

**Subject Code: 01EE0103**

**Subject Name: Basics of Electrical & Electronics Engineering**

**B.Tech. Year - I**

**Objective:** Students are expected to learn basics of Electrical Engineering which will help them to apply these concepts in day to day life. The course is divided into two parts: Electrical Circuits and Electrical Components. Keeping in view wide applications of batteries, a special unit of battery is introduced. To understand the construction and operation of various components and electronics circuits based on Diodes, BJT & OpAmp.

**Credits Earned:** 4 Credits

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

- Recognize importance of electrical energy and its day to day applications.
- Interpret the role of resistor, capacitor and inductor and their behaviour under various system conditions.
- Describe qualitative comparison between AC and DC system.
- Analyze and solve DC Circuits and AC Single phase
- Analyze and solve magnetic circuits.
- Explain the need of batteries, its characteristics and charging methods.
- Perceive the detail understanding of construction, operation and applications of various components like Diode, BJT and Op-Amp.
- Recognise basic electronic devices used in various circuits.
- Apply basic knowledge and techniques of electronics engineering for designing and analysing various electronic circuits like Rectifier, Amplifier, Integrator, Differentiator.

**Pre-requisite of course:** NA.

**Teaching and Examination Scheme**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA	(CSE)	Viva (V)	Term work (TW)	
3	0	2	4	50	30	20	25	25	150

**Contents:**

<b>Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Fundamental of DC circuits:</b> Definition of Current, Voltage, e.m.f., Power Energy, Resistance, Ohm's Law, Effect of variation in temperature on resistance, Series, Parallel and series-parallel connection of resistances, Comparison between series and parallel circuits, Open circuit and Short circuit, Kirchoff's Laws, Nodal Analysis, Mesh Analysis of Electrical Networks	5
2	<b>Magnetic Circuits and Electromagnetics:</b> Definition of magnetic quantities, Magnetic circuits, Comparison of electric and magnetic circuits, Calculation of Ampere turns, Leakage flux, Magnetization Curve  Electromagnetic induction, Faraday's Laws, Induced emf and direction of induced emf, self inductance, mutual inductance, energy stored in magnetic field, Charging and discharging of inductor, magnetic hysteresis, eddy current losses.	5
3	<b>Fundamental of AC Circuit:</b> Generation of Alternating voltage and current, sinusoidal function- Terminology, Form Factor and Peak Factor, Phase and Phase Difference, Phasor representation of alternating quantities, Phasor addition and subtraction Behaviour of purely resistive, inductive and capacitive circuits, Phase relation between voltage and current  Active, Reactive and Apparent Power, Power Factor and its significance in series RL circuit, series RC circuits, series RLC circuit  Parallel and series-parallel AC circuits, phasor method, admittance method Resonance in series and parallel circuit.	8
4	<b>Batteries:</b> Electric cell, types of cells, Equivalent circuits, grouping of cells, batteries, capacity of battery, efficiency of battery, charging method, Life of battery, Application of battery, Battery maintenance procedure.	2
5	<b>Safety and Protection</b> Electric Shock, First aid for electric shock, importance of grounding, Fuse, MCB, ELCB.	2
6	<b>Fundamentals of Semiconductor Material :</b> Energy Band Diagram of conductor, semiconductor and insulator; Bohr Atomic Model for Atom, Crystal Structure of Semiconductor Materials, Intrinsic and Extrinsic Semiconductor Materials.	3

7	<b>Semiconductor Diodes :</b> Symbol and Construction, Operating Characteristics in Forward and Reverse Bias, Applications of Diode as Switch, Clipper, Clamper and Rectifier; Special Purpose Diodes : Zener Diode; Optical Diodes like LED, Photo Diode, Laser Diode, Seven Segment Display; Other Diodes like Varactor Diode, Schottkey Diode, PIN Diode, Tunnel Diode , Step Recovery Diode.	5
8	<b>Bipolar Junction Transistor (BJT) :</b> History of BJT invention; Types, Symbol and Construction of BJT; Basic Operation of BJT; BJT Configurations : Common Base, Common Emitter, Common Collector with Operation, Input/Output Characteristics; Applications of Transistors as Switch and Amplifier.	5
9	<b>Operational Amplifiers :</b> Introduction to OpAmp, Differential and Common Mode Operation, OpAmp Basics, Practical OpAmp Circuits, OpAmp Applications as Summer, Integrator and Differentiator	5
<b>Total Hours</b>		<b>45</b>

**References:**

1. E. Hughes, 'Electrical and Electronic Technology', Prentice Hall India, 10<sup>th</sup> edition, 2008
2. V.N. Mittal, 'Basic Electrical Engineering', Tata Mcgraw-Hill, 2<sup>nd</sup> edition, 2006.
3. V. Del Toro, 'Electrical Engineering Fundamentals', Prentice - Hall India, 2<sup>nd</sup> edition, 2006.
4. D. P. Kothari and I. J. Nagrath, '*Theory and Problems in Basic Electrical Engineering*', Prentice Hall India
5. A. Chakrabarti, S. Nath, C. Chanda, '*Basic Electrical Engineering*', Tata McGrawHill Education India Pvt. Ltd, 2013.
6. B. L. Theraja, '*Electrical Technology*', S. Chand Publication, 2012.
7. U. A. Patel, '*Elements of Electrical Engineering*', AtulPrakashan, 8<sup>th</sup> edition, 2009
8. Albert Malvino and David Bates, "Electronics Principles" Tata McGraw-Hill, 7<sup>th</sup> Edition, 2006.
9. 2. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education, 10<sup>th</sup> Edition, 2009
10. 5. S Salivahanan and N Suresh Kumar, "Electronics Device and Circuits" Tata McGraw-Hill Education Private Limited, 2<sup>nd</sup> Edition, 2008.

11. Jacob Milman and Christos C. Halkias, "Electronics Device and Circuits", Tata McGraw-Hill, 3<sup>rd</sup> Edition, 2008.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

**Suggested List of Experiments:**

1. To verify ohm's law in an electric circuit
2. To observe the variation of temperature on resistance
3. Determination of B-H curve of magnetic material
4. To determine power in a single phase circuit using wattmeter
5. Determination of parameters in series RLC circuit
6. Study series resonance in RLC circuit
7. To study and perform the V-I characteristic of Silicon Diode and Zener Diode.
8. To use silicon Diode as a Clipper and Clamper.
9. To analyze the Half Wave, Full Wave and Bridge Rectifiers.
10. To use Transistor as a Switch.
11. To study and perform the Input and Output characteristic of BJT.
12. To use OpAmp as summer, Integrator and Differentiator.

**Instructional Method:**

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

**Supplementary Resources:**

1. <http://nptel.ac.in/courses/108108076/>
2. <http://nptel.ac.in/downloads/108105053/>
3. <http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/video-lectures/>
4. <https://www.facstaff.bucknell.edu/mastascu/eLessonsHTML/EEIndex.html>
5. <http://www.electrical4u.com/nature-of-electricity/>
6. <http://vlab.amrita.edu/index.php>
7. <http://textofvideo.nptel.iitm.ac.in/video.php?courseId=117103063>
8. <https://www.coursera.org/course/eefunlab>
9. <https://www.coursera.org/course/introtoelectronics>
10. <https://www.edx.org/course/circuits-electronics-1-basic-circuit-mitx-6-002-1x>
11. <http://www.learnabout-electronics.org>
12. <http://www.electronics-tutorials.ws>
13. <http://101science.com/Radio.htm>
14. <http://www.electronicandyou.com>

**List of simulation software:**

1. TINA
2. NI Multisim
3. OrCAD
4. Circuit Wizard