic Field & Waves: D. R. Corson and P. Lorain

References:
Fields and Waves in Communication Electronics: S. Ramo, J. R. Whinnery and T. V. Duzer

EEE 333 Communication Engineering I Credit: 3.00

Introduction of communication systems: Basic principles, fundamental elements, system limitations.

Information Theory: Information and system capacity, information transmission, entropy, continuous channel capacity, transmission through electrical network.

Analog communication: AM, FM, PM, DSB, SSB, VSB, ISB. Radio Engineering: AM, FM, PM transmitter & receiver, super heterodyne receiver.

Digital communication: Introduction, Nyquist sampling theorem, quantization of analog system, quantization noise, PAM, PWM, PPM, PCM, LOGPCM, and systems, Digital modulations, ASK, FSK, PSK, DPSK, MSK, M-array digital

HUM 311: Industrial Management Credit: 3.00

Management Functions and Organization: Evolution, management function: organization, theory and structure, span of control, authority delegation, manpower planning.

Personal Management: Importance, need hierarchy, motivation, leadership, wage incentives, performance appraisal, and participative management.

Operation Management: Production planning and control (PPC) functions, quantitative methods applied in production, quality management, location and layout planning safety and loss management.

Cost and Financial Management: Elements of cost products, cost analysis, investment analysis, and benefit cost analysis, risk analysis.

Management Accounting: Cost planning and control, budget and budgetary control.

Marketing Management: Concepts, strategy, sales promotion, patent laws.

Technology Management: Management of innovation and changes, technology life cycle.

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

Reference Book:
1. Fundamentals of Management: Ricky W. Griffin

2. Basic Science:

PHY 111: Physics I Credit: 3.00

Electricity and Magnetism: Electric charge and Coulomb’s law, Electric field, concept of electric flux and the Gauss’s law- some applications of Gauss’s law, Gauss’s law in vector form, Electric potential, relation between electric field and electric potential, capacitance and dielectrics, gradient, Laplace’s and Poisson’s equations, Current, Current density, resistivity, the magnetic field, Ampere’s
law, Biot-Savart law and their applications, Laws of electromagnetic induction-
Maxwell’s equation.

Waves: Periodic Motion, Simple Harmonic Oscillation, Types of waves, Equation of Waves, Velocity and Energy, Complex waves, Standing waves, Resonance and Beats, Sound waves, Doppler Effect.

Fundamentals of Light: Basic properties and theories of light, Electromagnetic
Spectrum and Visible Range, Refractive index, Optical Path, Dispersion, Wave
theory and Huygens’ principle, Photoelectric effect, Quantum theory of light,
Wave-particle duality, Photons.

Interference: Interference phenomena, Young’s double slit experiment,
Displacement of fringes and its uses, Fresnel bi-prism, Interference in thin films,
Newton’s rings, Interferometers.

Diffraction: Fresnel and Fraunhoffer 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 light, Brewster’s law, Malus
law, Polarization by reflection and refraction, Nicol prism, Optical activity,
Polarimeters.

Text Book:
1. David Halliday & Robert Resnick: Physics Part I & Part II.

Reference Books:
A. Beiser: Concept of Modern Physics
B. Francis A. Jenkins & Harvey E. White: Textbook of Optics

PHY 112: Physics I Lab                          Credit: 1.50
In this course students will perform experiments to verify practically the theories
and concepts learned in PHY 111.

of the DFT, circular convolution; Cooley-Tukey decomposition, recursive
application, radix-2 FFTs, time and frequency decimation, computational
complexity.

Z-Transforms: Basic Theory: background idea behind the z-transform (solution
to LTI discrete-time diff. eq.), calculation of z-transform and its inverse (briefly),
regions of convergence, Properties of z-transforms: role in solution of discrete-
time LTI systems, convolution property and graphical interpretation of the
convolution operation, z-transforms of cascaded systems, stability and causality.
Realization and frequency Response: Frequency response (Magnitude and
Phase), representation of LTI systems with rational polynomials, block-form
implementations of a rational polynomial transfer function

Digital Filters: FIR filters- linear phase filters, specifications, design using
window, optimal and frequency sampling methods; IIR filters- specifications,
design using impulse invariant, bi-linear z-transformation, least-square methods,
linear phase, Butterworth, Chebychev, Inverse Chebychev, Bessel and elliptic
filters, finite precision effects in implementing digital filters.

Text Book:
Digital Signal Processing: Principles, Algorithms and Applications by
G. Proakis and D. Manolakis

Reference Book:
Digital Signal Processing: R. A. Roberts and C. T. Mullis

EEE 326    Digital Signal Processing Lab                         Credit: 1.50
In this course students will perform experiments to verify practically the theories
and concepts learned in EEE 325.

EEE 331    Electromagnetic Fields & Waves                          Credit: 3.00
Review of Electrostatics and Magnetostatics.
Choppers: Type A, B, C and D choppers, Pulse width modulation - Gating requirements. DC motor control: DC motor drives, Induction and Synchronous motor drives, Stepper motor control, Switched reluctance and brushless motor drives.


Text Book:
2. Power Electronics: Circuits, Devices and Application by Muhamed H. Rashid

Reference Book:

EEE 324 Power Electronics Lab Credit: 1.50
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 323.

EEE 325 Digital Signal Processing Credit: 3.00

Introduction to Digital Signal Processing (DSP): Digital signals and systems: Operations in digital signal processing, the scope of DSP, analog to digital conversion, frequency Domain Effects of Sampling: Periodic repetitions in frequency domain due to sampling in time domain, recovery of continuous-time signal from its samples (reconstruction), role of anti-aliasing and reconstruction filters, examples of aliased signals (show how waveform is distorted), impulse response, finite impulse response (FIR) and infinite impulse response (IIR) of discrete-time systems, difference equation.

Discrete Transformations: Discrete Fourier series, the Discrete-Time Fourier Transform, discrete Fourier transform (DFT) and fast Fourier transform (FFT): Forward and inverse transforms; coefficient ordering; time and frequency resolution; periodic extension, zero padding and modulo-M reduction; properties

3. Mathematics:

MAT 111: Differentials and Integral Calculus Credit: 3.00

Differential Calculus: Differentiability, Differentiation and its geometrical representation. Successive differentiation of various types of function, Leibnitz’s theorem, Role’s, Mean value theorem, Taylor’s and Maclaurin’s theorem in finite and infinite forms. Divergency and Convergency of series. Functions of several independent variables, partial differentiation, Euler’s theorem, Jacobian. Tangent, Normal and Curvature. Determination of maximum and minimum values of function and point of inflection.


Text Book:
A. Calculus: Thomas & Finney

Reference Book:
A. Calculus vol. 1 & 2: Tom Apostol

MAT 121: Coordinate Geometry & Vector Analysis Credit: 3.00


Vector Analysis: Scalars and Vectors, equality of vectors, Addition and subtraction of vectors, Multiplication of vectors by scalars. Scalar and vector products of two vectors. Differentiation and integration of vectors, line, surface and volume integrals. Gradient of a scalar function, divergence and curl of a

**Text Book:**

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

**Reference Book:**

1. The Elements of Coordinate Geometry: S. L. Loney

**MAT 131: Differential Equations and Matrices Credit: 3.00**

*Ordinary Differential Equation:* Definition, Degree and order of differential equation. Formation of differential equations, Solution of first order differential equations by various methods, Solution of differential equation of first order and higher degrees. Solution of general linear equations of second and higher orders with constant co-efficient, Solution of Euler’s homogeneous linear equations, Solution of differential equations in series by the method of Frobenius. Bessel’s functions, Legendre’s Polynomials and their properties.

*Partial Differential Equation:* Elimination of arbitrary constant and arbitrary function. One dimensional wave equation, Two dimensional wave equation, Steady state heat flow equation, Solution of differential equation by the method based on the factorization of the operator and with initial and boundary conditions.

*Matrices:* Matrix algebra, Elementary transformation, Inverse by elementary transformation, Rank, Linear dependence and independence of vectors and matrices, Solution of linear equation using matrix, Vector spaces. Linear transformation, Eigen values and Eigen vectors, Cayley-Hamilton theorem.

**Text Book:**

1. A First Course in Differential Equations: D. G. Zill
2. Elementary Linear Algebra: H. A. Anton and C. Rorres

**Reference Book:**

1. Mathematical Methods with Applications: M. A. Rahman

**Mechanical Characteristics:** Transmission line Sag and Stress analysis, Wind and Ice loading, Supports at different elevations, Conditions at erection; Effect of temperature changes.

**Insulator for Overhead Lines:** Types of insulators and their constructions and performance, Potential distribution in a string of insulators, String efficiency, Methods of equalizing potential distribution, Special types of insulators, Testing of insulators, Corona.

**Insulated Cables:** Cables versus overhead lines, Insulating materials, Electrostatic stress grading, Three-core cables, Dielectric losses and heating, Modern development on oil filled and gas filled cables; Measurement of capacitances, Cable testing.

*Distribution system:* Radial, Ring mains and interconnections.

**Text Book:**

1. Transmission and Distribution Electrical Engineering: C. Bayliss and B. Hardy
2. Principles of Power System: VK Mehta

**Reference Book:**


**EEE 323 Power Electronics Credit: 3.00**

*Power semiconductor switches and triggering devices:* Power transistors, Fast recovery diodes, Thyristors, Power TRIAC, MOSFET, IGBT, GTO, UJT and DIAC-characteristics, rating, protection circuits, driver Circuits.

*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, Single phase cycloconverter.
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 313.

**EEE 316 Electrical Services Design Lab  Credit: 1.50**

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.

**EEE 321 Transmission & Distribution of Electrical Power  Credit: 3.00**

Inductance of Transmission Lines: Flux linkages, Inductance due to internal flux, Inductance of single phase two-wire line; Flux linkage of one conductor in a group, Inductance of composite conductor lines, G.M.D. Examples, 3-phase line with equilateral and with unsymmetrical spacing, Parallel circuit 3-phase lines.

Capacitance of Transmission Lines: Electric field, Potential difference between points due to a charge, Capacitance of a two-wire line, Group of charged conductors. Capacitance of 3-phase line with equilateral and with unsymmetrical spacing, Effect of earth, Parallel circuit’s lines.

Resistance and Skin Effects: Resistance and temperature, Skin effects influence on resistance.

Current and voltage relation on a transmission line: Representation of line- short, medium and long transmission lines; T and π Representation, Exact solution, Equivalent circuit of a long line; Generalized Line Constants; General line equation in terms of ABCD constants, Relation between constants, Charts of line constants, Constants of combined networks, Measurements of line constants.

Circle Diagrams: Receiving and sending end power circle diagrams, Power transmitted, Maximum power, Universal power circle diagrams. Voltage and power factor control in transmission systems; Tap changing transformers, On-load tap changing; Induction regulators, Moving coil regulators, Boosting transformer; Power factor control: Static condenser in series or parallel, Synchronous condensers, Ferranti effect.

**MAT 211 Fourier and Laplace Analysis  Credit: 3.00**

Fourier analysis: Fourier series, Fourier coefficients, even and odd functions, properties of Fourier series, Convergence of Fourier series, extension of internal Fourier series, Fourier integral, sine and cosine integrals, finite Fourier transformation, series, infinite Fourier transformation, use of Fourier transformation in boundary value problems.

Laplace transform: Laplace transforms of elementary functions, properties of Laplace transform, inverse Laplace transform and its properties, convolution theorem, application of Laplace transform to solve differential equations related linear circuit and partial differential equations.

Text Book:
1. Elementary Linear Algebra: H. A. Anton and C. Rorres
2. Schaum's Outline of Laplace Transform: M. R. Spiegel

**MAT 221 Complex Variables and Statistical Analysis  Credit: 3.00**

Complex Variable: Complex number system, General functions of a complex variable, Limits and continuity of a function of complex variable and related theorem, Complex differentiation and the Cauchy-Riemann equations, Complex integration and Cauchy’s theorem, Cauchy’s integral formulae and related theorems, Infinite series, Tailor’s and Laurent series, Residue, The residue theorem, Contour integration.

Text Book:

1. Schaum’s Outline of Complex Variables: M. R. Spiegel
2. Schaum’s Outline of Statistics: M. R. Spiegel
3. An Introduction to the theory of Statistics: Rabindranath Shill
4. Statistics and Probability: Mr. Nurul Islam
5. A First Course in Complex Analysis: Matthias Beck & Gerald Marchesi
6. A Guide to Complex Variables: Steven G. Krantz
8. Introduction to Probability and Statistics: D. V. Lindley

4. EEE Core Courses:

**EEE 111 Electrical Circuits I**  
Credit: 3.00

*Fundamental concepts and units, Variables and parameters:* Voltage, current, power, energy, independent and dependent sources, resistance.

*Basic laws:* Ohm’s law, Kirchhoff’s current and voltage laws, Joule’s law.

*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, Millman’s theorem, Compensation theorem, Maximum power transfer theorem and Reciprocity theorem.


**Text Book:**

1. Linear Systems and Signals: B. P. Lathi

**Reference Book:**

2. Signals and Systems: A.V. Oppenheim and A. S. Willsky

**EEE 313 Electrical & Electronic Measurement**  
Credit: 3.00

Measurement of resistance, inductance and capacitance, balancing procedure for A.C bridges, cable faults and localization of cable faults, magnetic measurement, ballistic galvanometers, flux meter, separation of iron losses, high voltage measurement.

*Measuring instruments:* Classification, operating principle of ammeters, voltmeters, wattmeter and watt-hour meters.

*Introduction to instrumentation Error:* Classification of error, normal law of error, guarantee of error.

*Transducer:* Resistive, strain gauges, thermal, magnetic, LVDT, capacitive, piezoelectric, optical, current and potential transformers.

*Electronic measuring instruments:* Oscilloscope, DMM, VTVM, TVM.

*Computer based instrumentation:* PC-based data acquisition, filtering by moving average, Instrumentation for process control, data conditioning.

*Mechanical measurement:* Measurement of speed, frequency, pressure, temperature, flow force, weight level detector, shaft encoder.

**Text Book:**

1. A Course in Electrical and Electronic Measurements and Instrumentation: A. K. Sawhney, Puneet Sawhney
2. Electronic instrumentation and measurement techniques: William David Cooper

**EEE 314 Electrical & Electronic Measurement Lab**  
Credit: 1.50
EEE 234 Digital Electronics Lab Credit: 1.50
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 233.

EEE 311 Signals and Systems Credit: 3.00
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. Analogous systems: f-v and f-i analogy, Electromechanical systems. Applications of time and frequency domain analyses: solution of analog electrical and mechanical systems, amplitude modulation and demodulation, time-division and frequency-division multiplexing.

Laplace transformation: Fourier to Laplace, Properties, inverse transform, solution of system equations, system transfer function, system stability and frequency response and application, Convolution integral and its application, Superposition integral.

The Z Transformation: Sampled data system, Definition and properties of Z-transform, ROC, Inverse Z-transform, Mapping between Z plane and S plane, Stability, Solution of Difference equations


Introduction to measuring instruments: Ammeter, voltmeter, galvanometer and wattmeter.

EEE 112 Electrical Circuits I Lab Credit: 1.50
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 111.

EEE 121 Electrical Circuits II Credit: 3.00
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 circuits: 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. Q-value and Bandwidth.

Magnetically coupled circuits: Analysis of coupled coils
Analysis of three phase circuits: Three phase supply, balanced and unbalanced circuits, power calculation.

Text Book:
1. Introductory Circuit Analysis: Robert L. Boylestad

Reference Book:
1. Introduction to Electric Circuits: R. C. Dorf and J. A. Svoboda

EEE 122 Electrical Circuits II Lab Credit: 1.50
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 121.

EEE 123 Electronics I Credit: 3.00
Introduction to Semiconductor: History of vacuum tube and modern electronics, Intrinsic and Extrinsic semiconductors, N and P type semiconductors; Mobility; Drift Velocity, Energy bands.

Semiconductor Diode: PN junction diodes and their I-V characteristics; Zener diode; Tunnel diode; Varactor diode; Photodiode and LDR; Transition & Diffusion capacitance.

Diode Circuits: Ideal rectifier concept; Half wave and Full wave rectifiers; Filters; Voltage regulators; Voltage doubler; Clippers and Clampers.

Bipolar Junction Transistors: PNP and NPN type, Transistor V-I characteristics, CE, CB, and CC configurations, Transistor action, Transistor as an amplifier, Operating point, Load line.

FET & MOSFET: Construction and classification, Principle of operation, Characteristic curves, Channel conductivity, Parameters of the FET, Effect of temperature on FET, Common source amplifier, Common drain amplifier, MOSFET.

EEE 233 Digital Electronics Credit: 3.00
Number systems: Representation of numbers in different bases, addition and subtraction in different bases, Complement: Subtraction using complements, binary multiplication & division.

Binary codes: Different coding system, Boolean algebra, various gates, sum of products and product of sums, standard and canonical forms and other logical operations.
Simplification of Boolean functions: Karnaugh map method, tabular method of simplification; Implementation of logic circuit using various gates, universal gates.

Combinational logic circuit: Design procedure: Adder, subtractor, code converters, parity bit checker and magnitude comparator, analysis of different combinational circuits, encoder, decoder, multiplexer, demultiplexer, ROM, PLA and their applications.

Flip-flops: SR, JK, Master slave, T and D type flip-flops and their characteristic tables & equations; triggering of flip-flops; flip-flop, excitation table.

Sequential circuits: Introduction to sequential circuits, analysis and synthesis of synchronous and asynchronous sequential circuits.
Counters: Classifications, Synchronous and asynchronous counter design and analysis, ring counter, Johnson counters, ripple counter and counter with parallel load.

Registers: Classification, shift registers, circular registers and their applications and registers with parallel load.

Digital IC logic families: Brief description of TTL, DTL, RTL, ECL, I^2L, MOS and CMOS logic and their characteristics, principles of operation and application.

Memory Units: Various memory devices and their interfacing.

Converters: Digital to Analog (D/A), Analog to Digital (A/D) converters, and their applications.
Reference Book:
2. Puchstein, T E Loyd & AG Conard: Alternating Current Machines

EEE 222  Electrical Machines II Lab  Credit: 1.50
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 221.

EEE 223  Numerical Methods for Engineering  Credit: 3.00
Introduction: Motivation and errors in numerical techniques, Taylor series.
Finite Difference Calculus: Forward, backward, divided and central difference and difference of a polynomial.
Interpolation and Extrapolation: Newton’s formula, Lagrange, spline, chebyshev and inverse; extrapolation.
Nonlinear Equations: Iteration, bisection, false position, Raphson, Secant and Muller’s methods.
Simultaneous Linear Algebraic Equations: Cramer’s rule, inversion if matrices, Gauss elimination, Gauss-Jordom method, factorization and Gauss-Seidal iteration methods.
Numerical integration: General quadrature formula, trapezoidal rule and simpson’s rule; numerical differentiation.

Text Book:
1. Introductory Methods of Numerical Analysis: S.S. Sastry
2. Numerical Methods for Engineers: Steven Chapra
3. Computer Oriented Numerical Methods: V Rajaraman

EEE 224  Numerical Methods for engineering lab  Credit: 1.50
Laboratory experiments based on theory and concept learnt in EEE 223.


Text Book:
1. J. Millman and C.C. Halkias: Electronic Devices and Circuits

Reference Book:
2. Robert Boylestad: Electronic Devices and Circuit Theory

EEE 124  Electronics I Lab  Credit: 1.50
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 123.

EEE 131  Electronics II  Credit: 3.00
Small Signal Amplifier: Low frequency amplifiers, Transistor equivalent circuits, Hybrid parameters, Analysis of CE, CB and CC amplifiers using h-parameters.
Amplifier Fundamentals: current gain, voltage gain, power gain, input impedance, output impedance, and classification of amplifiers, Distortion in amplifiers.
Feedback: Concept of feedback, Negative feedback, Positive feedback, Voltage feedback, Current feedback, Effect of feedback on impedance, Gain, Bandwidth, Distortion & Stabilization.
Operational Amplifier: Difference amplifier, CMMR, Ideal operational amplifier, Inverting amplifier, Non-inverting amplifier, General purpose IC operational amplifier, Integrator, Differentiator, Linear and non-linear applications of operational amplifier, Comparator and Converter.
Oscillators: Positive feedback, Condition of oscillation, RC phase shift oscillator, Wein bridge oscillator, Resonant circuit oscillators, Crystal oscillator and Waveform generators.
Text Book:

Reference Book:
2. Robert F. Coughlin: Operational Amplifier and Linear Integrated Circuits
3. Allen Mottershead: Electronic Devices and Circuits
4. David A. Bell: Electronic Devices and Circuits

EEE 132  Electronic Circuits II Lab  Credit: 1.50
Course Outline:
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 131.

EEE 213  Electrical Machines I  Credit: 3.00

D.C. Generator: Principles, Construction, Classification, Armature windings, Voltage build up, Armature reactions and Commutation, Performance and testing, Compounding of d.c. generator, Generator characteristics, Voltage regulation, Losses and efficiency, Parallel operation.

D.C. Motor: Operation, Types, Back e.m.f, Torque equations, Motor characteristics, Speed-Torque Characteristics, Speed regulation, Losses and efficiency, Methods of speed control, Methods of braking, Starters, Amplidyne and Metadyne.


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

Text Book:
1. Electric Machinery: A Fitzgerald

Reference Book:
2. Electric Machinery Fundamentals: Stephen Chapman
3. Direct and alternating current machinery: Jack Rosenblatt

EEE 214  Electrical Machines I Lab  Credit: 1.50
In this course students will perform experiments to verify practically the theories and concepts learned in EEE 213.

EEE 216  Circuit Simulation Lab  Credit: 1.50
Simulation laboratory based on EEE 111, EEE 121 and EEE 123 theory courses. Students will verify the theories and concepts learned in EEE 111, EEE 121 and EEE 123 using simulation softwares like PSpice, Electronic Workbench, Multisim and Matlab. Students will also perform specific design of electronic circuits theoretically and by simulation.

EEE 221  Electrical Machines II  Credit: 3.00
Course Outlines:

Polyphases Induction Motor: Principle of operation, Constructional details, Classifications, Equivalent circuits, Starting torque and maximum torque, Speed-torque relations, Losses and efficiency, Circle diagram, Starters, Methods of speed control, Methods of braking and plugging, Induction generator.

Single Phase Induction Motor: Principle, Construction and types, Performance, Double revolving field theory, Cross field theory, Equivalent circuits.

Synchronous Motor: Principle of operation, starting, effect of loading under different excitation, effect of changing excitation, synchronous condenser, V-curve and inverted V curve, applications.

Alternators: basic principle of operation and operational characteristics, vector diagrams at different loads, synchronous impedance, and synchronous impedance methods of predicting voltage regulation and its limitation. Parallel operation of alternators: necessary condition, synchronizing, circulating current.

Text Book:
1. CI Hubert: Electrical Machines