# List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

**Department : *Pure and applied physics***

**Programme Name : Batchelor of Science in Electronics**

***Academic Year : 2021-22***

***List of Courses Focus on Employability/ Entrepreneurship/Skill Development***

| Sr. No. | Course Code | Name of the Course |
|---|---|---|
| 01. | PLUATT2 | Basic Circuit Theory and Network Analysis |
| 02. | PLUALT2 | Basic Circuit Theory and Network Analysis Lab |
| 03. | PLUBTT1 | Semiconductor Devices |
| 04. | PLUBLT1 | Semiconductor Devices Lab |
| 05. | PLUBTT2 | Applied Physics |
| 06. | PLUBLT2 | Applied Physics Lab |

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# Scheme and Syllabus

| Sem | Course | Course Code | Course Name | Credits | Credits (T+L+P) | Internal Marks/ | ESE Max. Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|
| I | Core 1 | PLUATT1 | Mathematical Foundation for Electronics | 5 | 4+1+0 | 30 | 70 | 100 |
| | Core 2 | PLUATT2 | Basic Circuit Theory and Network Analysis | 3 | 3+0+0 | 30 | 70 | 100 |
| | | PLUALT2 | Basic Circuit Theory and Network Analysis Lab | 2 | 0+0+2 | 30 | 70 | 100 |
| | GE-1 | | Opted from the pool course and offered by sister Departments | 5 | | 30 | 70 | 100 |
| | AEC-1 | | Opted from the pool course and offered by University | 2 | | 30 | 70 | 100 |
| | SEC-1 | | Opted from the pool course and offered by University | 2 | | 30 | 70 | 100 |
| | **Total** | | | **19** | | | | **600** |
| II | Core 3 | PLUBTT1 | Semiconductor Devices | 3 | 3+0+0 | 30 | 70 | 100 |
| | | PLUBLT1 | Semiconductor Devices Lab | 2 | 0+0+2 | 30 | 70 | 100 |
| | Core 4 | PLUBTT2 | Applied Physics | 3 | 3+0+0 | 30 | 70 | 100 |
| | | PLUBLT2 | Applied Physics Lab | 2 | 0+0+2 | 30 | 70 | 100 |
| | GE-2 | | Opted from the pool course and offered by sister Departments | 5 | | 30 | 70 | 100 |
| | AEC-2 | | Opted from the pool course and offered by University | 2 | | 30 | 70 | 100 |
| | SEC 2 | | Opted from the pool course and offered by University | 2 | | 30 | 70 | 100 |
| | **Total** | | | **19** | | | | **700** |

**Semester - I**

**Core -2: Basic Circuit Theory and Network Analysis**
**Course Code: PLUATT2** **Credits = 3 (3+0+0)**

**Course Objectives:**
- The objective of the course is that the student acquires the knowledge of basics of electrical network.
- To gain the knowledge and critical analysis of electrical circuit using network theorem.

**Course Outcomes:**
- Understand the basic concepts, basic laws and methods of analysis of DC and AC networks and reduce the complexity of network using different network theorems.
- Student will understand the resonance in series and parallel circuits and also the importance of initial conditions and their evaluation.

**Unit – I: Circuit Analysis:** Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Node Analysis, Mesh Analysis, Star-Delta Conversion.

**Unit – II: DC Transient Analysis:** RC Circuit- Charging and discharging with initial charge, RL Circuit with Initial Current, Time Constant, RL and RC Circuits, DC Response of Series RLC Circuits.

**Unit – III: AC Circuit Analysis:** Sinusoidal Voltage and Current, Definition of Instantaneous, Peak, Peak to Peak, Root Mean Square and Average Values. Power in AC Circuits &Power Factor.Sinusoidal Circuit Analysis for RL, RC and RLC Circuits.Resonance in Series and Parallel RLC Circuits, Frequency Response of Series and Parallel RLC Circuits, Quality (Q) Factor and Bandwidth. Passive Filters: Low Pass, High Pass, Band Pass and Band Stop.

**Unit – IV: Network Theorems**:Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Millman's Theorem, Maximum Power Transfer Theorem.
Two Port Networks: Impedance (Z) Parameters, Admittance (Y) Parameters, Transmission (ABCD) Parameters.

**Reference Books:**
1. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill (2004).
2. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill.(2005).
3. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)
4. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill(2005).
5. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)
6. Grob's Basic Electronics, 11th ed., Mitchel E. Schultz, McGraw Hill.

**Core - 2: Basic Circuit Theory and Network Analysis Lab**

**Course Code: PLUALT2** **Credits = 2 (0+0+2)**

**Name of Experiments**

1. Verification of Kirchhoff's Law.
2. Verification of Norton's theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Superposition Theorem.
5. Verification of the Maximum Power Transfer Theorem.
6. Charging and discharging of Capacitor
7. Designing of a Low Pass RC Filter and study of its Frequency Response.
8. Designing of a High Pass RC Filter and study of its Frequency Response.
9. Study of the Frequency Response of a Series LCR Circuit and determination of its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width.
10. Study of the Frequency Response of a Series LCR Circuit and determination of its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width.

## Semester - II

**Core 3: Semiconductor Devices** **Credit: 3 (3+0+0)**
**Course Code: PLUBTT1**
**Course Objective:**

- This module introduces to the students some of the important semiconductor devices along with the underlying semiconductor physics. The module makes the students familiar with the working principles of major semiconductor diode, bipolar transistor, field-effect transistor devices, negative-resistance and power devices and photonic devices.
- Understand the fundamental principles and applications of modern electronic and optoelectronic semiconductor device.

**Course Outcomes:** After completion of this course, students will be able to

- Get an understanding about the working principles and characteristics of different types of semiconductor devices — p-n junction diodes, bi-polar transistors, MOSFETs, MESFETs, tunnel diodes, photo-detectors, LEDs and solar cells

**Unit – I: Semiconductor Basics**: Carrier Concentration at Normal Equilibrium in Intrinsic Semiconductors, Fermi Level for Intrinsic & Extrinsic Semiconductors, Donors, Acceptors, Dependence of Fermi Level on Temperature and Doping Concentration, Carrier Transport Phenomena: Carrier Drift, Mobility, Resistivity, Hall Effect, Diffusion Process, Einstein Relation, Current Density Equation, Continuity Equation.
**Unit – II: P-N Junction Diode**: Formation of Depletion Layer, Space Charge at a Junction, Derivation of Electrostatic Potential Difference at Thermal Equilibrium, Concept of Linearly Graded and an abrupt Junction, Depletion Width and Depletion Capacitance of an Abrupt Junction. Derivation of Diode Equation and I-V characteristics, Zener and Avalanche Junction Breakdown Mechanism. Tunnel diode, varactor diode, solar cell: circuit symbol, characteristics, applications.
**Unit – III: Bipolar Junction Transistors (BJT):** PNP and NPN Transistors, Basic Transistor Action, Emitter Efficiency, Current Gain, Energy Band Diagram of Transisto rin Thermal Equilibrium, Quantitative Modes of operation, Input and Output Characteristics of CB, CE and CC Configurations. Metal Semiconductor Junctions:
**Unit – IV: Field Effect Transistors:** JFET, Construction, Idea of Channel Formation, Pinch-Off and Saturation Voltage, Current-Voltage OutputCharacteristics. MOSFET, types of MOSFETs, Circuit symbols, Working and Characteristic curves of Depletion type MOSFET (both N-channel and P-Channel) and Enhancement type MOSFET (both N channel and P channel). Power Devices: UJT, Basic construction and working, Equivalent circuit, Characteristics and relaxation oscillator-expression. SCR, Construction, Working and Characteristics, MESFET, Circuit symbols, Basic constructional features, Operation and Applications.

**Reference Books:**
1) S. M. Sze, Semiconductor Devices: Physics and Technology, 2nd Edition, Wiley India edition (2002).
2) Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006)
3) Dennis Le Croissette, Transistors, Pearson Education (1989)

**Core 3: Semiconductor Devices Lab** **Credit: 2 (0+0+2)**

**Course Code: PLUBLT1**

**List of Experiments:**

1. Study of the I-V Characteristics of Diode – Ordinary and Zener Diode.
2. Study of the I-V Characteristics of the CE configuration of BJT and obtain $r_i$,$r_o$,β.
3. Study of the I-V Characteristics of the Common Base Configuration of BJT and obtain $r_i$, $r_o$,α.
4. Study of the I-V CharacteristicsoftheCommonCollectorConfigurationofBJTandobtainvoltagegain, $r_i$, $r_o$.
5. Study of the I-V Characteristics of the UJT.
6. Study of the I-V Characteristics of the SCR.
7. Study of the I-V Characteristics of JFET.
8. Study of the I-V Characteristics of MOSFET.
9. Study of Characteristics of Solar Cell

**Core 4: Applied Physics** **Credit: 3 (3+0+0)**

**Course Code: PLUBTT2**

**Course Objectives:**

Understand the fundamental principles and applications of modern physics.

This course covers certain conceptual courses of physics by virtue of which the students will be able to understand some concepts of Quantum Mechanics and solid state behavior.

It also imparts the basic principles of Quantum mechanics, Thermal Properties, Debye's Law and its applications

**Learning Outcomes:**

Upon successful completion of this course, students will be able to address following points:

Understand and explain the differences between classical and quantum mechanics.

Identify behavior of the solid Materials.

**Unit – I:** Quantum Physics: Inadequacies of Classical physics, Compton's effect, Photo-electric Effect, Wave-particle duality, de-Broglie waves, Basic postulates and formalism of quantum mechanics: probabilistic interpretation of waves, conditions for physical acceptability of wave functions, Schrodinger wave equation for a free particle and in a force-field (1dimension),Boundary and continuity conditions, Operators in Quantum Mechanics, Conservation of probability, Time-dependent form, Linearity and superposition, Operators, Time- independent one dimensional Schrodinger wave equation, Eigen-values and Eigen functions.

**Unit – II:** Mechanical Properties of Materials: Elastic and Plastic Deformations, Hooke's Law, Elastic Moduli, Brittle and Ductile Materials, Tensile Strength, Theoretical and Critical Shear Stress of Crystals. Strengthening Mechanisms, Hardness, Creep, Fatigue, Fracture.

**Unit – III:** Thermal Properties, Brief Introduction to Laws of Thermodynamics, Concept of Entropy, Concept of Phonons, Heat Capacity, Debye's Law, Lattice Specific Heat, Electronic Specific Heat, Specific Heat Capacity for Si and GaAs, Thermal Conductivity, Thermoelectricity, Seebeck Effect, Thomson Effect, Peltier Effect.

**Unit – IV:** Electric and Magnetic Properties: Conductivity of metals, Ohm's Law, relaxation time, collision time and mean free path, electron scattering and resistivity of metals, heat developed in current carrying conductor, Superconductivity, Concepts of Giant Magnetic Resistance (GMR), Magnetic recording.

**Reference Books:**

1. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
2. Quantum Mechanics: Theory & Applications, A. K. Ghatak & S.Lokanathan, 2004, Macmillan
3. Quantum Mechanics: Concepts and Applications, Wiley Publisher , Nouredine *Zettili*
4. Introduction to Solid State Physics, Charles Kittel, John Wiley & Sons, Inc
5. Material Science and Engineering ,5th Edition , V. Raghavan,

**Core 4: Applied Physics Lab** **Credit: 2 (0+0+2)**

**Course Code: PLUBLT2**

**Name of the Experiments**

1. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
2. To determine the Young's modulus of material of cantilever.
3. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
4. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
5. Determination of Planks constant by Photo electric effect.
6. To determine work function of material of filament of directly heated vacuum diode.
7. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.