SEMESTER 1st **MAJOR/MINOR COURSE**

Subject: Electronics
Course Title: Network Analysis and Analog Electronics

Title: Electronics-I **Code: BET22C101**

CREDIT: (4+2) THEORY: 04; PRACTICAL: 02 CONTACT HOURS: 64 (T) + 64 L)

Part 1: Theory (4 Credits)

Course Objectives:

- ✓ *To review the basic concepts of emf sources and Kirchhoff's laws*
- ✓ *To study network topology, network theorems and two port networks*
- ✓ *To provide a comprehensive understanding of electronic devices and circuits*
- ✓ *To understand the working of diode and transistor and to study basic circuits using diodes and transistors*
- ✓ *To understand the diode and transistor characteristics*

Learning outcomes:

- ✓ *On completion of the course, the student should be able to:*
- ✓ *Study basic circuit concepts in a systemic manner suitable for analysis and design.*
- ✓ *Analyze the electric circuit using network theorems.*
- ✓ *Determine AC steady state response.*
- ✓ *Have a comprehensive understanding of electronic devices and circuits*
- ✓ *Apply their knowledge in analyzing Circuits by using network theorems*
- ✓ *Know the characteristics of diodes and transistors*

Unit I: Basic Circuit Concepts ***(16 Contact hours)***

Voltage and Current Sources, V- I characteristics of ideal voltage and ideal current sources, various types of controlled sources, passive circuit components, V-I characteristics and ratings of different types of R, L, C elements. Source transformations: voltage to current and current to voltage sources. Determination of equivalent resistance for series, parallel, and series-parallel combination of resistances.

Unit II: Circuit Analysis ***(16 Contact hours)***

Ohms law. Kirchhoff's voltage law: Statement, proof, and examples; Kirchhoff's current law: Statement, proof, and examples. Definition of mesh and node, mesh analysis and nodal analysis Star-Delta Transformation.

Principal of Duality, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Maximum Power Transfer Theorem.

Unit III: Semiconductor Physics – I ***(16 Contact hours)***

Introduction to Semiconductors, Bonds in Semiconductors, commonly used semiconductormaterials (Ge, Si, and GaAs etc.), Energy Band description of Semiconductor, Effect of Temperature on conductivity of Semiconductors, Hole Current, Intrinsic Semiconductor, Extrinsic Semiconductor, N-type Semiconductor, P-type semiconductor. P-N junction Diode, Volt-Ampere Characteristics of P-N Junction (Forward Biasing and Reverse Biasing), Concept of Breakdown Voltage and Knee Voltage. Rectifiers: Half wave rectifier, Full wave rectifiers (center tapped and bridge), working and waveforms, ripple factor and efficiencyof Half wave rectifies and Full wave rectifier.

Unit IV:Semiconductor - II ***(16 Contact hours)***

Bipolar Junction Transistor, Construction & Working (PNP & NPN). Characteristics of transistor in CE, CB & CC Configurations. Regions of operation (active, cut off and saturation), Transistor as a Switch, Current gains in CB mode and CE mode. Relation between α and β. DC load line and Q point.

Transistor biasing and Stabilization circuits- Fixed Bias and Voltage Divider Bias. Thermal runaway, stability and stability factor S, Transistor as Amplifier:JFET, Construction, Working and I-V characteristics (output and transfer), Pinch-off voltage, Introduction to MOSFET.

Books Recommended:

1. Sudhakar and Shyam Mohan, **Network and Circuits: Analysis Synthesis**, Tata McGraw- Hill, NewDelhi
2. V.K. Mehta and Rohit Mehta, Principles of Electronics, S. Chand and Company
3. M.E.Van Valkenburg, Network Analysis, Prentice-Hall of India, NewDelhi
4. Schaum's outline series, Electric Circuits, Tata McGraw Hill, NewDelhi
5. T.F. Bogart Jr. Electric Circuits, Tata McGraw-Hill, NewDelhi
6. M. Nahvi and J. Edminister, Schaum'sOutline Series, Tata McGraw Hill.(2005)
7. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)

8. Jacob Millman, Christos Halkias, Chetan Parikh, Millman's Integrated Electronics - Analog and Digital Circuit and Systems | 2nd Edition
9. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill(2005)
10. Alexander and M. Sadiku, Fundamentals of Electric Circuits, McGraw Hill (2008)

Part 2: Laboratory Course(2 Credits)

Course Objectives:

- ✓ *To learn core components, Devices, process and functionalities of Electronics*
- ✓ *To understand the basic measuring equipment's required to perform electronic experiments.*
- ✓ *To understand the role of electronics in day-to-day life.*

Learning outcomes:

On completion of the course, the student should be able to:

- ✓ *Verify the network theorems and operation of typical electrical circuits.*
- ✓ *Choose the appropriate equipment for measuring electrical quantities and verify the same for different circuits.*
- ✓ *Prepare the technical report on the experiments carried*

Note: Each student has to perform a minimum of 08 experiments.

1. To determine the value of different resistances using colour coding and verify using multi-meter.
2. To determine the equivalent resistance of series connection of resistances.
3. To determine the equivalent resistance of parallel connection of resistances.
4. To determine the equivalent resistance of series-parallel connection of resistances.
5. To verify Kirchhoff's voltage law.
6. To verify Kirchhoff's current law.
7. To verify Thevenin's theorem.
8. To verify Norton's theorem.
9. To verify Superposition theorem.
10. To verify Maximum power transfer theorem.
11. Study of the I-V Characteristics of Diode – Ordinary and Zener Diode.
12. Study of the I-V Characteristics of the CE configuration of BJT and obtain input resistance, output resistance, β.

13. Study of the I-V Characteristics of the Common Base Configuration of BJT and obtaininput resistance, output resistance, α.
14. Study of the I-V Characteristics of the Common Collector Configuration of BJT and obtain voltage gain, input resistance, output resistance.

Books Recommended:

1. Robert L. Boylestad, **Essentials of Circuit Analysis**, Pearson Education (2004)
2. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill(2005)
3. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)