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Syllabus for Bachelor of Technology

Electronics and Communication Engineering

Subject Code: 01EC0101

Subject Name: Basics of Electronics Engineering

B.Tech. Year – I

Objective: The subject aims to prepare the students:

To understand the basic Electronic Engineering concepts required in analysis and design of electronic circuits and systems.

To understand the construction and operation of various components and circuits such as Diodes, BJT, JFET, MOSFET, OpAmp, Oscillators and Voltage Regulator and also the capability to analyze and design the simple electronic circuits.

Credits Earned: 4 Credits

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

- Identify the difference between electronics and electrical engineering.
- Perceive the detail understanding of construction, operation and applications of various components like Diode, BJT, JFET and MOSFET.
- 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, Oscillator and Voltage Regulator.
- Understand the role of electronics in solving various engineering problems.

Pre-requisite of course: Basic knowledge of physics and fundamental concept of electrical engineering.

Teaching and Examination Scheme

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

Contents:

Unit	Topics	Contact Hours
1	**Fundamentals of Semiconductor Material :** Energy Band Diagram of conductor, semiconductor and insulator; Bhor Atomic Model for Atom, Crystal Structure of Semiconductor Materials, Intrinsic and Extrinsic Semiconductor Materials.	4
2	**Semiconductor Diodes :** 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.	6
3	**Bipolar Junction Transistor (BJT) :** 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.	6
4	**BJT Biasing :** DC Operating Point, Fixed (Base) Biasing, Emitter Biasing, Voltage Divider Bias, Emitter Feedback Bias, Collector Feedback Bias, Collector and Emitter Feedback Bias.	7
5	**Field Effect Transistor :** Types, Symbol, Construction, Operation, Input/Output Characteristics and Applications of Junction Filed Effect Transistor (JFET), Metal Filed Effect Transistor (MOSFET)	6
6	**Operational Amplifiers :** Introduction to OpAmp, Differential and Common Mode Operation, OpAmp Basics, Practical OpAmp Circuits, OpAmp Applications as Summer, Integrator and Differentiator	7
7	**Basic of Organic Electronics :** Introduction, Types of Organic Materials, Organic Electronic Devices, Applications	6
	Total Hours :	**42**

References:

1. Albert Malvino and David Bates, "Electronics Principles" Tata McGraw-Hill, 7th Edition, 2006.
2. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education, 10th Edition, 2009.
3. Hagen Klauk "Organic Electronics: Materials, Manufacturing, and Applications", WILEY – VCH, 2006, ISBN: 978-3-527-31264-1
4. Thomas L. Floyd, "Electronics Devices: Conventional Current Version", Pearson Education, 7th Edition, 2008.
5. S Salivahanan and N Suresh Kumar, "Electronics Device and Circuits" Tata McGraw-Hill Education Private Limited, 2nd Edition, 2008.
6. Jacob Milman and Christos C. Halkias, "Electronics Device and Circuits", Tata McGraw-Hill, 3rd 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 study and perform the V-I characteristic of Silicon Diode and Zener Diode.
2. To use the Zener Diode as voltage regulator.
3. To use silicon Diode as a Clipper and Clamper.
4. To analyze the Half Wave, Full Wave and Bridge Rectifiers.
5. To study and perform the Input and Output characteristic of BJT.
6. To use Transistor as a Switch.
7. To Analyze CE, CB and CC Amplifier Circuit.
8. To measure the variation of current gain with variation in temperature for different biasing of a transistor.
9. To study and perform the Input and Output characteristic of FET.
10. To study and perform the Input and Output characteristic of MOSFET.
11. To Study and Perform the Common mode and Differential mode of operation for OpAmp.
12. To use OpAmp as summer, Integrator and Differentiator.
13. To test the performance of negative feedback amplifier and compare gain, BW with

and without feedback.

14. To Study and Perform Wien Bridge Oscillator.
15. To Analyze Voltage Regulator by using Integrated Circuit.

Open ended problems:

1. Design a full wave bridge rectifier for input 50 Hz $10V_{p-p}$ AC signal and expected output of 5 V DC signal.
2. Design a regulated power supply using zener diode for input variation of 10 to 20 V_{p-p}.
3. A silicon diode has a reverse current of 5 μA at 25°C and 100 μA at 100°C. What are the values of the saturation current and the surface-leakage current at 25°C?
4. Demonstrate Automatic street light control system using LED.
5. Design a +5 to +25 V variable power supply.

Instructional Methods:

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://textofvideo.nptel.iitm.ac.in/video.php?courseId=117103063
2. https://www.coursera.org/course/eefunlab
3. https://www.coursera.org/course/introtoelectronics
4. https://www.edx.org/course/circuits-electronics-1-basic-circuit-mitx-6-002-1x
5. http://www.learnabout-electronics.org
6. http://www.electronics-tutorials.ws
7. http://101science.com/Radio.htm
8. http://www.electronicsandyou.com

List of simulation software:

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

5. Ngspice (free ware)
6. Logisim (free ware)
7. 123d circuits (online free ware)

Major equipment:

CRO/DSO, Function generator, Power supply, Multi meter, Bread board, Components, Experimental trainer Kits, Bread board, General purpose PCB, Connectors, Soldering iron

Special skill development (Self-study / Communication):

Each student group (2-3 members) has to present a latest devices / technology based on electronic principles using PPT/functional models as part of laboratory term work submission.