### 6. DEPARTMENT OF ELECTRICAL/ ELECTRONICS ENGINEERING

(a) **Curriculum for B.Sc. Degree in Electrical/ Electronics Engineering**

#### 100 LEVEL HARMATTAN SEMESTER

<table>
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#### 100 LEVEL RAIN SEMESTER

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## 200 LEVEL HARMATTAN SEMESTER

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EEE 200: SWEP (Vacation Period) 8 weeks
### 300 LEVEL HARMATTAN SEMESTER

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### 300 LEVEL RAIN SEMESTER

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EEE 300: Student Work Experience Programme (Vacation Period) 8 weeks
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**Electives:** Not less than 3 units from the following:

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### Power & Machine Option

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500 LEVEL RAIN SEMESTER

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**Communications Option**

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**Instrumentation & Control Option**

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**Power & Machine Option**

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**COURSE DESCRIPTION (B.Sc. Mathematics)**

**MEE 101: ENGINEERING DRAWING I (2 UNITS)**

Instruments for engineering drawing and their uses. Drawing paper sizes, margins and title blocks. Lettering and types of line, Geometrical instruction bisection of lines and angels and their applications. Polygon, tergency, locus of simple mechanism. Pictorial drawing, isometric, oblique and perspectives. Orthographic
projection. Dimensioning and development of simple shape. Assembly drawing of simple component.

**MEE 102: WORKSHOP PRACTICE I (2 UNITS)**

General Introduction of facilities in engineering workshops and safety in workshops. Measuring instruments, calipers, micrometers, gauges etc. manual and machine-operated workshop tools for metals and wood work and their care.


**MTH 101 GENERAL MATHEMATICS I (Algebra and Trigonometry) (3 UNITS) (L30 HRS, PO: T15HRS)**


**MTH 102 GENERAL MATHEMATICS II (Calculus) (3 UNITS) (L30, PO: T15)**

Pre-requisite: MTH 101


**MTH 104 GENERAL MATHEMATICS III (Vectors, Geometry and Dynamics) (3 UNITS) (L30HRS: PO: T15HRS)** Pre-requisite: MTH 101


**CVE 200 STUDENTS WORK EXPERIENCE PROGRAMME I (2 UNITS)**

A practical work programme, during the long vacation, arranged within the campus and its immediate environment to enable the students gain some basic skills in the
profession of engineering in general and student’s chosen field of engineering in particular.

**CVE 201: INTRODUCTION TO ENGINEERING AND TECHNOLOGY (1 UNIT)**


**CVE 202: STRENGTH OF MATERIALS (2 UNITS)**

Force equilibrium free body diagrams. Elasticity – concept of stress strain,


**CVE 204: ???????????????????????????**

**EEE 201: BASIC ELECTRICAL ENGINEERING 1 (2 UNITS)**


**EEE 207: BASIC ELECTRICAL ENGINEERING PRACTICALS (1 UNIT)**

Laboratory experiments to demonstrate the application of the theory covered in the courses.

**MEE 201: ENGINEERING MATERIALS (2 UNITS)**

Physical properties of materials; atomic and molecular structure, bonding forces, structure of materials, wood, cement, plastics, metallic states. Crystals and defects crystal, isotrophy and anisotrophy; essential and desirable properties of engineering materials; physical mechanical, thermal, chemical, technology and electrical properties. Common engineering materials for structures, machine parts/equipment, electrical items, instruments. Factors to be considered in the selection and choice of engineering materials.

**MEE 208: WORKSHOP TECHNOLOGY II (2 UNITS)**

Introduction to automobiles; main components of automobiles. Fundamentals of engine operation and construction; basic concepts and definitions, engine cycles, principles of operation of valve mechanism, cooling, lubrication, fuel and starting
system, etc maintenance and general servicing of automobiles; daily routine
preventive maintenance, etc. Fault training, trouble shooting and remedies for
ignition fuel, brake systems etc. Fabrication and machining of components from
available drawings. Welding and fabrication, fundamentals of welding, welding
processes, welding joint preparation, welding inspection etc.

MEE 203: ENGINEERING MECHANICS I (STATICS) (2 UNITS)
Statics law of statics, system forces and their properties. Simple problems. Centre
of mass, moment of Enertia, analysis of coplanar forces, friction. Work and energy.
Vectors centre of gravity and centre of mass.

MEE 204: ENGINEERING MECHANICS II (DYNAMICS) - (2 UNITS)
Newton’s laws of motion and their application. Impulse and momentum kinetic
energy. Kinematics of a point, composition and resolution of velocities and
accelerations, relative velocities and acceleration, representation of vectors. Plane
kinematics of a rigid body, angular velocity diagrams applied to simple
mechanisms. Instantaneous centre of rotation. Equation of motion, linear
momentum and moment of momentum. Kinetic energy, moment of inertia.free
vibrations of systems with one or two degrees of freedom including damping.
Tortional vibration – SWEP

MEE 205: BASIC THERMODYNAMICS (2 UNITS)
Definition of basic thermodynamics terminologies system, state, properties and
processes. Energy and energy conversion; work, heat, non-flow processes. Zeroth
law. First law of thermodynamics and application o closed and open systems. The
steady flow energy equation and its applications. Second law of Thermodynamics;
Consequences and applications of second law. Thermodynamics properties of ideal
and real fluids. thermodynamics tables Introduction to steam power and
refrigeration cycles.

MEE 206: BASIC FLUID MECHANICS (2 UNITS)
Element of fluid statics; density, pressure, surface tension, viscosity,
compressibility e.t.c. Hydrostatic forces on submerged surfaces due to
incompressible fluid. Introduction to fluid dynamics – conversion laws.
Introduction to viscious flow. Dynamics of fluid flow – conservation. Equation of
mass and momentum. Euler and Bernonlli’s equations. Reynolds number
Dimensional analysis, similitude, Buckingham P,. Theorems. Application of
hydraulic models. Flow meters and error in measurement.

MTH 201 MATHEMATICAL METHODS I (2 UNITS) (C) (L15HRS: P0:
T15HRS) Pre-requisite - MTH101, MTH102
Real-value functions. Review of Differentiation and integration and their applications.
Mean value theorem, Taylor series. Real-value functions of two or three variables.
Partial derivatives, chain rule, Lagrange multipliers, extrema (maxima and minima),

**MTH 202 ELEMENTARY DIFFERENTIAL EQUATIONS I (2 UNITS)**
(L15HRS: P 0: T15HRS) Pre-requisite - MTH102


**MTH 206 INTRODUCTION TO NUMERICAL ANALYSIS (3 UNITS) (L30HRS: P 0: T15HR)** Pre-requisites - MTH101, MTH102


**STA 201: STATISTICS FOR PHYSICAL SCIENCES AND ENGINEERING (4 UNITS)**

Probability- elements of probability, density and distribution functions, moments, standard distribution, etc. statistics- Regression and correlation- Large sampling theory. Test hypothesis and quality control.

**EEE 201 APPLIED ELECTRICITY I**
2-1-0 (3 Units)
Ideal Sources and Passive Components
Linear Resistive Networks
Network theorems – Kirchoff’s voltage law (KVL), Kirchoff’s current law (KCL), Norton, Thevenin and Superposition theorems
Non-linear Resistive Networks
Digital Abstraction
Digital Representation and Processing
Energy Storage
Elementary Discussion of Solid State Devices

**EEE 202 APPLIED ELECTRICITY II**
2-1-0 (3 Units)
Magnetic field of currents in space
Time-varying Signals
Step Response of RC, RL and RLC Circuits
Impulse Response of RC, RL and RLC Circuits
Single-Phase Alternating Current circuits- complex impedance and admittance, resonant circuits
Sinusoidal Steady State Response of RC, RL and RLC Circuits
Magnetic Circuits, mutual inductances, transformers. Introduction to electrical generators and motors.
Introduction to measuring instruments.

**EEE 291: APPLIED ELECTRICITY LABORATORY I**
0-0-3 (1 Unit)
Laboratory experiments to demonstrate the application of the theory covered in EEE 201.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
<th>Pre-requisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEE 292</td>
<td>APPLIED ELECTRICITY LABORATORY II</td>
<td>0-0-3(1 Unit)</td>
<td>EEE 202</td>
</tr>
<tr>
<td>EEE 301</td>
<td>MICROELECTRONICS DEVICES &amp; CIRCUITS I</td>
<td>2-1-0 (3 Units)</td>
<td>EEE 201</td>
</tr>
<tr>
<td>EEE 302</td>
<td>MICROELECTRONICS DEVICES &amp; CIRCUITS II</td>
<td>2-1-0 (3 Units)</td>
<td>EEE 301</td>
</tr>
<tr>
<td>EEE 303</td>
<td>ELECTROMECHANICAL DEVICES</td>
<td>2-1-0 (3 Units)</td>
<td>EEE 202</td>
</tr>
<tr>
<td>EEE 304</td>
<td>ELECTRICAL MACHINES</td>
<td>2-1-0 (3 Units)</td>
<td>EEE 202</td>
</tr>
</tbody>
</table>

Pre-requisites EEE 303

EEE 305: COMPUTATIONAL STRUCTURES I 2-1-0 (3 Units)
Boolean algebra
Information representation
CMOS technology
Combinational Logic
Programmable/Reconfigurable Logic
Sequential Logic
Static D Latch
Clocked Sequential Circuits
Metastability and Arbitration
Control Structures
Fundamentals of Computing

Pre-requisites EEE 201

EEE 306: COMPUTATIONAL STRUCTURES II 2-1-0 (3 Units)
Fundamentals of Computing
Programmable Architecture
Instruction Set Architecture
Machine Model
Machine Language Programming
Computer System Communication Issues
Memory Hierarchy
Operating System Issues

Pre-requisites EEE 305

EEE 307: GROUP DESIGN I (1 Unit)
Students will be divided into groups and assigned mini-design projects to carry out.

EEE 308: DIGITAL CIRCUIT ANALYSIS AND DESIGN 2-1-0 (3 Units)
Review of device models
Digital building blocks
Storage elements and sequential circuits
Circuit techniques for array architectures
Interconnects
Energy consumption
Timing issues
Memory architecture

Pre-requisites EEE 305

EEE 309: SIGNALS AND SYSTEMS 2-1-0 (3 Units)
Classification of Signals and Systems
Systems properties
Fourier series
Fourier transform
Sampling of ICT signals
Sinusoidal modulation
Laplace transforms applications
Feedback systems
z – transform

Pre-requisites EEE 201 & EEE 202
EEE 310: MEASUREMENT & INSTRUMENTATION  2-1-0 (3Units)
Introduction to Signals and Measuring Systems
Modeling of Measuring Systems
Instrument for direct measurement of current and voltage
Measurement of resistance, inductance and capacitance, measurement of electrical energy, power, power factor and frequency. Principle of cathode-ray oscilloscope.
Transducers
Analog Signal Processing
Analog to Digital and Digital to Analogue Conversion
Design of measurement systems, transducers, instrumentation amplifier, differential amplifier circuits, sample-and-hold circuits, multipliers, linear and non-linear converters, Signal recovery. ADCs and DACs, Digital signals processing
Introduction to Biomedical-Electronics and medical instrumentation. Pre-requisites EEE 201 & 202

EEE 311: ELECTROMAGNETIC THEORY  2-1-0 (3 Units)
Review of Electrostatics
Review of Magnetostatic Fields
Ferromagnetic Materials
Boundary Value Problems
Time varying electromagnetic field
Maxwell’s equations, their interpretation and physical significance
Waves: Solution of wave equations
Scattering of waves at boundaries Pre-requisites EEE 202

EEE 391: ELECTROTECHNICS LABORATORY  (1 Unit)
Laboratory experiments to demonstrate the application of the theory covered in the courses.

EEE 392: ELECTRICAL MACHINES LABORATORY  (2 Units)
Laboratory experiments to demonstrate the application of the theory covered in the courses.

EEE 401: ELECTRIC POWER PRINCIPLES  2-1-0 (3 Units)
Introduction to power systems
Properties of three-phase systems
Energy sources
Components of power generating systems
Transmission line and underground cables
Design and organization of power stations
Power system equipment: standards and safety Pre-requisites EEE 303

EEE 403: GROUP DESIGN II  (1 Units)
Students will be divided into groups and assigned mini-design projects to carry out.

EEE 405: ANALOG CIRCUIT DESIGN  2-1-0 (3 Units)
Passive filter design and synthesis. Spectral transforms and their application in the synthesis of high-pass and band-pass filters.
Op Amps as independent sources. The use of independent sources to change the poles and zeroes of transfer functions. Active network realization.

**Pre-requisites EEE 302**

**EEE 407: INTRODUCTION TO CONTROL ENGINEERING** 2-1-0 (3 Units)
Control system concepts and components
Models of typical electrical, mechanical, thermal and fluid systems.
Block and signal flow diagrams.
Transfer functions of electrical and control systems
Frequency domain: Introduction to Transfer Functions
Time domain: General state space representation
Time response of systems
Reduction of multiple subsystems
System stability

**Pre-requisites EEE 309**

**EEE 409: COMMUNICATION PRINCIPLES:** 2-1-0 (3 Units)
Basic concepts of communication system – Source, channel and user.
Baseband signals and systems analysis: Fourier series, Fourier transforms, impulse response, frequency response, distortion and group delay.
Amplitude Modulation and demodulation methods. Comparison of AM systems.
Angle modulation and demodulation; Wideband and narrowband FM
Sampling principles: theorems and techniques, quantization
Compounding, pulse modulation: PAM, PWM and PCM. Delta modulation, Adaptive delta modulation, differential PCM. Data transmission and reception: Binary ASK, FSK, and PSK: M-ary FSK and PSK, QAM.

**Pre-requisites EEE 309**

**EEE 411: SEMICONDUCTOR DEVICES** 3-0-0 (3 Units)
Semiconductor fundamentals
Conduction mechanisms
Poisson and continuity equations
MOS Transistors
PN Junction Diode, Bipolar Junction Transistor
Microwave semiconductor devices
LED, LCD and other optical devices
Integrated circuits (IC): principles and fabrication of semiconductor devices.

**Pre-requisites EEE 302**

**EEE 491: COMMUNICATION AND CONTROL LABORATORY** (4 Units)

**Pre-requisites EEE 392**

**EEE 501: FINAL YEAR PROJECT I** (3 Units)

**EEE 502: FINAL YEAR PROJECT II** (3 Units)

**EEE 503: CONTROL SYSTEMS ENGINEERING I** 2-1-0 (3 Units)
Linear control systems
Stability: Nyquist stability criterion, bode diagram approach, root locus and root contour method
Design of linear servo systems
State-space systems
Compensator design using the bode and root locus methods
Multiple loop feedback systems
Minimization of unwanted disturbance
Single and multi-term electronic controllers
Hydraulic and pneumatic controllers
Sensitivity of control systems  

Pre-requisites EEE 407

EEE 504: DIGITAL SIGNAL PROCESSING  
Discrete-time systems and sampling
z-transforms
Discrete Fourier Transforms and Fast Fourier Transforms
Digital Processors
Digital Filters
Introduction to spectral analysis
Introduction to adaptive filtering
Introduction to signal compression  

Pre-requisites EEE 309

EEE 505: PROBABILITY AND STOCHASTIC PROCESSES:  
Introduction to probability
Random variables
Multiple random variables
Functions of random variables
Moments and conditional statistics
Random processes
Correlation functions
Power density spectrum  

Pre-requisites STA 201

EEE 506: ELECTRICAL SERVICES AND ENERGY UTILIZATION  
Design and organization of power supply: rated voltages and frequency. Types of power consumers and their characteristics, electrical installation in residential and industrial buildings.
Motor control for industrial system: general and special factory drives.
Regulations on installation and operation of electrical equipment. Metering and tariff systems  

Pre-requisites EEE 401

EEE 508: APPLICATION OF ELECTROMAGNETIC PRINCIPLES  
Impedance matching and tuning: Lumped elements. Quarter-wave impedance transformer. Resonant cavities.
Radio wave propagation: Atmosphere and multipath effects, Signal fading and channel noise.
Antennas: dipole, Loop and monopole; radiation pattern and Antenna arrays  

Pre-requisites EEE 409

EEE 511: RADIO FREQUENCY ELECTRONICS  
Radio spectrum, ITU and spectrum management, Transmission lines and scattering parameters; Design of RF components (low noise amplifiers, power amplifiers, oscillators, RF power detector, active and passive mixers); Properties and representation of noise; passive device design (microstrip lines); active device design (bipolar and FETs). Parametric amplifiers, Microwaves solid state components; TWT, Klystrons and their applications  

Pre-requisites EEE 409
EEE 513: WIRELESS COMMUNICATION 2-1-0 (3 Units)
Tropospheric propagation: Special features of VHF and UHF propagation. Propagation characteristics at microwave frequencies. Design of microwave links system. Effect of ionosphere on radio waves. Satellites communication systems, Multiple access methods in satellite communication. Earth stations for international communications. Mobile radio communications: simplex, half-simplex or full duplex, FDD, TDD cordless telephone system cellular systems: System design fundamentals.

Pre-requisites EEE 409

EEE 514: TELECOMMUNICATIONS ENGINEERING 2-1-0 (3 Units)
Introduction to telephony, signaling. Principles of automatic telephone; strowger and cross bar exchanges, Electronic switching system. Tariff considerations. Telex and facsimile transmission, data transmission. Introduction to television Engineering, Black and white television broadcasting, colour television systems. Cable TV systems

Pre-requisites EEE 513

EEE 516: COMPUTER COMMUNICATIONS 2-1-0 (3 Units)

Pre-requisites EEE 513

EEE 518: COMMUNICATIONS THEORY 2-1-0 (3 Units)

Pre-requisites EEE 409

EEE 521: INTRODUCTION TO MODERN CONTROL 2-1-0 (3 Units)
State Space Modelling: Derivation of Models – Modeling with differential equations, Block diagrams, signals flow graphs.

Pole Placement using State Feedback, Pole Placement using Output Feedback, State Observers/Reduced Order Observers. Application of calculus of variation, dynamic programming and Pontryagin’s maximum principles; Time optimal control system, optimal systems based on the quadratic performance indices LQR/LQG. $H_2$ and $H_{inf}$ system design, Introduction to Robust Control Design.
Minimum time problem, minimum fuel consumption problem, minimum energy problem. Liapunov second 
method and approach to solution of optimal control problems. Model reference control system.
Introduction to Adaptive control system.  

**Pre-requisites EEE 407**

**EEE 522: CONTROL SYSTEMS ENGINEERING II**  2-1-0 (3 Units)  
Non-linear differential equations. Characteristics of non-linear systems; common non-linearities. Analysis of 
non-linear systems. Linearizing approximations, piecewise linear approximation, the describing function 
concept and derivation for common non-linearities, the dual input describing function; stability using the 
describing function. Limit cycle prediction. The phase-plane method for construction of phase trajectories, 
transient analysis by the phase method. Stability analysis of non-linear systems using Liapunov method. 
Introduction to sample data systems; The z-transforms; pulse transfer function and stability analysis in the z-
plane.  

**Pre-requisites EEE 503**

**EEE 523: INSTRUMENTATION ENGINEERING**  2-1-0 (3 Units)  
Introduction to reliability, maintainability, availability and element reliability theory. Application to power 
system and electronic components. Climatic factors affecting reliability of electrical components and devices. 
Introduction to the design of electronics equipment. Specification including environmental factors such as 
vibration, humidity and temperature. Tolerance and safety measures. Reliability and testing, Duplication of 
least reliable parts (standby), Ergonomics, aesthetics and economics. Miniature and micro miniature 
construction using printed circuit boards and integrated circuits. Maintainability. Computer based design 
methods. Virtual Instrumentation.  

**Pre-requisites EEE 510**

**EEE 524: MODELING AND SIMULATION OF DYNAMIC SYSTEMS:**  2-1-0 (3 Units)  
Introduction to concepts in modeling and simulation  
Analog simulations:  
Study of differential equations  
Generation of time scaling  
Simulation of control systems from block diagrams  
Transfer functions and state equations  
Analog memory and its applications  
Repetitive and iterative operation of an analog computer  
Digital Simulation:  
Comparison of digital and analog/hybrid simulation  
Modeling and Simulation software packages  
Study of a few algorithms of interest in modeling and simulation: genetic algorithms, 
Monte Carlo Techniques etc  

**Pre-requisites EEE 521**

**EEE 526: INTRODUCTION TO HEURISTIC METHODS IN CONTROL**  2-1-0 (3 Units)  
Review of Classical and Modern Control  
Digital Control Systems  
Hierarchical Control Architectures  
Rule-based Systems  
Adaptive Control and Self-learning Systems  
Fuzzy Logic and its Application in Control  
Neutral Network and Neural Control  
Genetic Algorithms  
Expert and planning Systems  

**Pre-requisites EEE 521**
EEE 531: POWER ELECTRONIC DEVICES AND CIRCUITS 2-1-0 (3 Units)
Introduction to power semiconductor components: Power rectifier and circuits; half wave, full wave and three phase full wave rectifier circuit, controlled rectifier circuits; one phase one half wave, full wave three phase, half and full wave controlled rectifier circuits. Voltage-time area analysis; single phase and polyphase inverter circuits, harmonic analysis.
Chopper circuits: Types A and B. Four quadrant chopper circuits, A.C to A.C converters, A.C to D.C transmission links. Application of power semi-conductor circuits; regulated power supplies, uninterruptible power supplies, d-c and a-c drives. Induction heating and relays.

Pre-requisites EEE 302

EEE 532: HIGH VOLTAGE ENGINEERING 2-1-0 (3 Units)
Concept of breakdown in gases, vacuum, liquids and solids;
Insulation of overhead line and substation, busbars, and circuit breakers insulation. Insulation of transformers, generators, cable and condensers. Preventive testing of insulation, processes in a multi-layer dielectric, measurement of tan δ, capacitance, partial discharge voltage distribution, leakage resistance.

Pre-requisites EEE 401

EEE 535: POWER SYSTEM ENGINEERING I 2-1-0 (3 Units)
Overhead Transmission Lines:
Transmission line parameters (R, L and C) calculations. Equivalent circuits of transmission line, Underground types and parameters.
Modeling of Power Components
Transformers, transmission lines and synchronous machines;
System Modeling
Per unit calculations, network matrices
Power Flow Analysis
Gauss Siedel, Network-Raphson, and Fast decoupled methods
Control of voltage, real and reactive power in load flow problems
Faults in Power Systems:
Short-circuit analysis of synchronous machines. Synchronous and unsymmetrical fault analysis.

Pre-requisites EEE 401

EEE 536: POWER SYSTEMS ENGINEERING II: 2-1-0 (3 Units)
System Stability:
Transient stability swing equation, equal area criterion, multimachine stability, power system stabilizers.
Automatic Generation Control and Voltage Regulation:
Circuits breakers, relays, instrument transformers, protective schemes control circuits. Protection of transmission lines, transformers, generators and motors. Automatic reclosure and cut-in of standby supply.
Power System Planning:
Station management and maintenance routine.

Pre-requisites EEE 535