Department of Electrical and Electronic Engineering (EEE)
University of Dhaka

The framework of the semester system:

Program:B.Sc. Engg. in EEE

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

Class:	14 weeks (3 class hours/week for each course)
Preparation Leave (PL):	02 weeks
Exam:	03 weeks
Results:	03 weeks
Total:	22 weeks per semester

4. **Total Credits in 8 semesters (4 years):** 165.0

Introduction and Course Identification:

The undergraduate students of different years of this department have to follow the course schedule given. The letter prefix in any course number indicates the department offering the courses or the discipline viz. **EEE** for **Electrical and Electronic Engineering**, **CSE** for C**omputer Science and Engineering**, **IPE** for **Industrial and Production Engineering**, **ME** for **Mechanical Engineering**, **CHE** for **Chemistry**, **PHY** for **Physics**, **MAT** for **Mathematics** and **GED** for **General Education**.

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

- ✓ The **first digit** corresponds to the **year** in which the course is taken by the student.
- ✓ The **second digit** represents the **semester** in which the course is taken by the student.

- ✓ The **third digit** is reserved for **departmental use** for such things as to identify different areas within a department.
- ✓ The **last digit** is 'odd' for a theoretical course and 'even' for a laboratory or sessional course.

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

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

The minimum credits to be completed for obtaining the degree of B.Sc. Engg in Electrical and Electronic Engineering are 165.

Teaching of the courses:

a. For each credit of a theory course, there will be 1 class per week of 1 hour duration.

b. Total classes in a semester for each credit of a theory course will be 15 (15x1).

c. Total Contact Hours in a semester for each 1.0 credit theory course: 15x1=15.

d. For each 1.0 credit lab course, there will be 1 class per week of 2 hours duration.

e. Total classes in a semester for each 1.0 credit lab course in 15 weeks: 15x1=15.

f. Total Contact Hours in a semester for each 1.0 credit lab course: 15x2=30.

Evaluation of the courses:

As per university rule

Grading System:

The current UGC approved grading system applies as per university rules.

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

Marks Distribution:

g. **For a theory course:**

i.	Attendance	05%
ii.	Assignment/Presentation	05%
iii.	Incourse	30%
iv.	Final Examination	60%
	Total Marks	**100%**

h. **For a lab course:**

i.	Attendance	10%
i.	Reports	20%
ii.	Continuous Assessment	50%
iii.	Viva	20%
	Total Marks	**100%**

Attendance:

Students with **75% attendance and above** in each course will be eligible to sit for the semester final examinations. Students having attendance **>=60% and <75%** will be considered to sit for the examination after paying the some required fines. ***Students having attendance below 60% will not be eligible to appear at the examination***. The marks distribution for attendance is given below:

Attendance	Marks
90% and Above	*5.0%*
85% to < 90%	*4.5%*
80% to < 85%	*4.0%*
75% to < 80%	*3.5%*
70% to < 75%	*3.0%*
65% to < 70%	*2.5%*
60% to < 65%	*2.0%*
Less Than 60%	*0.0%*

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

Four Year Distribution

Year	***Courses (Semester)***	
Year 1	***Semester I:*** *Theory =5 courses* *Lab =3* ***Total: 19.5 Credits***	***Semester II:*** *Theory =4 courses* *Lab =4* ***Total: 18 Credits***
Year 2	***Semester I:*** *Theory =6 courses* *Lab =2* ***Total: 21 Credits***	***Semester II:*** *Theory =5 courses* *Lab =3* ***Total: 19.5 Credits***

Year 3	***Semester I:*** *Theory =5 courses* *Lab =3* ***Total: 19.5 Credits***	***Semester II:*** *Theory =6 courses* *Lab =2* ***Total: 21 Credits***
Year 4	***Semester I:*** *Theory =5 courses* *Lab =3* *Project/Thesis* ***Total: 22.5 Credits***	***Semester II:*** *Theory =6 courses* *Lab =2* *Project/Thesis* ***Total: 24 Credits***
Grand Total 165 Credits		

Optional Courses:

From Year-3, Semester-2, Department of EEE starts offering optional courses under 4 groups, viz., Electronics, Communication, Power, and Computer. Besides these, one optional course is to be chosen from interdisciplinary group. Students will be assigned one of the four groups as major and another as minor by taking written options from the students. For regular students, this will be done in Year-3, Semester-1. Major and minor group assignment will be based on options and CGPA of first four terms from Year-1, Semester-1 to Year-2, Semester-2.

A student will have to take 4/5 optional theory courses from the respective major group and remaining 3/2 optional theory courses from the respective minor group. A student must also take one theory course along with its corresponding lab from the interdisciplinary group.

Students will be assigned their Year-4 projects/ theses from the area of their respective major group.

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

Syllabus for B.Sc. in Electrical and Electronic Engineering

First Year (Semester-I)

Course Code	*Course Title*	*Credits*
EEE 1101	*Electrical Circuit Analysis I*	*3.0*
CSE 1101	*Computer Programming*	*3.0*
CSE 1102	*Computer Programming Laboratory*	*1.5*
PHY 1101	*Electricity and Magnetism*	*3.0*
PHY 1102	*Physics Laboratory I*	*1.5*
MAT 1101	*Differential and Integral Calculus*	*3.0*
MAT 1103	*Vector Analysis*	*3.0*
EEE 1102	*Computer aided Engineering Drawing*	*1.5*
	Total Credits in 1st Semester	***19.5***

First Year (Semester-II)

Course Code	*Course Title*	*Credits*
EEE 1201	*Electrical Circuit Analysis II*	*3.0*
EEE 1202	*Electrical Circuit Laboratory*	*1.5*
EEE 1204	*Electrical Circuit Simulation Laboratory*	*1.5*
PHY 1201	*Optics, Modern Physics, Wave and Oscillations*	*3.0*
PHY 1202	*Physics Laboratory II*	*1.5*
MAT 1201	*Linear Algebra*	*3.0*
CHE 1201	*Chemistry*	*3.0*
CHE 1202	*Chemistry Laboratory*	*1.5*
	Total Credits in 2nd Semester	***18***

Second Year (Semester-I)

Course Code	*Course Title*	*Credits*
EEE 2101	*Analog Electronics I*	*3.0*
EEE 2102	*Electronic Circuit Simulation Laboratory*	*1.5*
EEE 2103	*Digital Electronics*	*3.0*
EEE 2104	*Digital Electronics Laboratory*	*1.5*
EEE 2105	*Physical Electronics and Semiconductor Theory*	*3.0*

EEE 2107	*Electromechanical Energy Conversion I*	*3.0*
MAT 2101	*Differential Equations*	*3.0*
GED 2103	*English for Technical Communication*	*3.0*
	Total Credits in 1st Semester	***21***

Second Year (Semester-II)

Course Code	***Course Title***	***Credits***
EEE 2201	*Analog Electronics II*	*3.0*
EEE 2202	*Analog Electronics Laboratory*	*1.5*
EEE 2203	*Electromechanical Energy Conversion II*	*3.0*
EEE 2204	*Electromechanical Energy Conversion II Laboratory*	*1.5*
GED 2201	*Fundamentals of Economics*	*3.0*
STA 2201	*Statistics and Probability*	*3.0*
ME 2201	*Fundamentals of Mechanical Engineering*	*3.0*
ME 2202	*Mechanical Engineering Laboratory*	*1.5*
	Total Credits in 2nd Semester	***19.5***

Third Year (Semester-I)

Course Code	***Course Title***	***Credits***
EEE 3101	*Electromagnetic Theory*	*3.0*
EEE 3102	*Numerical Technique Laboratory*	*1.5*
EEE 3103	*Microprocessor and Interfacing*	*3.0*
EEE 3104	*Microprocessor and Interfacing Laboratory*	*1.5*
EEE 3105	*Communication Theory*	*3.0*
EEE 3106	*Communication Laboratory*	*1.5*
EEE 3107	*Signals and Systems*	*3.0*
EEE 3109	*Electronic Devices*	*3.0*
	Total Credits in 1st Semester	***19.5***

Third Year (Semester-II)

Course Code	***Course Title***	***Credits***
EEE 3201	*Power System I*	*3.0*
EEE 3202	*Power System I Laboratory*	*1.5*
EEE 3203	*Digital Signal Processing*	*3.0*
EEE 3204	*Digital Signal Processing Laboratory*	*1.5*
EEE 3205	*Electrical Services Design and Drafting*	*3.0*
EEE 32**	*Optional I*	*3.0*
GED 3201	*Financial Accounting and Cost Management*	*3.0*
IPE 3201	*Industrial Management*	*3.0*
	Total Credits in 2nd Semester	***21***

Fourth Year (Semester-I)

Course Code	***Course Title***	***Credits***
EEE 4101	*Power Electronics*	*3.0*
EEE 4102	*Power Electronics Laboratory*	*1.5*
EEE 4103	*Control System I*	*3.0*
EEE 4104	*Control System I Laboratory*	*1.5*
EEE 4105	*Material Science*	*3.0*
EEE 41**	*Optional II*	*3.0*
EEE 41**	*Optional III*	*3.0*
EEE 41**	*Optional III Laboratory*	*1.5*
EEE 4100	*Project/Thesis*	*3.0*
	Total Credits in 1st Semester	***22.5***

Fourth Year (Semester-II)

Course Code	***Course Title***	***Credits***
EEE 42**	*Optional IV*	*3.0*
EEE 42**	*Optional V*	*3.0*
EEE 42**	*Optional VI*	*3.0*

EEE 42**	*Optional VI Laboratory*	*1.5*
EEE 42**	*Optional VII*	*3.0*
EEE 42**	*Interdisciplinary Optional*	*3.0*
EEE 42**	*Interdisciplinary Optional Laboratory*	*1.5*
GED 4201 / GED 4203	*Bangladesh Studies /Professional Ethics*	*3.0*
EEE 4200	*Project/Thesis*	*3.0*
	Total Credits in 2nd Semester	***24***
	Grand Total Credits	***165***

Optional Courses (7 courses with two Lab /24 credits)

Elective Courses are classified into four specialized groups-Electronics, Communication, Power and Computer. A student has to take 6 elective courses from the respective chosen major group of concentration.

i. Electronics Group

Sl. No	*Course Code*	*Course Title*	*Credits*
1.	***EEE 3231***	*Optoelectronics*	*3.0*
2.	***EEE 4131***	*Analog Integrated Circuits*	*3.0*
3.	***EEE 4133***	*VLSI I*	*3.0*
4.	***EEE 4134***	*VLSI I Laboratory*	*1.5*
5.	***EEE 4231***	*Semiconductor Technology*	*3.0*
6.	***EEE 4233***	*Nanoscience and Technology*	*3.0*
7.	***EEE 4235***	*VLSI II*	*3.0*
8.	***EEE 4236***	*VLSI II Laboratory*	*1.5*
9.	***EEE 4237***	*Semiconductor Heterostructures*	*3.0*

ii. Communication Group

Sl. No	*Course Code*	*Course Title*	*Credits*
1.	***EEE 3241***	*Telecommunication Engineering*	*3.0*
2.	***EEE 4141***	*Radio and Television Engineering*	*3.0*
3.	***EEE 4143***	*Microwave and Satellite Communication*	*3.0*
4.	***EEE 4144***	*Microwave and Satellite Communication Laboratory*	*1.5*
5.	***EEE 4241***	*Digital Image Processing*	*3.0*
6.	***EEE 4243***	*Digital Communication*	*3.0*
7.	***EEE 4245***	*Optical Fiber Communication*	*3.0*
8.	***EEE 4246***	*Optical Fiber Communication Laboratory*	*1.5*
9.	***EEE 4247***	*Mobile Cellular Communication*	*3.0*

iii. Power Group

Sl. No	*Course Code*	*Course Title*	*Credits*
1.	***EEE 3251***	*Energy Conversion III*	*3.0*
2.	***EEE 4151***	*Power System II*	*3.0*
3.	***EEE 4153***	*Power System Protection*	*3.0*
4.	***EEE 4154***	*Power System Protection Laboratory*	*1.5*
5.	***EEE 4251***	*Power System Operation and Control*	*3.0*
6.	***EEE 4253***	*Power Plant Engineering*	*3.0*
7.	***EEE 4255***	*High Voltage Engineering*	*3.0*
8.	***EEE 4256***	*High Voltage Engineering Laboratory*	*1.5*
9.	***EEE 4257***	*Power System Reliability*	*3.0*

iv. Computer Group

Sl. No	*Course Code*	*Course Title*	*Credits*
1.	***CSE 3261***	*Computer Organization and Architecture*	*3.0*
2.	***CSE 4161***	*Database System*	*3.0*
3.	***CSE 4163***	*Microcontroller based System Design*	*3.0*
4.	***CSE 4164***	*Microcontroller based System Design Laboratory*	*1.5*

5.	**CSE 4261**	*Multimedia Communication*	3.0
6.	**CSE 4263**	*Intelligent Systems*	3.0
7.	**CSE 4265**	*Computer Networks*	3.0
8.	**CSE 4266**	*Computer Networks Laboratory*	1.5
9.	**CSE 4267**	*Simulation and Modeling*	3.0

V. Interdisciplinary Optional Courses (1 course with Lab /4.5 credits)

A student has to take one interdisciplinary elective course with laboratory from the following list:

Sl. No	Course Code	Course Title	Credits
1.	**EEE 4271**	*Control System II*	3.0
2.	**EEE 4272**	*Control System II Laboratory*	1.5
3.	**EEE 4273**	*Measurement and Instrumentation*	3.0
4.	**EEE 4274**	*Measurement and Instrumentation Laboratory*	1.5
5.	**EEE 4275**	*Medical Instrumentation*	3.0
6.	**EEE 4276**	*Medical Instrumentation Laboratory*	1.5
7.	**EEE 4277**	*Renewable Energy Technology*	3.0
8.	**EEE 4278**	*Renewable Energy Technology Laboratory*	1.5
9.	**EEE 4281**	*Numerical Method for Engineering*	3.0
10.	**EEE 4282**	*Numerical Method for Engineering Laboratory*	1.5
11.	**EEE 4283**	*High Performance Computing and Parallel Processing*	3.0
12.	**EEE 4284**	*High Performance Computing and Parallel Processing Laboratory*	1.5

Optional I (any one course)

Sl.	Course Code	Course Title	Credi

No			ts
1.	**EEE 3231**	*Optoelectronics*	3.0
2.	**EEE 3241**	*Telecommunication Network*	3.0
3.	**EEE 3251**	*Energy Conversion III*	3.0
4.	**CSE3261**	*Computer Organization and Architecture*	3.0

Optional II (any one course)

Sl. No	Course Code	Course Title	Credits
1.	**EEE 4131**	*Analog Integrated Circuit*	3.0
2.	**EEE 4141**	*Radio and Television Engineering*	3.0
3.	**EEE 4151**	*Power System II*	3.0
4.	**CSE 4161**	*Database System*	3.0

Optional III (any one course with Lab)

Sl. No	Course Code	Course Title	Credits
1.	**EEE 4233**	*VLSI I*	3.0
2.	**EEE 4234**	*VLSI I Laboratory*	1.5
3.	**EEE 4243**	*Microwave and Satellite Communication*	3.0
4.	**EEE 4244**	*Microwave and Satellite Communication Laboratory*	1.5
5.	**EEE 4253**	*Power System Protection*	3.0
6.	**EEE 4254**	*Power System Protection Laboratory*	1.5
7.	**CSE 4263**	*Microcontroller based System Design*	3.0
8.	**CSE 4264**	*Microcontroller based System Design Laboratory*	1.5

Optional IV (any one course)

Sl. No	*Course Code*	*Course Title*	*Credits*
1.	***EEE 4231***	*Semiconductor Technology*	*3.0*
2.	***EEE 4241***	*Digital Image Processing*	*3.0*
3.	***EEE 4251***	*Power System Operation and Control*	*3.0*
4.	***CSE 4261***	*Multimedia Communication*	*3.0*

Optional V (any one course)

Sl. No	*Course Code*	*Course Title*	*Credits*
1.	***EEE 4233***	*Nanoscience and Technology*	*3.0*
2.	***EEE 4243***	*Digital Communication*	*3.0*
3.	***EEE 4253***	*Power Plant Engineering*	*3.0*
4.	***CSE 4263***	*Intelligent Systems*	*3.0*

Optional VI (any one course with Lab)

Sl. No	*Course Code*	*Course Title*	*Credits*
1.	***EEE 4235***	*VLSI II*	*3.0*
2.	***EEE 4236***	*VLSI II Laboratory*	*1.5*
3.	***EEE 4245***	*Optical Fiber Communication*	*3.0*
4.	***EEE 4246***	*Optical Fiber Communication Laboratory*	*1.5*
5.	***EEE 4255***	*High Voltage Engineering*	*3.0*
6.	***EEE 4256***	*High Voltage Engineering Laboratory*	*1.5*
7.	***CSE 4265***	*Computer Network*	*3.0*
8.	***CSE 4266***	*Computer Network Laboratory*	*1.5*

Optional VII (any one course)

Sl. No	*Course Code*	*Course Title*	*Credits*

1.	***EEE 4237***	*Semiconductor Heterostructures*	*3.0*
2.	***EEE 4247***	*Mobile Cellular Communication*	*3.0*
3.	***EEE 4257***	*Power System Reliability*	*3.0*
4.	***CSE 4267***	*Simulation and Modeling*	*3.0*

Interdisciplinary Optional Courses (any one course with Lab)

Sl. No	*Course Code*	*Course Title*	*Credits*
1.	***EEE 4271***	*Control System II*	*3.0*
2.	***EEE 4272***	*Control System II Laboratory*	*1.5*
3.	***EEE 4273***	*Measurement and Instrumentation*	*3.0*
4.	***EEE 4274***	*Measurement and Instrumentation Laboratory*	*1.5*
5.	***EEE 4275***	*Medical Instrumentation*	*3.0*
6.	***EEE 4276***	*Medical Instrumentation Laboratory*	*1.5*
7.	***EEE 4277***	*Renewable Energy Technology*	*3.0*
8.	***EEE 4278***	*Renewable Energy Technology Laboratory*	*1.5*
9.	***EEE 4279***	*Numerical Method for Engineering*	*3.0*
10.	***EEE 4270***	*Numerical Method for Engineering Laboratory*	*1.5*
11.	***EEE 4281***	*High Performance Computing and Parallel Processing*	*3.0*
12.	***EEE 4282***	*High Performance Computing and Parallel Processing Laboratory*	*1.5*

GED Core (4 courses / 12 credits)

Course Code	*Course Title*	*Credits*

GED 2101	*English for Technical Communication*	*3.0*
GED 2201	*Fundamentals of Economics*	*3.0*
GED 3201	*Financial Accounting and Cost Management*	*3.0*
GED 4201/ GED 4203	*Bangladesh Studies /Professional Ethics*	*3.0*
	Total	***12***

CSE, Physics, Mathematics, Statistics, Chemistry, Mechanical Engineering, Industrial and Production Engineering, and Engineering Drawing Core Courses:

Course Code	***Course Title***	***Credits***
CSE 1101	*Computer Programming*	*3.0*
CSE 1102	*Computer Programming Laboratory*	*1.5*
PHY 1101	*Electricity and Magnetism*	*3.0*
PHY 1102	*Physics Laboratory I*	*1.5*
PHY 1201	*Optics, Modern Physics, Wave and Oscillations*	*3.0*
PHY 1202	*Physics Laboratory II*	*1.5*
MAT 1101	*Differential and Integral Calculus*	*3.0*
MAT 1103	*Vector Analysis*	*3.0*
MAT 1201	*Linear Algebra*	*3.0*
MAT 2101	*Differential Equation and Complex variables*	*3.0*
STA 2201	*Statistics and Probability*	*3.0*
CHE 1201	*Chemistry*	*3.0*
CHE 1202	*Chemistry Laboratory*	*1.5*
ME 2201	*Fundamentals of Mechanical Engineering*	*3.0*
ME 2202	*Mechanical Engineering Laboratory*	*1.5*
IPE 3201	*Industrial Management*	*3.0*
EEE 1102	*Computer Aided Engineering Drawing*	*1.5*

Total	***42***

First Year (Semester-I)

EEE 1101	**Electrical Circuit Analysis I**	**3 Credits, 3 hours/week**

Circuit Variables and Elements: Voltage, current, power, energy, independent and dependent sources, resistance.

Basic Laws of Electrical Circuits: Ohm's law, Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL).

Simple Resistive Circuits: Series and parallel circuits, voltage and current division, Source transformation, wye-delta transformation.

Methods of Analysis: Nodal and Mesh analysis, supernode and supermesh.

Circuit Theorems: Thevenin's, Norton's and superposition theorems with applications in circuits having independent and dependent sources, maximum power transfer condition and reciprocity theorem.

Capacitors and Inductors: Inductors and capacitors, their characteristics, series-parallel combination of inductors and capacitors.

First Order and Second Order Circuits: Natural and step responses.

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

CSE 1101	**Computer Programming**	**3 Credits, 3 hours/week**

Data Structure and Algorithm: Data representations; data types and data structures; ways to support data structures (hardware versus software); Abstract Data Types; arrays, stacks, queues, priority queues, lists, trees, graphs and

tables; Search algorithms and structures, Sorting Techniques, Algorithm design techniques.

Programming in C: Overview of C, Constants, Variable and Data Types, Operators and Expressions, Managing input and Output Operators, The Design Control a Case Control Structure, The Loop Control Structure, Recursion and Iterations Arrays, 2D Array, User Defined Functions, Structures and Unions, Pointers, Searching and Sorting Techniques, Linked List in C, Playing with Bits and Bytes, File Management.

Object oriented programming using C++: Introduction, classes and objects; polymorphism; function and operator overloading; inheritance.

CSE 1102	Computer Programming Laboratory	1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in **CSE 1101**.

PHY 1101	Electricity and Magnetism	3 Credits, 3 hours/week

Charge: Micro charge, macro charge, charging by rubbing, Coulomb's law: 1D, Coulomb's law: 2D, insulators and conductors, charging by induction, forces on conductors.

The Electric Field: Introduction to electric field, electric field of point charges, electric field of continuous charges, particle motion, field lines, 2d and 3d charge distributions.

Gauss's Law: Vector flux, gauss's law, finding electric filed with gauss's law: line of charge, plane of charge and sphere of charge, electric field in and around conductors, electrostatic shielding.

The Electric Potential: Introduction to electric potential, potential near a point charge, potential near charge distribution, potential and field, equipotential surface and electric filed energy to assemble charges, potential of a conductor.

Capacitor: Conductors and insulators, conductors as shields, capacitance and capacitors, energy stored in capacitors, capacitors and dielectrics.

Circuits: Current, resistance, circuits, dc circuits, Kirchhoff's rules, RC circuits.

The Magnetic Field: Introduction to magnetic field, magnetism from electricity, magnetic force on a free charge, charged particle motion, magnetic force on a wire, magnetic force on a loop.

Sources of Magnetic Fields: Biot-Savart Law, Magnetic force on parallel wires, Ampere's law, Cabrera's law, Solenoids, Magnetism in Matter.

Faraday's Law: Faraday's Law, Motional EMF, Lenz's law, Eddy Currents, Faraday's law and Electric Fields.

AC Circuits: Inductance and Magnetic energy, RL circuits, LC circuits, RLC circuits, AC elements, Driven RLC circuits.

Waves and Light: Waves on a sting, Normal modes, Travelling modes, Differential form, Maxwell's equations.

PHY 1102	Physics Laboratory I	1.5 Credits, 3 hours/week

Laboratory experiments based on theory and concepts learnt in **PHY 1101**.

MAT 1101	Differential and Integral Calculus	3 Credits, 3 hours/week

Differential Calculus: Successive differentiation of one variable and Leibnitz theorem. Taylor's and Maclaurin's expansion of functions of single variable. Functions of several variable, partial derivatives, Euler's theorem, derivatives of composite and implicit functions, total derivatives, Jacobian's, Taylor's and Maclaurin's expansion of functions of several variables, maxima and minima of functions of several variables, Lagrange's method of undetermined multipliers. Curvature and asymptotes, concavity, convexity and point of inflection. Curve Tracing.

Integral Calculus :Improper integrals, convergence of improper integrals, test of convergence, Beta and Gamma functions and its properties, Differentiation under integral sign; differentiation of integrals with constant and variable limits; Leibnitz rule. Evaluation of double integrals, change of order of integration, change of coordinates, evaluation of volumes of solids and curved surfaces using double and triple integrals.

MAT 1103	Vector Analysis	3 Credits, 3 hours/week

Vector Analysis: Vector in two and three dimensions, Different co-ordinate systems and curvilinear co-ordinate, Vector addition and multiplications, Vector differentiation and integration, line, surface and volume integral, gradient, curl and divergence, stokes's and divergence theorem, Stoke's theorem, Green's theorem and Gauss's theorem..

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

EEE 1102	Computer Aided Engineering Drawing	1.5 Credits, 3 hours/week

Introduction to engineering drawing; drafting as a language, drafting environment, board drafting, Computer Aided Drawing and Design. Geometrical Constructions; two- dimensional sketching, sketching for creating solid models, drawing and editing commands in CAD environments. Orthographic projection; 1st and 3rd angle projection, Principal Views, Basic Dimensioning, size tolerances. Creating three- dimensional models; Extrude, Revolve, Holes, Shell, Fillet, Chamfer, Split, Sculpt, Work Planes, Ribs, Loft, Sweep. Creating orthographic views from a solid model, Auxiliary views. Pictorial Drawing;

Isometric Drawing, Oblique Drawing. Sectioning and conventions. Introduction to Solid Modeling for Assemblies, Assembly Drawing.

First Year (Semester-II)

EEE 1201	Electrical Circuit Analysis II	3 Credits, 3 hours/week

RLC Transients: RLC circuit response to DC input: Underdamped, Overdamped, Critically Damped Case, Charging and Discharging Phase.

Series and Parallel AC Circuits: Impedance and Phasor diagram, Series Configuration, Voltage divider rule, Admittance and Susceptance, Parallel ac Networks, Current Divider rule.

Methods of Analysis – AC networks: Independent versus Dependent sources, Mesh and Nodal Analysis, Wye-Delta and Delta-Wye Conversions.

Network Theorems – AC networks: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Substitution, Reciprocity and Millman's Theorems.

Power – AC networks: Average, Apparent and Reactive Power, The Power Triangle, The Total *P*, *Q* and *S*, Power Factor Correction.

Polyphase Systems: The Three phase generator, The Y-connected generator, The Y-connected generator with a Y-connected Load, the Wye-Delta system, the Delta connected generator, the delta-delta, delta-Wye three phase systems, the three wattmeter method, the two wattmeter method, unbalanced three-phase, four wire, Y-connected load, Unbalanced three-phase, three wire Y-connected load.

Decibels, filters and Bode plots: R-C Low-pass filters, R-C high pass filters, Pass-band filters, Stop-Band filters, Bode Plots.

Fourier Method of Waveform Analysis: Trigonometric Fourier Series, Exponential Fourier Series, Waveform Symmetry, Line Spectrum, Waveform Synthesis, Application in Circuit Analysis.

Complex Frequency: Introduction, Network analysis in the s-domain, network response in the s-domain.

The Laplace Transform method: Introduction, the Laplace Transform, Selected Laplace Transforms, Initial Value and Final Value Theorem.

EEE 1202	**Electrical Circuit Laboratory**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 1101** and **EEE 1201** theory courses.

EEE 1204	**Electrical Circuit Simulation Laboratory**	**1.5 Credits, 3 hours/week**

Simulation laboratory based on **EEE 1101** and **EEE 1201** theory courses. Students will verify the theories and concepts learned in those courses using simulation software like PSpice, Proteus, and Matlab.

PHY 1201	**Optics, Modern Physics, Wave and Oscillations**	**3 Credits, 3 hours/week**

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

Optics: Wave Motion, Light as Electromagnetic Wave, Irradiance, Superposition of Waves, Two beam and Multiple Beam Interference, Interferometers: Wavefront-splitting, Amplitude-splitting, Fabry-Perot, Mach-Zender Interferometer, Multilayer Antireflection Coating. Fresnel Diffraction: For a Semi-Infinite Screen, Rectangular and circular aperture, Laser Beam Divergence, Fresnel to Fraunhofer Diffraction Limit, Fraunhofer Diffraction:

Single Slit, Double Slit and Many Slits, Diffraction Grating and Grating Spectroscopy, Resolution of Imaging System. Different Types of Polarization, Polaroid, Birefringent Polarizer, Wave Plates, Optical Activity, Induced Optical Effects, Optical Modulators.

Modern Physics: Electromagnetic Waves, Photoelectric Effect, Quantum Theory of Light, X-ray and X-ray Diffraction, Compton Effect. De Broglie Waves, Phase and Group velocity Particle Diffraction, Particle in a Box, Uncertainty Principle. Rutherford Model of the Atom, Electron, Orbits, Atomic Spectra, the Bohr Atom, Energy Levels and Spectra, Atomic Excitation. Introduction, Wave Function and Wave Equation, Time Dependent Schrodinger's Equation, Expectation Values, Steady state Schrodinger's Equation, Linearity and Superposition, Operators, Particle in a box, Reflection and Transmission by a barrier, Tunnel Effect, Harmonic Oscillator.

PHY 1202	**Physics Laboratory II**	**1.5 Credits, 3 hours/week**

Laboratory based on **PHY 1201** theory course.

MAT 1201	**Linear Algebra**	**3 Credits, 3 hours/week**

Systems of Linear Equations, Row Reduction and Echelon Forms, Vector Equations, The Matrix Equation $Ax = b$, Solution Sets of Linear Systems, Applications of Linear Systems, Linear Independence, Introduction to Linear Transformations, The Matrix of a Linear Transformation, Linear Models in Engineering, Matrix Operations, The Inverse of a Matrix, Characterizations of Invertible Matrices, Matrix Factorizations, The Leontief Input-Output Model, Introduction to Determinants, Properties of Determinants, Cramer's Rule, Volume, and Linear Transformations, Vector Spaces and Subspaces, Null Spaces, Column Spaces, and Linear Transformations, Linearly Independent Sets; Bases, Coordinate Systems, The Dimension of Vector Space, Rank, Change of Basis, Applications to Difference Equations OR, Applications to Markov Chains, Eigenvectors and Eigenvalues, The Characteristic Equation, Diagonalization, Eigenvectors and Linear Transformations, Complex Eigenvalues, Discrete Dynamical Systems OR, Inner Product, Length, and

Orthogonality, Orthogonal Sets, Orthogonal Projections, The Gram-Schmidt Process, Least-Squares Problems, Symmetric Matrices, Quadratic Forms, Application of linear algebra to electric networks.

CHE 1201	Chemistry	3 Credits, 3 hours/week

Atomic Structure and Periodic Classification: Atom, atomic masses, atomic nucleus, nuclear binding energy, nuclear stability, de Broglie's theory of matter, standing waves and quantization, Heisenberg's uncertainty principle, Schrödinger's wave equation and its application to hydrogen atom, wave function and its significance, quantum numbers, atomic orbitals and their energies, shapes and orientation, Pauli exclusion principle, Aufbau principle, Hund's rule, electronic configurations, classification of elements, periodic properties - ionization energy, electron affinity and electronegativity, shielding effect and effective nuclear charge, Slater's rule for calculating shielding effect and effective nuclear charge, size of atoms or ions.

Chemical Bonds: Chemical bond, types of chemical bonds, ionic bond, properties of ionic compounds, factors influencing the formation of ionic bond, radius ratio rule, sodium chloride structure, experimental determination of lattice energy, covalent bond, sigma and pi bond, properties associated with covalent compounds, polar covalent bond, valence shell electron pair repulsion (VSEPR) theory and molecular geometry, valence bond theory, hybridization of bond orbitals, molecular orbital theory, the LCAO method, molecular orbital diagram, HOMO and LUMO, MO descriptions of homonuclear diatoms of He_2 to F_2, Mixing of MOs and the correlation diagrams, metallic bond, properties of metals, the band structure of metals.

Redox Reactions: Charge and electronic concept, oxidizing and reducing agents, redox half reactions, rules for balancing redox reactions.

Acids and Bases: Brønsted-Lowry concept, Lewis concept, acid - base strength, pH, acid-base titration, indicators, buffers, Henderson-Hasselbach equation, hard and soft acids and bases.

Thermochemistry: Conservation of energy, heats of reaction, enthalpy, enthalpies of formation, enthalpies of combustion, Hess's law, heat capacity and specific heat.

CHE 1202	Chemistry Laboratory	1.5 Credits, 3 hours/week

Laboratory based on **CHE 1201** theory course.

Second Year (Semester-I)

EEE 2101	Analog Electronics I	3 Credits, 3 hours/week

Diode Circuit: P-N Junction Diode characteristics, The ideal Diode and Real Diode, P-N Junction Diode as a circuit Element, load Line Analysis of a diode Circuit, Special Diodes – Zener Diodes, LED and Tunnel Diode. Half-wave and Full wave Rectifier, Voltage Regulation, Voltage Doublers, Clippers and Clamper.

Bipolar Junction Transistors: Bipolar junction transistor Construction and Operation, Amplifying action, Common Base, Common Collector, Common Emitter Configuration, Relations Between α and β, Leakage Current in a Transistor, Thermal Runaway in a Transistor, DC Load Line – Q Point. Transistor Biasing Factor, Effects on Bias Variations, Stability factor for CB and CE Configurations, Different Methods for Transistor Biasing, Load Line and output Characteristics, AC load Line.

Field Effect Transistor (FET): JFET Configuration, Operation and Characteristics, MOSFET Construction, Operation and Characteristics, Small Signal JFET parameters, DC Biasing of JFET, DC Load Line, Common Source JFET Amplifier, Modeling and Equivalent Circuit of BJTs and FETs, Conversion of an amplifier circuit to a standard form, General Black box theory, Impedance Parameters and Hybrid parameter, Parameters models of transistor, BJT Hybrid – II parameter Model for high Frequency, FETs Small Signal Model, Voltage- controlled and Current-Controlled models.

BJT Small Signal (Single Stage) Amplifier Circuit Analysis: Classification of Amplifiers, CE Fixed Bias Configuration, CB Configuration, Collector Feedback Configuration, loading Effect of R2 and R1, Complete Hybrid Equivalent Circuit, Design of CE Amplifier, Application in Class A Amplifier, Transformer coupled classes, Class B push-pull Amplifiers, Class C Amplifiers, Tuned Amplifier, Distortion in Amplifiers Variation in Amplifier Gain with Frequency, Cut-off Frequencies.

FET Small Signal Analysis: JFET/Depletion, MOSFET Amplifier with Source Resistance, Small Signal Model, AC Small Signal Operation, Loading Effects, Source Follower (Common Drain) circuit, Common Gate Circuit, Design of FET Amplifier Circuit (CS, CD or CG).

Multistage Amplifiers: Amplifier coupling, RC Coupled two Stage Amplifier, Advantages of RC Coupling, Impedance coupled two stage amplifier and its Advantages and Disadvantages and Applications, DC Two-stage amplifier and its advantages, disadvantages and applications, Darlington Pair, Comparison between Darlington Pair and emitter Follower, Multistage frequency effects, Differential Amplifiers.

Feedback Amplifiers: Principle of Feedback Amplifier positive and Negative feedback, Advantages of negative feedback, gain Stability, Decreased Distortion, Increased Bandwidth, Forms of Negative Feedback, Practical feedback Circuits.

EEE 2102	**Electronic Circuit Simulation Laboratory**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 2101** theory course.

EEE 2103	**Digital Electronics**	**3 Credits, 3 hours/week**

Digital Logic Basics: Switches and logic gates (basic and universal), Logic functions, truth tables and variables,

I**ntroduction to Combinational Logic**: Boolean axioms and laws, Sum of Products (SOP), Product of Sums (POS), Combinational Logic Optimization

(Using Boolean Algebra and Karnaugh Map), "Don't Care" conditions, Technology: Logic voltage levels (TTL, CMOS, ECL), NMOS and CMOS logic gates, Multilevel logics, Real propagation delay, Timing Diagram, Timing analysis of digital circuits, Introduction to Verilog (a language for describing hardware) and associated CAD tools,

Sequential Logic: NOR/NAND gates based gated latch, Various Flip-flops (FF), Master-Slave FF, Shift registers, Counters, Set-up & hold time, Finite State Machines: State diagrams, Moore-type and Mealy-type machines, State machine synthesis, State machines in Verilog, State encoding,

Digital Numbers and Arithmetic: Number representation schemes, Basic adder and subtractor (half and full adder), Ripple carry adder, Carry look ahead Adder, BCD adder, Special Circuits: ring counter, Johnson counter, Multiplexors & tristate gates, Encoder, decoders, Real world interfacing: ADC, DAC,
Introduction to programmable logic devices: PLD, PLA, FPGA.

EEE 2104	**Digital Electronics Laboratory**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 2103** theory course.

EEE 2105	**Physical Electronics and Semiconductor Theory**	**3 Credits, 3 hours/week**

Crystallography and Crystal Structure: Lattice parameters, Electronic motion in periodic lattice, Brillouin zones, and reciprocal lattice, Lattice Matching and Mismatch, Crystalline Materials, Crystal Orientation, Single Crystal, Polycrystalline and Amorphous Structure, Crystal defects.
Free Electron Theory: Drude-Lorentz Theory, Application of Classical Free Electron Theory, Fermi-Dirac Distribution Function, Position of Fermi Level, Electrical Conductivity and Thermal Conductivity, Electronic Specific Heat.

Zone Theory: Kronig-Penney Model, Allowed Energy Zones, Brillouin Zones, K-Space, Fermi Surface, Density of States, Application of Zone Theory, Conductors and Semiconductors, Superconductivity.

Electron Emission: Work Function, Surface Potential Barrier and Contact Potential Thermal Emission, Schottky effect, Field Emission and Fowler Nordheim Equation, Secondary Emission, Secondary Multipliers, Photoelectric Effect and Emission, Thermo-electricity for metals and Semiconductors, Electron Ballistics, Lorentz Equation and its application, Child-Langmuir three-halves power law, Electron Optics, Electron Microscope.

Electronic Theory of Semiconductor: Elementary Band theory, Metals, Semiconductors, Insulators, Intrinsic and Extrinsic Semiconductors, Position of Fermi Level, Concept of Holes, Hall Effect and Galvanomagnetic effects, Equilibrium of Carrier Densities, Generation and Recombination of Excess Carriers, Carrier Life-time, Carrier Movement of Diffusion and Drift, Einstein relation, Derivation of Conductive Equations, Ohmic and Rectifying Contacts, rectifier Equation.

EEE 2107	**Electromechanical Energy Conversion I**	**3 Credits, 3 hours/week**

Transformer: Ideal transformer- transformation ratio, no-load and load vector diagrams; actual transformer- equivalent circuit, regulation, short circuit and open circuit tests.

Three phase induction motor: Rotating magnetic field, equivalent circuit, vector diagram, torque-speed characteristics, effect of changing rotor resistance and reactance on torque-speed curves, motor torque and developed rotor power, no-load test, blocked rotor test, starting and braking and speed control.

Single phase induction motor: Theory of operation, equivalent circuit and starting.

MAT 2101	**Differential Equations**	**3 Credits, 3 hours/week**

Ordinary Differential Equations: Degree and order of ordinary differential equations, formation of differential equations. Solution of first order differential equations by various methods. Solution of general linear equations of second and higher orders with constant coefficients. Solution of homogeneous linear

equations. Solution of differential equations of the higher order when the dependent or independent variables are absent. Solution of differential equation by the method based on the factorization of the operators. Frobenius method.

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

GED 2103	**English for Technical Communication**	**3 Credits, 3 hours/week**

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.

Report Writing: Defining a report, classification of reports, structure of a report, and writing of reports.

Second Year (Semester-II)

EEE 2201	Analog Electronics II	3 Credits, 3 hours/week

Operational Amplifiers: Differential amplifier circuits, Constant current source, Current mirror, Active load, Common mode rejection, the ideal op-amp, the practical op-amp, Frequency response of an op-amp, Linear application of op-amp, Inverting amplifier, non-inverting amplifier, Differentiator, Integrator, Precision rectifier, Sample and hold circuit, Capacitance multiplier, Active filter, Log and anti-log amplifier, Comparator, Window Detector, Schmidt trigger.

Multivibrators with Op-Amp: Astable Multivibrator, Monostable Multivibrator, Bistable Multivibrator, Sine wave oscillators, Triangular wave generators, Voltage controlled oscillator, Voltage regulation.

Oscillators: Negative feedback in amplifiers, Bark-Hausen criterion for oscillation, Phase shift oscillators, Wein Bridge oscillator, Bridge-Tuned twin T oscillator, LC oscillators – Hartley and Colpitts, Negative resistance oscillator, Crystal oscillator – frequency stability.

Power and Tuned Amplifiers: Class A power amplifier, Class-B power amplifier, Push-pull amplifier, Complementary symmetry, Quasi-complementary, Class-D amplifier, Tuned amplifier, Single tuned amplifier, Double tuned amplifier, Stagger tuned amplifier.

Wideband Amplifier: Broadbanding techniques, Base compensation, IC wideband amplifiers, Shunt compensation and series compensation.

Pulse and Switching Circuits: Astable with BJT, JFET and timer IC; Monostable with BJT and timer IC; Bistable triggering problem; Schmidt trigger with BJT; Blocking oscillators; Voltage and time base generators; Exponential sweep circuits; Constant current charging circuit; the Miller circuit and Bootstrap circuit; Current time-base generation; Trapezoidal waveform; Sweep circuit for TV receivers; Pulse transformer.

Analog Multipliers: Multiplication techniques, Power quadrant multiplier, Logarithmic exponential multiplier, Application of multiplier; Division, Squaring and square root circuits; RMS and phase detector circuits; Modulation and demodulation with multiplier.

Voltage Regulators: Series and shunt regulations, IC voltage regulators, Switching regulators.

Phase Locked Loops: Basic PLL, Major building blocks; Lock and Capture range; Applications of PLL, FM demodulation, FSK demodulation, AM demodulation, Frequency synthesizer.

Switching Capacitor Circuits: Theory of operation, Switched capacitor, Capacitor integrator, Switched capacitor filter.

EEE 2202	Analog Electronics Laboratory	1.5 Credits, 3 hours/week

Laboratory based on **EEE 2102** theory course.

EEE 2203	Electromechanical Energy Conversion II	3 Credits, 3 hours/week

Synchronous Generator: excitation systems, equivalent circuit, vector diagrams at different loads, factors affecting voltage regulation, synchronous impedance, synchronous impedance method of predicting voltage regulation and its limitations. Parallel operation: Necessary conditions, synchronizing, circulating current and vector diagram.

Synchronous motor: Operation, effect of loading under different excitation condition, effect of changing excitation, V-curves and starting.

DC generator: Types, no-load voltage characteristics, build-up of a self excited shunt generator, critical field resistance, load-voltage characteristic, effect of speed on no-load and load characteristics and voltage regulation.

DC motor: Torque, counter emf, speed, torque-speed characteristics, starting and speed regulation. Renewable Energy Conversion: Introduction to wind turbine generators. Construction and basic characteristics of solar cells.

EEE 2204	Electromechanical Energy Conversion II Laboratory	1.5 Credits, 3 hours/week

Laboratory based on **EEE 2107** and **EEE 2203** theory courses.

GED 2101	Fundamental of Economics	3 Credits, 3 hours/week

Introduction to economics. Economics and engineering. Different economic systems. Fundamental economic problems. Basic elements of demand, supply and product market. Theory of utility and preferences, consumer's surplus. Theory of production and cost. Theory of the firm and market structure. Optimization. Introducing macroeconomics. National income accounting, the simple Keynesian analysis of national income, employment and inflation. Savings, investment and decision making. Fiscal policy and monetary policy-money and interest rate, income and spending.
Economics of development and planning.

STA 2201	Statistics and Probability	3 Credits, 3 hours/week

Introduction: Modern Statistics, Statistics and Engineering.

Probability: Sample Spaces and events, Counting, The Axioms of Probability, Theorems of Probability. Conditional Probability, Baye's Theorem, Mathematical Expectation and Decision Making.

Probability Distributions: Random Variables, The Binomial Distribution, The Hypergeometric distribution. The Mean and Variance of a Probability Distributuons, Chebyshev's theorem, the Poisson approximation to the Binomial Distribution, Poisson Processes, The Geometric Distributuon. The Multinomial Distribution.

Probability Densities: Continuous Random Variables, The Normal Distribution, The Normal Approximation to the Binomial Distribution, The Uniform Distribution. The Weibull Distribution, Joint Probability Densities.

Treatment of Data: Frequency Distributions, Graphs of Frequency Distributions, Stem-and-leaf Plots, Descriptive Measures, Calculation of x and s

Sampling Distributions: Population and Samples, The sampling distribution of the Mean (known). The Sampling Distribution of the Mean (Unknown). The Sampling Distribution of the Variance.

Inferences Concerning means: Point Estimation, Bayesian Estimation, Bayesian Estimation, Tests of Hypotheses. Null Hypotheses and Significance Tests, Hypotheses concerning one Mean, Operating Characteristic Curves, Hypotheses concerning two Means.

Inferences Concerning Variances: The Estimation of Variances, Hypotheses concerning One Variance, Hypotheses concerning Two Variances.

Inferences Concerning Proportions: Estimation of proportions, Bayesian Estimations, Hypotheses concerning One Proportion. Hypotheses concerning Two Proportions. The Analysis of rxc Tables, Goodness of Fit.

Nonparametric Tests: The Sign Test. The Rank-Sum Tests. Test of Randomness. The Kolmogorov-Smirnov Tests.

Curve Fitting: The Method of Least Squares, Inferences Based on Least Square Estimators. Curvilinear Regression, Multiple Regression, Correlation.

Analysis of Variance: General Principles, Completely Randomized Designs, Randomized Block Designs, Multiple Comparisons. Analysis of Covariance.

Factorial Experimentation: Two-Factor Experiments, Multifactor Experiments, 2^n Factorial Experiments, Confounding in a 2^n Factorial Experiment, Fractional Replication.

ME 2201	Fundamentals of Mechanical Engineering	3 Credits, 3 hours/week

Applied Heat: Production of low Temperature and Liquefaction of Gases, Superconductivity concept, Production of High Temperature, Temperature Measurement Techniques, Heat Transfer processes, Derivation of Conduction equation, EM wave Spectrum and Thermal Radiations, Emissive Power, Radiation Loss, Radiation intensity, Net Heat Transfer Between Two radiation Surfaces.

Thermodynamics: Thermal Equilibrium and Zeroth Law of Thermodynamics, First and Second Law of Thermodynamics and Their Applications in the Analysis of Basic Heat Engines, Entropy.

Introduction to sources of energy: Steam generating units with accessories and mountings; steam turbines. Introduction to internal combustion engines and their cycles, gas turbines.

Refrigerator and Air-Condition: Units of Refrigeration Capacity, Vapor Compression Refrigeration System, Vapor Absorption Refrigeration System, Properties of Refrigerants, Atmosphere and Human Comfort, Measurement of Relative humidity, Summer Air-Conditioning System.

Fluid machinery: impulse and reaction turbines; centrifugal pumps, fans, blowers and compressors.

Basics of conduction and convection: critical thickness of insulation.

ME 2202	**Mechanical Engineering Laboratory**	**1.5 Credits, 3 hours/week**

Laboratory based on **ME 2201** theory course.

Third Year (Semester-I)

EEE 3101	**Electromagnetic Theory**	**3 Credits, 3 hours/week**

Electromagnetic Theory: Scalar and vector fields, Different coordinate systems, Time varying field and phasor representation, Maxwell's equations:

(differential and integral form), Boundary conditions, Potential functions, Time harmonic fields and Poynting theorem. Plane Wave Propagation and reflection of electromagnetic waves in unbounded media, Plane waves in loss-less media – Doppler effect, Wave impedance, Polarization of EM waves, Plane waves in lossy media, Loss-less dielectrics, Good conductors, Group velocity, Instantaneous and average power densities.

Antenna: Radiation mechanism of antenna; Types of antennas (wire antennas, aperture antennas, array antennas, reflector antennas, lens antennas & their radiation patterns), Isotropic, Directional and omnidirectional pattern, Principle pattern, Radiation pattern lobes, Field regions, Radian and tertian.

Parameters: Fundamental parameters of antenna, Radiation power density, Radiation intensity, Gain, Directive gain, Power gain, Directivity, Antenna efficiency, Effective aperture, Physical aperture, Radiation resistance, Transmission between two antenna, Radar equation, Front to back ration, Antenna band width, Antenna beam width.

Antenna arrays – design and synthesis. Reflector type antennas. Babiner's principles and complementary antennas. Application of reaction concept and variational principles in antennas and propagation. Frequency independent antennas, Scattering and diffraction. Selected topics in microwave antennas. Printed antenna. Antenna measurements. Applications in broadcasting, telecommunication, microwave links, satellite communications, etc.

Transmission Line: Line Parameters, Characteristic Impedance of Symmetrical Network, Properties of Symmetrical Networks, Inductance of a line of two parallel conductors and co-axial line, skin effect, capacitance of two parallel and coaxial lines, Transmission line Theory, A line of cascaded T section, The transmission line: general solution, the infinite line, wavelength Velocity of propagation, waveform distortion, distortion-less line, reflection on a line not terminated in Z_o, Reflection coefficient, Line Calculation, Input and transfer impedance, Open and short circuited lines, Reflection and Insertion loss, T and π section equivalent to lines.

EEE 3102	Numerical Technique Laboratory	1.5 Credits, 3 hours/week

Laboratory on numerical techniques using computer solution of differentiation and integration problems, transcendental equations, linear and non-linear differential equations and partial differential equations.

EEE 3103	Microprocessor and Interfacing	3 Credits, 3 hours/week

Microprocessor:

Introduction to Microprocessor: Overview of computer architecture, Evolution of Microprocessors, Difference between microprocessor and microcontroller, Introduction to 8086/8088: Basic architecture of 8086, Memory segmentation, Flags, Addressing Modes, Pins & Signals, Single and Multi-processor systems, Microprocessor Programming: Instruction sets, Introduction to Assembly language programming, Tools: Assemblers, Debuggers, Development Systems, Memory: Types of memory, Memory banks, Memory read and write cycles.

Interfacing:

Clock and Bus Controller interfacing: Clock generator, Bus demultiplexer, Bus controller interfacing, Memory Interfacing: SRAM and EEPROM Interfacing, Types of I/O: Parallel I/O, Programmed I/O, Interrupt Driven I/O, I/O port address decoding, Programmable Peripheral Interface (8255A), Interface examples– Keyboard matrix, LCD/7-Segment Display, Printer, stepper motor, A/D and D/A converter, Timer Interfacing: The 8254 Programmable Interval Timer (PIT), Timing applications, Serial I/O Interface: Asynchronous and synchronous communication, Physical communication standard-EIA RS232, Programmable Communication Interface, Interfacing serial I/O devices- mouse, modem, PC Keyboard, Interrupts: Interrupt driven I/O, Software & Hardware interrupts, Interrupt vectors and vector table, Interrupt processing, Programmable Interrupt Controller (8259A), DMA: DMA Controller(8237).

EEE 3104	Microprocessor and Interfacing Lab	1.5 Credits, 3 hours/week

Laboratory based on **EEE 3103** theory course.

EEE 3105	Communication Theory	3 Credits, 3 hours/week

Spectral Analysis: Fourier Series, The Sampling Function, Response of a Linear System, Normalized Power, Normalized Power in a Fourier Expansion, Power Spectral Density, The Fourier Transform, Convolution, Parseval's Theorem, Correlation between Waveforms, Autocorrelation.

Random Variables and Processes: Probability, Cumulative distribution function, Probability Density Function, Tchebycheff's Inequality, The Gaussian Probability Density, The Error Function, The Rayleigh Probability Density, Correlation between random variables, the central-limit theorem, Random Processes, Autocorrelation, Power Spectral Density of a Sequence of Random Pulses, Power Spectral Density of Digital Data, Effect of rudimentary filters of digital data, the complimentary error function.

Mathematical Representation of Noise: Some sources of noise, a frequency-domain representation of noise, spectral components of noise, response of a narrowband filter to noise, effect of a filter on the power spectral density of noise, superposition of noises, mixing involving noise, linear filtering, noise bandwidth, quadrate components of noise, power spectral density of nc(t) and ns(t), Probability density of nc(t) ,ns(t) and their time derivatives.

Information theory: Discrete message, the concept of amount of information, average information, Entropy, Information rate, coding to increase average information per bit, Shannon's theorem, channel capacity, capacity of a Gaussian channel, bandwidth-S/N tradeoff, use of orthogonal signals to attain Shannon's limit, efficiency of orthogonal signal transmission.

Communication System and Noise Calculations: Resistor noise, multiple resistor noise sources, networks with reactive elements, an example, available power, noise temperature, two ports, noise bandwidth, effective input-noise

temperature, noise figure, noise figure and equivalent noise temperature of a cascade, an example of a receiving system, antennas, system calculation.

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

EEE 3106	**Communication Laboratory**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 3105** theory course.

EEE 3107	**Signals and Systems**	**3 Credits, 3 hours/week**

Introduction: Continuous- and discrete-time signals, Operations on signals, Properties of signals, Elementary signals, Continuous- and discrete-time systems, Interconnections of systems, System Properties.

Time Domain Representations for Linear Time-Invariant Systems, Convolution, Properties of convolution, Difference and differential equations - characterizing solutions.

Fourier Representations of Signals, Discrete-time periodic signals - the discrete-time Fourier series, Continuous-time periodic signals - the Fourier series Discrete-time nonperiodic signals - the discrete time Fourier transform, Continuous-time nonperiodic signals - the Fourier transform, Properties of Fourier representations.

Applications of Fourier Representations, Frequency response from time-domain system descriptions, Fourier transform representations for periodic signals, Convolution and modulation revisited - mixing periodic and nonperiodic signals, The Fourier transform representation for discrete-time signals, Sampling of continuous-time signals, Reconstruction of continuous-time signals from samples.

The Laplace transform, Definition, Convergence Properties, Inversion, Solving Differential Equations, Transform analysis of Systems.

EEE 3109	**Electronic Devices**	**3 Credits, 3 hours/week**

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.

Third Year (Semester II)

EEE 3201	Power System I	3 Credits, 3 hours/week

Network representation: Single line and reactance diagram of power system and per unit. Line representation: equivalent circuit of short, medium and long lines. Load flow: Gauss- Siedel and Newton Raphson Methods.

Power flow control: Tap changing transformer, phase shifting, booster and regulating transformer and shunt capacitor.

Fault analysis: Short circuit current and reactance of a synchronous machine. Symmetrical fault calculation methods: symmetrical components, sequence networks and unsymmetrical fault calculation.

Protection: Introduction to relays, differential protection and distance protection. Introduction to circuit breakers. Typical layout of a substation.

Load curves: Demand factor, diversity factor, load duration curves, energy load curve, load factor, capacity factor and plant factor.

EEE 3202	Power System I Laboratory	1.5 Credits, 3 hours/week

Laboratory based on **EEE 3201** theory course.

EEE 3203	Digital Signal Processing	3 Credits, 3 hours/week

Introduction: Signals, Systems and Signal Processing, Classification of Signals, Analog-to-Digital and Digital-to-Analog Conversion.

Discrete Time Signals and Systems: Discrete Time Signals, Discrete Time Systems, Analysis of Discrete Time Linear Time-Invariant Systems, Discrete Time Systems Described by Difference Equations, Correlation of Discrete-Time Signals

The Z-Transform: The z-transform, properties of z-Transform, Rational z-Transform, Inversion of z-transform, One-sided z-transform, Analysis of Linear Time-Invariant Systems in the z-Domain.

Frequency Analysis of Signals and Systems: Frequency Analysis of Discrete-Time Signals, Properties of the Fourier Transform for Discrete Time Signals, Frequency Domain Characteristics of Linear Time Invariant Systems.

Discrete Fourier Transform: Frequency Domain Sampling: The Discrete Fourier Transform, Properties of the DFT, Frequency Analysis of Signals Using DFT

Fast Fourier Transform: FFT Algorithms, Application of FFT Algorithms, Quantization Effects in the Computation of the DFT

Digital Filter Design: Structures of FIR and IIR Filters, Design of FIR filters using: windows method, Frequency Sampling Method, Chebyshev Approximation Method, Design of IIR Filters: Impulse Variance, Bilinear Transform, Approximation of Derivatives.

EEE 3204	Digital Signal Processing Laboratory	1.5 Credits, 3 hours/week

Laboratory based on **EEE 3203** theory course.

EEE 3205	Electrical Services Design and Drafting	3 Credits, 3 hours/week

Wiring system design, drafting, 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 32**	Optoelectronics (EEE 3231)	3 Credits, 3 hours/week

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 in radiation.

Properties of light: Light waves in Homogeneous Medium, Refractive index, Optical resonators, Diffraction grating.

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.

Semiconductor Lasers: Population inversion in degenerate semiconductors, laser cavity, operating wavelength, threshold current density, power output, hetero-junction lasers, optical and electrical confinement. Introduction to quantum well lasers, Single frequency solid state lasers, VCSELs.

Photo-detectors: Photoconductors, junction photo-detectors, PIN detectors, avalanche photodiodes and phototransistors.

Solar cells: Solar energy and spectrum, photovoltaic device principles, I-V characteristics, Equivalent circuit, Thin film solar cell, Solar cells materials, devices and efficiencies, Heterojunction solar cell, Tandem solar cell.

Modulation of light: Phase and amplitude modulation, electro-optic effect, acousto-optic effect and magneto-optic devices. Introduction to integrated optics.

EEE 32**	**Telecommunication Network (EEE 3241)**	**3 Credits, 3 hours/week**

Introduction: Basic concept of electricity for communication, Electrical Signals, Transmission of electrical signals – wire pair, co-axial cable, optical fiber cable, radio transmission; Voice and data transmission, Impairments to voice transmission – amplitude distortion, phase distortion, noise; Simple telephone communication, Subscriber's line circuit, two-wire and four-wire

transmission, Basic switching system, Conventional analog switching, Types of electromechanical switches – Strowger and Crossbar switch.

Pulse and digital signals: Pulse Amplitude Modulation (PAM), Pulse code modulation (PCM), Delta modulation (DM), Adaptive delta modulation (ADM), Delta-Sigma Modulation, Differential PCM (DPCM), Adaptive DPCM (ADPCM). Digitization of Voice; Multiplexing techniques- TDM and FDM; Digital signal hierarchies in telephone systems – DS0, DS1, DS3, E1, E2, E3, etc.

Signal Switching: Stored program control, Centralized SPC, Distributed SPC, Software architecture, Application software, Enhanced services, Two-stage network, Three-stage network, n-stage network. Concepts of TDM, Basic time division space switching, Basic time division time switching, Time multiplexed space switching, Time-multiplexed time switching, Combination switching, Three-stage combination switching, n-stage combination switching.

Switching Systems: Principles of common control, touch tone dial telephone, Crosspoint technology, No. 1 ESS, Japanese D-10, Metaconta.

Telephone Networks: Subscriber loop systems, Switching hierarchy and routing, Transmission plan, Transmission systems, Numbering plan, Charging plan, Signaling techniques, Inchannel signaling, Common channel signaling, Digital loop carrier – versions of DSL.

Integrated Services Digital Network: Motivation for ISDN, New services, Network and protocol architecture, Transmission channels, User-network interfaces, Signaling, Numbering and addressing, Service characterization, Inter working, ISDN standards, Expert Systems in ISDN, Broadband ISDN, Voice data integration.

CCITT Signaling System No. 7 (SS7): Overview of SS 7 architecture, Relationship to OSI, Layer 1, 2 and 3; Signaling network structure, Signaling performance, Numbering plan, Signaling connection control part (SCCP), User part.

EEE	**Electromechanical Energy Conversion III**	**3 Credits, 3**

32**	**(EEE 3251)**	**hours/week**

Special machines: series universal motor, permanent magnet DC motor, unipolar and bipolar brush less DC motors, stepper motor and control circuits. Reluctance and hysteresis motors with drive circuits, switched reluctance motor, electro static motor, repulsion motor, synchronous and control transformers. Permanent magnet synchronous motors.

Acyclic machines: Generators, conduction pump and induction pump. Magneto hydrodynamic generators. Fuel Cells, thermoelectric generators, flywheels. Vector control, linear motors and traction.

Photovoltaic systems: stand alone and grid interfaced.
Wind turbine generators: induction generator, AC-DC-AC conversion.

CSE 32**	**Computer Organization Architecture (CSE 3261)**	**3 Credits, 3 hours/week**

The Computer System: Organization, structure, and functions, System buses, interconnection structures (Bus structure and bus types).

The Memory System: Memory system overview, Internal and external memory, Memory chip organization and error correction, Cache memory and its mapping functions, Virtual memory management, Memory storage devices

Input/Output: I/O devices, I/O modules, programmed and interrupt-driven I/O, direct memory access (DMA).

CPU/ALU: Integer and floating point arithmetic, Signed operand multiplication, Fast multipliers, Instruction sets, Types of operands, Addressing modes, CPU structure and functions, Process organization, Register organization, Instruction cycle, Instruction pipelining; Arithmetic and Logic Unit (ALU), Bit Sliced ALU.

Control Unit: Micro-operations, Hardwired control unit, Control unit operation, Micro-instruction sequencing and execution, Grouping of signals, Micro-programmed control unit, Microprogram sequencing.

High Performance Computer Systems: Techniques to achieve high performance, RISC, CISC, introduction to superscalar processor, parallel processor, array processor, multi-programming, Vector processing, Fault tolerant computing, High performance scientific computing.

GED 3201	**Financial Accounting and Cost Management**	**3 Credits, 3 hours/week**

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

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

IPE 3201	**Industrial Management**	**3 Credits, 3 hours/week**

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

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

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

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

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

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

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

Fourth Year (Semester-I)

EEE 4101	**Power Electronics**	**3 Credits, 3 hours/week**

Power Electronics Systems: Power electronics system, Power electronics versus linear electronics, Power semiconductor devices (application perspective): Power diode, Power Transistor, Thyristor, SCR, DIAC, TRIAC, GTO, MOSFET, IGBT, SIT.

Power Electronic Converters: Fixed output voltage and phase controlled AC/DC converters, single phase, three phase, semi/full, Analysis and performance with passive load, Dual converters, Power factor movement and forced commutation angle, PWM control.

DC/DC Converters: Chopper regulators, Step-up, Step-down, Chopper classification, Switch mode regulators, Thyristor chopper circuits.

Cyclo-Converters (Frequency Converters): Single phase, Three-phase and AC voltage converters with PWM.

DC/AC Inverters: PWM, Resonant pulse inverters, Push-pull inverters, Transformer-less inverters, MPPT, Grid-interactive inverters, Switch utilization in inverters, PV inverters.

Industrial Electronics: Magnetic amplifier and its applications, Control of temperature and other non-electric quantities, Elements of microprocessor based control system for industries.

Motor Devices: DC and AC motor devices, Speed and position control of DC motors, Microprocessor based motor drive.

Industrial Heating: Resistive heating, High frequency heating, Induction heating, Dielectric heating and its use and applications, Servo mechanism, Closed loop control system, Polyphase rectifier.

PLC: Controllers, Hardware, Internal architecture, Programming, Testing and debugging, Commercial PLC.

EEE 4102	**Power Electronics Laboratory**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 4101** theory course.

EEE 4103	**Control System I**	**3 Credits, 3 hours/week**

Introduction: Introduction to control systems, Definitions and Mathematical background.

Writing System Equations: State concepts, Transfer function and block diagram, Mechanical translation systems, Mechanical rotational systems.

Solution of Differential Equations: Standard inputs to Control systems, Steady-state response and transient response.

Laplace Transform: Definition, Laplace transform theorems, Application of the Laplace transforms to differential equations, Inverse transformation, Heavi-side partial-fraction expansion theorems.

System Representation: Block diagrams, Determination of the **overall transfer function, Standard block diagram terminology**, Simulation diagrams, Signal flow graphs.

Control System Characteristics: Routh-Hurwitz stability criterion, Feedback system types, Analysis of system types, Steady-Mate error coefficients, Non unity-feedback system.

Root Locus: Plotting roots of a characteristics equation, Qualitative analysis of the root locus, Op-M-loop transfer function, Poles of the control ratio, Applications Of the magnitude and angle condition.

Frequency Response: Correlation of the sinusoidal. and time responses, Frequency response curves, Bude plots (Logarithmic plots), Geiser ;1frequency transfer function relationship, Nyquist's criterion, definitions of phase margin and their relation to stability.

Root Locus compensation Design: Introduction to design, transient response dominant complex poles, additional significant poles, ideal integral cascade compensation (PI controller), Ideal derivative cascade compensation (FD controller), FID controller, Introduction to feedback compensation.

Introduction Digital Control systems: Introduction, sampling, ideal sampling z-transform theorems, synthesis in the z-domain (direct method), the inverse z-transform, zero-order hold, analog controller design, basics of digital control, representation of digital control systems in s-plane and z-plane, interpretation of pole-zero maps in z-plane, frequency-folding effects, digital design by emulation.

EEE 4104	**Control System I Laboratory**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 4103** theory course.

EEE 4105	**Material Science**	**3 Credits, 3 hours/week**

Structural Properties: Crystalline, amorphous, composite, fibrous, polymers, mastics, binding forces, Elastic properties, dislocations, defects.

Thermal and Electrical Properties: Specific heat, Thermal expansion, Thermal conductivity Electrical conductivity of metals.

Dielectric properties of solids: Basic relationship and parameters, Modes of dielectric polarization, Experimental methods and results, Ferro electricity, Piezo Electricity.

Optical properties of solids: Classical theory, Semi-classical theory, Free carrier effects, Lattice absorption, Electronic absorption.

Magnetic properties of solid: Atomic magnetic moments, Dia- and Para magnetism, Ferromagnetism, Anti-ferromagnetism and Ferri-magnetism, Magnetic resonance.

Superconductivity: Superconductivity of material, type-1, type-2 superconductors and some applications.

Nonlinear Optics: Laser Characteristics, second harmonic generation and optical mixing, parametric amplification.

EEE 41**	**Analog Integrated Circuit (EEE 4131)**	**3 Credits, 3 hours/week**

Review of FET amplifiers: Passive and active loads and frequency limitation. Current mirror: Basic, cascode and active current mirror.

Differential Amplifier: Introduction, large and small signal analysis, common mode analysis and differential amplifier with active load.

Noise: Introduction to noise, types, representation in circuits, noise in single stage and differential amplifiers and bandwidth.

Biasing: Supply voltage independent biasing, temperature independent biasing, proportional to absolute temperature current generation and constant transconductance biasing.

Switch capacitor circuits: Sampling switches, switched capacitor circuits including unity gain buffer, amplifier and integrator.

Phase Locked Loop (PLL): Introduction, basic PLL and charge pumped PLL.

EEE 41**	**Radio and Television Engineering (EEE 4141)**	**3 Credits, 3 hours/week**

Introduction: The communication process, Sources of information, Communication networks, Communication channels, Analog and digital type of communication; Radio frequency spectrum, Propagation of radio signals; Noise in communication channel: Shot noise, Thermal noise, White noise, Gain in decibel, Signal to noise ratio.

Analog Communication System:Amplitude modulation (AM), AM broadcast technical standards, Double sideband suppressed carrier (DSBSC), Single sideband suppressed carrier (SSB), Vestigial sideband (VSB), Phase modulation (PM) and frequency modulation (FM), Envelop detector, Product modulator, AM transmitter (AM modulator), AM demodulator, Superheterodyne receiver, FM transmitters and recivers. Comparison of AM and FM receivers, Noise in receiver, Noise limiting circuits. AGC circuits, Receiver sensitivity, Cross modulation, spurious response converters, Detector and modulation circuits.

Digital Modulation Techniques: Digital passband transmission, Amplitude Shift Keying (ASK), Phase Shift Keying (PSK), Differential PSK (DPSK), Frequency Shift Keying (FSK), Quadrature Amplitude Modulation (QAM), MSK, GMSK, M-Ary modulation techniques, Spread spectrum modulation techniques, DSSS, FHSS.

Fundamentals of TV: Analysis and synthesis of TV picture, Scanning, Standard scanning pattern, Synchronization, Blanking pulses, Composite video signal, Color video signals, Matrix circuits, Colourplexed composite video signal, Signal transmission, TV channels, Channel bandwidth.

TV Camera: Storage type camera tubes: Non-storage type camera tubes; Iconoscope; Image orthicon, Vidicon, Plumbicon, Colour TV camera and other types of camera tubes.

TV Receiver & Transmitter: Fundamentals of TV receiver, Picture tubes, Deflection circuit, High voltage power supply, Colour picture tube, Folded dipole with directors and reflectors for TV receiver, TV Transmitter and TV studio design.

Digital Television and Video: Video Digitization formats – the 4:2:2 formats, 4:2:0 format, Source Intermediate Format (SIF), Common Intermediate Format (CIF).

EEE 41**	**Power System II(EEE 4151)**	**3 Credits, 3 hours/week**

Transmission lines cables: overhead and underground. Stability: swing equation, power angle equation, equal area criterion, multi-machine system, step by step solution of swing equation. Factors affecting stability. Reactive power compensation. Flexible AC transmission system (FACTS). High voltage DC transmission system. Power quality: harmonics, sag and swell.

CSE 41**	**Database System (CSE 4161)**	**3 Credits, 3 hours/week**

Introduction: General overview and purpose of DBMS, advantages, applications, common features and overall structure of the database.

Data modeling:Relational model: structure of relational model, key constraints, referential integrity constraints, general constraints, relational algebra – fundamental, additional and extended operations, aggregate functions, outer joins and database modification using RA. ER model: entity and relationship sets, constraints – key, mapping cardinality and participation constraints, strong and weak entity sets, E-R diagram, class hierarchies, aggregation, conceptual database design with the ER

model, converting ER to relational model, Object-relational data model: complex data types, structured types and inheritance, implementing O-R features.

Relational database design: Features of good relational design, functional dependency theory - basic concept, uses, closure of a set of FDs, closure of attribute sets, canonical cover, algorithms for FDs, decomposition using FDs & its desirable properties, atomic domains and first normal form, BCNF and 3NF, multivalued dependencies and fourth normal form, decomposition algorithms for different normal forms, database design process.

Database application development: Database Management Systems (DBMSs), SQL: data definition and data manipulation languages, integrity constraints, basic queries, nested and complex queries, modification of the database, Views: definition, update on views, cursors, Extending DBMS functionality: stored procedures, assertions and triggers, embedded and dynamic SQL, DBMS administration: DBA, users, privileges, security, performance, ODBC, JDBC, Web/Database architectures.

DBMS implementation technology: Storage and file structure: different storage types, file and record organization, data dictionary storage, Indexing and hashing: basic concepts, ordered indices, B+-tree index files, B-tree index files, static & dynamic hashing, comparison of ordered indexing & hashing.

Query processing: overview, measures of query costs, selection operation, sorting, join operation, other operations, evaluation of expressions. Query optimization: Introduction, transformation of relational expressions, evaluation plan.

Transaction processing: Transactions: concepts, ACID properties, transaction states, concurrent schedules, serializability - conflict and view serializability, recoverability, Concurrency control: lock-based concurrency control, two-phase locking, problems with

locking, locking and starvation, deadlock – prevention, detection and recovery.

Introduction to modern database systems: object-relational databases, deductive databases, spatial databases, temporal databases, multimedia databases, mobile databases and advanced relational databases.

Fourth Year (Semester-II)

EEE 42**	**VLSI I (EEE 4233)**	**3 Credits, 3 hours/week**

VLSI technology: Top down design approach, technology trends and design styles.

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

CMOS circuit characteristics and performance estimation: Resistance, capacitance, rise and fall times, delay, gate transistor sizing and power consumption.

CMOS circuit and logic design: Layout design rules and physical design of simple logic gates.

CMOS subsystem design: Adders, multiplier and memory system, arithmetic logic unit.

Programmable logic arrays. I/O systems. VLSI testing.

EEE 42**	**VLSI I Laboratory (EEE 4234)**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 4233** theory course.

EEE 42**	**Microwave and Satellite Communication (EEE 4243)**	**3 Credits, 3 hours/week**

Microwave generation: Klystrons, Reflex Klystrons, Magnetrons and other devices, Microwave tubes, Microwave components, Microwave measurements, power, frequency, wavelength, microwave transmission media, Anisotropy media, impedance, Hollow, surface wave, dielectric waveguide, waves on a transmission line, standing wave ration, quarter wave transformers.

Micro-strip lines: wave propagation and micro-strip lines, dielectric constants, characteristic impedance, attenuation factors.

Microwave Circuit Design: Low frequency parameters, s-, y-, z-, h-parameter, ABCD parameters, transmission matrix, passive circuit design, the Smith Chart, mixer design, microwave control circuit design, wireless microwave systems, noise in microwave circuits, Microwave IC, HMICs, MMICs.

Microwave Engineering for wireless system: Microwave networks, Active networks, Design of matching networks, Noise, Microwave link, Rectifier and Detector Design, Frequency and Modulation Techniques, Transmitting and Receiving Equipment.

Satellite Communication: Introduction, Orbits, station keeping, satellite altitude, transmission path, path loss, noise consideration, satellite system, saturation flux density, effective isotropic radiated power, multiple access methods, earth station antenna, satellite link design, frequency plan, satellite communication for Internet, VSAT network, One-way, two-way and open-sky satellite communication, GNSS-GPS and Galileo systems and GIS, Satellite Navigation, DBS-TV.

Radar: Basic principles, Radar equation, factors influencing maximum range, effect of noise, power and frequencies used in Radar, types of Radar, Basic pulsed Radar system, Modulators, receivers, Bandwidth requirements, factors governing pulse characteristics, Duplexer, moving target indicator (MTI), tracking Radar systems and search systems.

EEE 42**	**Microwave and Satellite Communication Laboratory (EEE 4244)**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 4243** theory course.

EEE 42**	**Power System Protection (EEE 4253)**	**3 Credits, 3 hours/week**

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. Instrument transformers: CT and PT. Electromechanical, electronic and digital Relays: basic modules, over current, differential, distance and directional. Trip circuits.

Unit protection schemes: Generator, transformer, motor, bus bar, transmission and distribution lines. Miniature circuit breakers and fuses.

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

EEE 42**	**Power System Protection Laboratory (EEE 4254)**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 4253** theory course.

CSE 42**	**Microcontroller Based System Design (CSE 4263)**	**3 Credits, 3 hours/week**

What is microcontroller, Comparison between microcontroller and microprocessor, Microcontroller of different manufacturers, Classification of microcontrollers according to their capacity; PIC16F84, Block diagram, Architecture, Memory organization, Special purpose registers, I/O ports, Instruction set of PIC16F84, Programming, Simulation using MPLAB, Microcontrollers with internal ADC and DAC, Some practical examples.

CSE 42**	**Microcontroller Based System Design Laboratory (CSE 4264)**	**1.5 Credits, 3 hours/week**

Laboratory based on **CSE 4263** theory course.

EEE	**Semiconductor Technology (EEE 4231)**	**3 Credits, 3**

42**		hours/week

Physics of Semiconductor: Intrinsic and extrinsic semiconductor, Compound Hetrosturcture Semiconductors, Group III-V, III-nitride and II-V semiconductors, Band gap Engineering.

Vacuum Science and Plasma: Production of Vacuum, Pressure ranges and Vacuum Pumps: Ion Pump, Oil Free Pump, Turbo Molecular Pump, Vacuum Seals and Pressure Measurements, The DC Glow Discharge and RF Discharge, High-Density Plasma,

Crystal Growth Technology: Phase Diagram and Solid Solubility, Metallurgical Grade and Electronic Grade of Growth, Purification of Grown Crystals, Czhorkralski method, Wafer Preparation and Specifications, Shaping of Wafers, Solution growth, sol gel method, traveling heater method, zone processes: Zone refining and zone leveling, polysilicon and amorphous silicon deposition.

Epitaxial growth: Epitaxy, Gas Kinetics, Vapor Phase Epitaxy, Molecular Beam Epitaxy, Metal Organic Chemical Vapor Deposition, Organo Metallic Vapor Phase Epitaxy, HVPE, Gas Source MBE and Chemical Beam Epitaxy, Atomic Layer Deposition.

Clean Room: Clean room technology and contamination control, impurities control, Classification of Clean Room, Design Strategy and construction of Clean Room.

Wafer Fabrication Technology: Preparation of Wafers: Scribing, Chemical Mechanical Polishing, Cleaning and Inspection of Wafers.

EEE 42**	Digital Image Processing (EEE 4241)	3 Credits, 3 hours/week

Introduction, Image Representation, Brightness adaption and discrimination, Pixels, Coordinate conventions, Imaging Geometry, Perspective Projection, Image acquisition and digitization, Human visible system/ perception, Image Quality, Intensity Transformations and Spatial Filtering, Filtering in Frequency Domain, Image Restoration, Image Segmentation, Color Image Processing, Image Transformation, Image Compression.

EEE 42**	Power System Operation and Control (EEE 4251)	3 Credits, 3 hours/week

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.

CSE 42**	Multimedia Communication (CSE 4261)	3 Credits, 3 hours/week

Types of media. Multimedia signal characteristic: sampling, digital representation, signal formats.

Signal coding and compression: entropy coding, transform coding, vector quantization. Coding standards: H.26x, LPEG, MPEG.

Multimedia communication networks: network topologies and layers, LAN, MAN, WAN, PSTN, ISDN, ATM, internetworking devices, the internet and access technologies, enterprise networks, wireless LANs and wireless multimedia. Entertainment networks: cable, satellite and terrestrial TV networks, ADSL and VDSL, high speed modems.

Transport protocols: TCP, UDP, IP, Ipv4, Ipv6, FTP, RTP and RTCP, use of MPLS and WDMA. Multimedia synchronization, security, QoS and resource management.

Multimedia applications: The WWW, Internet telephony, teleconferencing, HDTV, email and e-commerce.

EEE 42**	Nanoscience and Technology (EEE 4233)	3 Credits, 3 hours/week

Introduction of Quantum Mechanics, Statistical Machanics, Chemical Kinetics, Classical equilibrium thermodynamics and modern nanothermodynamics.

Interactions at the Nanoscale: Bonding considerations at the nanoscale, electrostatic interactions, hydrogen bonding, Van der Waals attractions, hydrophobic Effect.

Physics of nano-structured materials: Zero-dimensional materials, one-dimensional materials, two-dimensional Materials, hierarchical Structures, quantum size effects and scaling Laws.

Quantum confinement: 2-DEG, QWs, QDs, coupled wells, nanowires and nanotubes.

Photonics: Semiconductor Lasers, single photon devices, optical fibers, non-linear optical effects. Solitons. Introduction to Spintronics.

Microscopy and tools: Electron microscopy, STM, AFM, nano measurement technique.

Making nanostructures: Top-down and bottom-up. Self-assembled nanostructures in nature and industry, physics-based experimental approaches to nanofabrication and nanotechnology, quantum technologies based on magnetism, electron spin, superconductivity, Micro- and nano-electromechanical systems (MEMS and NEMS): fabrication; mechanical properties of MEMS and NEMS; accelerometers; motors; gyroscopes.

EEE 42**	Digital Communication (EEE 4243)	3 Credits, 3 hours/week

Introduction: Communication channels, mathematical model and characteristics. Probability and stochastic processes.

Source coding: Mathematical models of information, entropy, Huffman code and linear predictive coding.

Digital transmission system: Base band digital transmission, inter-symbol interference, bandwidth, power efficiency, modulation and coding trade-off.

Receiver for AWGN channels: Correlation demodulator, matched filter demodulator and maximum likelihood receiver.

Channel capacity and coding: Channel models and capacities and random selection of codes. Block codes and conventional codes: Linear block codes, convolution codes and coded modulation. Spread spectrum signals and system.

EEE 42**	Power Plant Engineering (EEE 4253)	3 Credits, 3 hours/week

Power plants: general layout and principles, steam turbine, gas turbine, combined cycle gas turbine, hydro and nuclear. Power plant instrumentation.

Selection of location: Technical, economical and environmental factors. Load forecasting.

Generation scheduling: deterministic and probabilistic. Electricity tariff: formulation and types.

CSE 42**	Intelligent System (CSE 4263)	3 Credits, 3 hours/week

Overview of Al, AI programming language: prolog, Environment Types, Agent Types, Agent Model, Reactive Agents, Perception: Neurons – Biological and Artificial, Perceptron Learning, Linear Separability, Multi-Layer Networks,Problem solving and searching: 8-puzzle problem, N-queen problem, robotic arm assembly, general search, Review of Un-Informed Search Strategies: bredth first search, uniform cost search, depth-first search, iterative deepening, bidirectional search; Informed search algorithms: best-first search, A* search, Beam search, Huristic searching, Memory Bounded Search (e.g. IDA*, RBFS, SMA*); Local Searches: Hill Climbing, Simulated Annealing, Constraint Satisfaction Problems. Genetic Algorithm. Motion planning: motion planning search, configuration, action and obstacle, Road map, Game Playing: motivation, minimax search, resource limits and heuristic evaluation, α-β pruning, stochastic games, partially observable games, continuous, embodied games, Neural Networks: Multi-Layer Neural Networks, Backpropagation, Variations on Backprop, Cross Entropy, Weight Decay, Momentum, Training Tips, Applications ALVINN, TD-Gammon, Machine Learning: Supervised Learning, Decision Trees, Reinforcement Learning, Exploration vs. Exploitation, Q-Learning, Temporal Difference learning, General concepts of knowledge, Knowledge representation, frame problem, representing time, events and actions, Utility and MEU, Value of Information, Decision Networks, Value Iteration algorithm,

Partially Observable Markov Decision Process, Introduction to Game Theory. Logical Agent: Knowledge-based agents, Logic in general—models and entailment, Propositional (Boolean) logic, Equivalence, validity, satisfiability, Inference rules and theorem proving -- forward chaining, backward chaining, resolution, First order Logic: Universal and Existential Quantifiers, Keeping Track of Change, Inference in first order logic Planning, Situation Calculus, Belief Networks Probabilistic Reasoning, Hidden Markov Model and the Dynamic Bayesian Network. Logical Inference, Communication, Robotics

EEE 42**	**VLSI II (EEE 4235)**	**3 Credits, 3 hours/week**

VLSI MOS system design: Layout extraction and verification, full and semi-full custom design styles and logical and physical positioning.
Design entry tools: Schematic capture and HDL. Logic and switch level simulation. Static timing. Concepts and tools of analysis, solution techniques for floor planning, placement, global routing and detailed routing. Application specific integrated circuit design including FPGA.

EEE 42**	**VLSI II Laboratory (EEE 4236)**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 4235** theory course.

EEE 42**	**Optical Fiber Communication (EEE 4245)**	**3 Credits, 3 hours/week**

Introduction: Optical fibers; Structure, Step-index and graded-index fibers, Modes of propagation, modal theory for circular waveguide, Modal equations, Waveguide equations, Power flow in optical fibers, Signal degradation in optical fibers, Fiber attenuation, Distortion in optical guides, Dispersions, Mode coupling.

Optical Sources and Detectors: Light emitting diode (LED) and semiconductor laser diode (SLD), Structures, Modulation capability, Transient response, Power

bandwidth product, Modal noise, Temperature Effects and reliability; p-i-n and avalanche photodetectors, Structures, Principles of operations.

Optical modulation and detection schemes, Direct and coherent detection receivers: configuration, operation, noise sources, sensitivity calculation, performance curves, Optical Amplifiers, Design of analog and digital receivers.

Wavelength Division Multiplexing (WDM), Dense Wavelength Division Multiplexing (DWDM) and Optical frequency division multiplexing (OFDM) transmission schemes.

Optical data coding, links, power budget. Optical data buses, optical networks, Fiber Distributed Data Interface (FDDI) and Synchronous Optical Network (SONET)/SDH.

EEE 42**	**Optical Fiber Communication Laboratory (EEE 4246)**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 4245** theory course.

EEE 42**	**High Voltage Engineering (EEE 4255)**	**3 Credits, 3 hours/week**

High voltage DC: Rectifier circuits, voltage multipliers, Van-de-Graaf and electrostatic generators. High voltage AC: Cascaded transformers and Tesla coils. Impulse voltage: Shapes, mathematical analysis, codes and standards, single and multi-stage impulse generators, tripping and control of impulse generators. Breakdown in gas, liquid and solid dielectric materials. Corona. High voltage measurements and testing. Over-voltage phenomenon and insulation coordination. Lightning and switching surges, basic insulation level, surge diverters and arresters.

EEE 42**	**High Voltage Engineering Laboratory(EEE 4256)**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 4255** theory course.

CSE 42**	Computer Network (CSE 4265)	3 Credits, 3 hours/week

Data Communication Networking: Data communication model, Network topologies, Protocol layer architecture, OSI reference architecture, TCP/IP reference architecture, Local area network (LAN), metropolitan area network (MAN) and wide area network (WAN), Circuit switching versus packet switching, Datagram and virtual circuits, LAN, MAN and WAN standards, Network Interconnections – bridges, hubs, switches, routers and gateways.

Physical Layer and Media: Analog and digital data transmission, Spectrum and bandwidth, Data rate and channel capacity, Transmission impairments; Twisted-pair, Co-axial and Fiber-optic cable, Wireless media; Multiplexing – Frequency division multiplexing, International FDR carrier standards, Synchronous time division multiplexing (TDM) and international TDR carrier standards, Statistical TDM and wavelength division multiplexing; Digital data, digital signals: Signal encoding schemes – NRZ, NRZ-L, NRZI, Bipolar-AMI and pseudoternary, Manchester and differential Manchester, B8ZS, HDB3, etc.

Data Link Layer: Asynchronous and synchronous transmission, Flow control and error control, Data link layer protocols – Stop-and-wait flow control, Sliding window flow control, Stop-and-wait ARQ, Go back N ARQ, selective repeat ARQ; Error detection and error correction, HDLC, PPP; Medium Access Control (MAC) Sublayer: Multiple access protocols – ALOHA, CSMA, CSMA/CD, Binary exponential backoff algorithm, MACA; IEEE802.2 LLC.

Network standards: IEEE 802.3 (Ethernet) specifications, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet; IEEE802.11 (WiFi) protocol architecture, Physical layer, MAC sublayer; IEEE 802.16 (WiMAX) Standard; Frame relay, ATM.

Network Layer: Network layer design issues – Store and forward packet switching, Implementation of connectionless service, Implementation of connection-oriented service; Routing algorithms – The optimality principle, Shortest path routing, Flooding, Distance vector routing, Link state routing, Broadcast and multicast routing, Routing in ad-hoc networks; Congestion

control, QoS; Network layer in the Internet – the Internet Protocol (IP), IP address, IPv4, IPv6, Mobile IP, Internet control protocols – ICMP, ARP, RARP, DHCP; OSPF, BGP.

Transport Layer: The transport service, UDP, TCP, TCP congestion control.

Network Security: Introduction to network security, Encryption – DES, AES, Public key encryption and digital signatures, IP security, Authentication protocols.

CSE 42**	Computer Network Laboratory (CSE 4266)	1.5 Credits, 3 hours/week

Laboratory based on **CSE 4265** theory course.

EEE 42**	Semiconductor Heterostructures (EEE 4237)	3 Credits, 3 hours/week

Compound semiconductor: Zinc-blend crystal structures, growth techniques, alloys, band gap, density of carriers in intrinsic and doped compound semiconductors.

Hetero-Junctions: Band alignment, band offset, Anderson's rule, single and double sided hetero-junctions, quantum wells and quantization effects, lattice mismatch and strain and common hetero-structure material systems. Hetero-Junction diode: Band banding, carrier transport and I-V characteristics.

Hetero-junction field effect transistor: Structure and principle, band structure, carrier transport and I-V characteristics.

Hetero-structure bipolar transistor (HBT): Structure and operating principle, quasi-static analysis, extended Gummel-Poon model, Ebers-Moll model, secondary effects and band diagram of a graded alloy base HBT.

EEE 42**	Mobile Cellular Communication (EEE 4247)	3 Credits, 3 hours/week

Evolution and concept of Mobile Radio Communication, Concept of Cellular Mobile System, Generations of Cellular Mobile Systems, Specifications of Analog Cellular systems.

Cellular Mobile System Fundamentals: Frequency reuse and frequency planning, Co-channel interference, Hand off, Traffic intensity, Grade of Service (GOS), Capacity calculation, Trunking efficiency, Cell splitting.

Mobile radio propagation: Propagation characteristics, Multipath propagation, Multipath fading, Delay spread, Doppler shift, Models for radio propagation.

Frequency Management and Channel Assignment: Fundamentals, spectrum utilization, fundamentals of channel assignment, fixed channel assignment, non-fixed channel assignment, traffic and channel assignment, Sectorization.

Handoffs and Dropped Calls: Reasons and types, forced handoffs, mobile assisted handoffs and dropped call rate.

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

Digital Cellular Systems: Concept of TDMA and CDMA; IS-54/136 (NA-TDMA); GSM – GSM system architecture, Protocol layers, GSM air interface specification, IS-95; Mobile Cellular Data Networks: GPRS/EDGE, IMT-2000, UMTS, HSDPA/HSUPA.

EEE 42**	**Power System Reliability (EEE 4257)**	**3 Credits, 3 hours/week**

Review of probability concepts. Probability distribution: Binomial, Poisson, and Normal. Reliability concepts: Failure rate, outage, mean time to failure, series and parallel systems and redundancy. Markov process. Probabilistic generation and load models. Reliability indices: Loss of load probability and loss of energy probability. Frequency and duration. Reliability evaluation techniques of single area system.

CSE 42**	**Simulation and Modeling (CSE 4267)**	**3 Credits, 3 hours/week**

Systems- System environment and System components; System models and Simulation - types of System model and simulation – Discrete and Continues, Static and Dynamic, Deterministic and Stochastic; Discrete Event driven simulation – Components and Organization, Event Scheduling/ Time Advance approach and Process Interaction approach, Event lists and List processing. Basics of Parallel and Distributed Simulation; Simulation Languages and Packages – Process approach to simulation, application oriented and general purpose simulation language and software: GPSS, SSF API for JAVA and C++, Arena, Extend, SIMUL8 etc. Probability and Statistical concepts in simulation – Random variable and its probability distributions, stochastic process – e.g. Poisson process, Non stationary Poisson process, Compound Poisson process and their properties. Basics of Estimation, Hypothesis tests: Confidence Intervals and t-distribution. Queuing Models – Queuing Systems, Queuing behavior (e.g. balk, renege and jockey) and Queuing disciplines, Arrival process, Inter-arrival time distributions and Service time distributions. Long run measures of performance, Little's formula, Analysis of different Single-server and Multi-Server queuing systems, Queuing networks and their analysis, Jackson's theorem; Inverse transformation technique for generating random variates, other techniques: Acceptance–Rejection, Special properties, Convolution etc. Random Number generation: Linear Congruent method, composite generators, Random number streams; Testing for random numbers – frequency test and test for autocorrelation; Input modeling: identifying input model with data – Histograms, Q-Q plots, selecting the family of distribution, parameter estimation and Goodness-of-fit tests; selecting input model without data, multivariate and time-series input models, Models of arrival processes. Verification and Validation of simulation models – face validity, validation of model assumptions, input-out transformation and input output validation using historical input data. Output data analysis – types of simulation with respect to output analysis, stochastic nature of output data, measure of performance and their estimators, output analysis for terminating the simulation and for steady state simulations. Techniques for comparison of alternative system design through simulation.

Simulation and queuing models of computer systems: CPU, memory simulation; Traffic modeling and simulation of computer networks and network protocols, using queuing network analysis.

EEE 42**	Control System II (EEE 4271)	3 Credits, 3 hours/week

Compensation using pole placement technique. State equations of digital systems with sample and hold, state equation of digital systems, digital simulation and approximation. Solution of discrete state equations: by z-transform, state equation and transfer function, state diagrams, state plane analysis. Stability of digital control systems. Digital simulation and digital redesign. Time domain analysis. Frequency domain analysis. Controllability and observability. Optimal linear digital regulator design. Digital state observer. Microprocessor control. Introduction to neural network and fuzzy control, adaptive control, nonlinear control.

EEE 42**	Control System II Laboratory (EEE 4272)	1.5 Credits, 3 hours/week

Laboratory based on **EEE 4271** theory course.

EEE 42**	Measurement and Instrumentation (EEE 4273)	3 Credits, 3 hours/week

Instrument Classification & Characteristics: Instrument classification, Standards, Static Characteristics of Instruments, Dynamic Characteristics of Instruments, Calibration, Choice of Instruments.

Measurement system errors: Introduction, Systemic errors, Random errors, Total measurement of system errors.

Instrument Calibration: Introduction, Process instrument calibration, Standards laboratories, Validation of standards laboratories, primary reference standards, trace ability, Documentation un the work place.

Instrumentation and measurements: Significance and methods of measurements, direct and indirect method, and standard Types of Instruments.

Transducers: Active and passive type, application realms of transducer

Analog Voltmeters: RMS and quasi-responding voltmeters. Average responding voltmeters, Amplifier driven type, D'Arsonvel types, Direct compile type, chopper type, Potentiometric type, Accuracy and error of analog Voltmeters.

Analog Ammeters: Different types of ammeters, Accuracy and error of analog ammeters.

Digital voltmeters: Stair-case ramp type, Successive approximation type, Integrating type, Dual slope integrating type, Delta pulse modulation type.

Oscilloscopes: Single beam, Dual beam, Sampling, and storage types, Conversion of single beam to multi beam oscilloscope. Oscilloscope measurements – Digital signal measurement, FFT measurement, Basic time domain reflectometry.

Signal generators: Sine wave sources , Imperfection in sine wave sources – Frequency accuracy, frequency stability, Amplitude accuracy, Distortion, Spurious responses, Close-in sidebands Sweep frequency generators, Function generators, Pulse generators, RF Signal generators, Frequency synthesizer.

Analyzers: Wave analyzer, Spectrum analyzer: Bank of filters spectrum Analyzers, FFT spectrum Analyzers, Swept spectrum Analyzers, Network analyzers, Distortion Analyzers, RF power measurement, RF power meter.

Analytical instruments: pH meter, Thermal conductivity meters, Gas chromatography, Spectrophotometers and Mass Spectrophotometers.

EEE 42**	Measurement and Instrumentation Laboratory (EEE 4274)	1.5 Credits, 3 hours/week

Laboratory based on **EEE 4273** theory course.

EEE 42**	Medical Instrumentation (EEE 4275)	3 Credits, 3 hours/week

Medical instruments: ECG, EEG, EMG, Blood-dialysis machine, Endoscopy, Blood sugar meter, Blood pressure meter, Analog and digital Pace makers.
Imaging system: X-ray, CT scan, Ultrasonic imaging system, Magnetic imaging system.

EEE 42**	**Medical Instrumentation Laboratory (EEE 4276)**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 4275** theory course.

EEE 42**	**Renewable Energy Technology (EEE 4277)**	**3 Credits, 3 hours/week**

Instruments: Radiation characteristics of materials: Absorptance, Emittance, Reflectance and Selective Surfaces, Modes of heat transfer.

Solar Collectors: Flat plate collectors, Concentrating collectors, Solar distillation, Solar energy systems for process heating, Solar Thermal Power generation and Solar refrigeration, Solar thermal system optimization and performance study, Solar thermal modeling.

Solar Photovoltaic Energy Conversion: Solar cell fundamental, Basic principle, Types of solar cells, P-N junction as photovoltaic cell, Heterojunction, Schottky barrier junction, Fabrication of solar cell, Effect of environment on solar cells, (effect of irradiance once, and effect of temperature), Effect of shading, Thin film solar cell, Multiple sun solar cells, Fabrication of photovoltaic modules and panels, Dimension of cells, Packing efficiency of cells in modules, Characterization of cells and modules, Organic and polymer matrix for the fabrication of solar cell, Nanostructure Solar cell.

Power Conditioning of Photovoltaic System: Batteries, Battery charge controllers. Inverters, Maximum power point trackers (MPPT).

Different types of PV system: Stand-alone PV system. Grid-interconnection PV system and Hybrid system, Design of PV system, Stand alone PV system sizing.

Other Non-conventional Energy Options: Wind, Geothermal, OTEC, Wave energy, Biomass, MHD, Chemical energy, Fuel cell, Nuclear fusion.

EEE 42**	**Renewable Energy Technology Laboratory (EEE 4278)**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 4277** theory course.

EEE 42**	**Numerical Method for Engineering (EEE 4279)**	**3 Credits, 3 hours/week**

Introduction: Motivation and errors in numerical techniques. Taylor series.

Finite difference calculus: Forward, backward, divided, and central difference and difference of a polynomial.

Interpolation: 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 of matrices, Gauss elimination, Gauss-Jordan method, factorization and Gauss-Siedel iteration methods.

Curve Fitting: Linear and polynomial regression, fitting power, exponential and trigonometric functions.

Ordinary differential equations: Initial value problem, Taylor's series method, Picard's method of successive approximation, Euler's method and Runge Kutta method. Boundary value problems

Numerical integration: general quadrature formula, trapezoidal rule and Simpson's rule.

Numerical differentiation.

EEE 42**	**Numerical Method for Engineering Laboratory (EEE 4280)**	**1.5 Credits, 3 hours/week**

Laboratory based on **EEE 4279** theory course.

EEE 42**	High Performance Computing and Parallel Processing (EEE 4281)	3 Credits, 3 hours/week

Parallel Processing Concepts: Levels of parallelism（instruction, transaction, task, thread, memory, function）. Models（SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation etc）. Architectures: N-wide superscalar architectures, multi-core, multi-threaded.

Parallel Programming with CUDA: Processor Architecture, Interconnect, Communication, Memory Organization, and Programming Models in high performance computing architectures: （Examples: IBM CELL BE, Nvidia Tesla GPU, Intel Larrabee Microarchitecture and Intel Nehalem microarchitecture）. Memory hierarchy and transaction specific memory design. Thread Organization.

Fundamental Design Issues in Parallel Computing: Synchronization, Scheduling, Job Allocation, Job Partitioning, Dependency Analysis, Mapping Parallel Algorithms onto Parallel Architectures, Performance Analysis of Parallel Algorithms.

Fundamental Limitations Facing Parallel Computing: Bandwidth Limitations, Latency Limitations, Latency Hiding/Tolerating Techniques and their limitations.

Power-Aware Computing and Communication: Power-aware Processing Techniques, Power-aware Memory Design, Power-aware Interconnect Design, Software Power Management.

Advanced Topics: Petascale Computing, Optics in Parallel Computing, Quantum Computers, Recent developments in Nanotechnology and its impact on HPC.

EEE 42**	High Performance Computing and Parallel Processing Laboratory (EEE 4282)	1.5 Credits, 3 hours/week

Laboratory based on **EEE 4281** theory course.

GED 4201	Professional Ethics	3 Credits, 3 hours/week

Definition and scopes of Ethics: Different branches of Ethics. Social change and the emergence of new technologies. History and development of Engineering Ethics. Science and Technology- necessity and application. Study of Ethics in Engineering. Applied Ethics in engineering.

Human qualities of an engineer: Obligation of an engineer to the clients. Attitude of an engineer to other engineers. Measures to be taken in order to improve the quality of engineering profession.

Ethical Expectations: Employers and Employees; inter-professional relationship: Professional Organization- maintaining a commitment of Ethical standards. Desired characteristics of a professional code. Institutionalization of Ethical conduct.

GED 4203	Bangladesh Studies	3 Credits, 3 hours/week

Introduction: Historical Background of Bangladesh, Ancient Bengal, the Medieval Bengal, Moghal Period, British rule in Bangladesh, Pakistan Period, Emergence of Bangladesh.

Cultural development: Development of Bengali cinema, Drama, Literature movement, Socio-cultural development in recent Bangladesh.

Liberation War and Emergence of Bangladesh: Primary stage of liberation, language movement, Declaration of Independence, Freedom fighting, Genocides during Liberation period, Freedom fighters and their contributions for Independence, Birshresto and other award winners during Liberation time, Day of Independence and Bijoy Dibash, Rule of Foreign for Independence of Bangladesh, Legislature, Judiciary system.

Structure of activity of government: constitution of Bangladesh, Reconstructions and rehabilitations works, Economic constrains during early

days, Rule of Donors to activate country's economic and other development activities.

Geophysical condition: Position of Bangladesh in Global map, Current District and Thana administrations and locations, Rivers in Bangladesh and their importance, flood situation and waterflow system.

Industrial Development: Introduction of Industries, structure of Industries, success and failure history, development of manufacturing sector, export development, developing agencies, Industrial export-import policies of Bangladesh.

Educational Development: Education structure in primitive and present situation, educational policies, crisis of implementation, literacy rate, current situation of educational environment in Bangladesh, human resource development trends and manpower export from Bangladesh, computer literacy.

Rural and Urban Development: Rural situation during early days and latest condition, migration of rural people to urban area, economic and other gaps of rural and urban peoples, rural and urban communications, minimization gaps of rural and urban peoples, sanitation system, health care and education level, economic and manufacturing levels and life style of urban and rural area, religious activities in Bangladesh and the moral values.

Economic activities: Major economic sectors, trends of economic growth, recent development in various sectors, rule agricultural sector, RMG sector, leather sector, frozen foods and other potential sectors in Bangladesh, transport and port facilities.