



A. Course Handout (Student & Faculty)

Institute/School Name	Chitkara University Institute of Engineering and Technology		
Department Name	Department of Electronics and Communication Engineering (CUIET)		
Programme Name	Bachelor of Engineering (B.E.), Computer Science & Engineering		
Course Name	Basic Electronics	Session	2022-2023
Course Code	EC22001	Semester/Batch	1 st /2022
L-T-P (Per Week)	4-0-2	Course Credits	5
Course Coordinator	Dr. Geetanjali		

1. Scope & Objective of the Course:

- To comprehend the principles of basic electronics for engineering undergraduates.
- To understand the characteristics of semiconductor devices such as diodes, transistors and operation of circuits such as rectifier, voltage regulator and amplifiers.
- To implement simple Boolean expressions using logic gates.

The main objectives of the course are: The students should be able to

- Understand the basic concepts of semiconductor diodes and transistors and their applications in electronic circuits.
- Differentiate between V-I characteristics of forward and reverse biased PN junctions and their implementation in engineering disciplines.
- Understand the basic building block of digital electronics and its applications.

2. Course Learning Outcomes:

	Course Learning Outcome	POs	CL	KC	Sessions
CLO01	To understand the basics of electronics elements, their functionality and applications and to perceive the concept of analog and digital electronics.	PO1,PO2	K2	Fundamental Conceptual	9
CLO02	To analyse the characteristics of various types of diodes and transistors to describe the operation of related circuits for evolving engineering solutions.	PO2	K4	Factual Conceptual	7
CLO03	To apply fundamental principles of electronics together with analytic tools to evaluate and describe physical situations appropriate to address a scientific problem.	PO3	K3	Conceptual Procedural	7
CLO04	To possess an ability to explore physical systems by setting up experiments, collecting and analyzing data, identifying sources of uncertainty, and interpreting their results in terms of the fundamental principles and concepts of electronics.	PO7	K4	Conceptual Procedural	12
Total Contact Hours					48

CLO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
CLO1		H	M												
CLO2			H												
CLO3				M											
CLO4								M							
L: Low, M: Medium and H: High															

3. ERISE Grid Mapping

Feature Enablement	Level(1-5, 5 being highest)
Entrepreneurship	1
Research	1
Innovation	2
Skills	2
Employability	2

4. Recommended Books (Reference Books/Text Books):

- **B1:** Basic Electronics and Linear Circuits by N. N Bhargava, D. C Kulshreshtha, S. C Gupta; McGraw Hill Publications, Second Edition, 2013.
- **B2:** Basic Electrical and Electronics Engineering by R. Muthusubramanian, S. Sahlivahanan McGraw Hill, First Edition, 2010.
- **B3:** Basic Electronics by D. P. Kothari, I. J. Nagrath, McGraw Hill, Second Edition, 2014.
- **B4:** Solid State Electronic Devices by D. K. Bhattacharya, Rajnish Sharma, Oxford University Press, Second Edition, 2013.
- **B5:** Electronic Principles by Albert Malvino, David J. Bates, McGraw Hill Education, Seventh Edition, 2007.

5. Other readings & relevant websites:

S.No.	Link of Journals, Magazines, websites and Research Papers
Link 1	https://www.electronics-tutorials.ws/diode/diode_2.html/
Link 2	https://www.electrical4u.com/pnp-transistor/
Link 3	https://whatis.techtarget.com/definition/field-effect-transistor-FET/ https://www.youtube.com/watch?v=ybPQ1IDfTb8&list=PLbwxc126fT08Yeq6CXjc7o3xo6NQNm7KN/
Link 4	http://www.powershow.com/view/1f9351-OGY1M/Logic_Gates_powerpoint_ppt_presentation/

6. Recommended Tools and Platforms:

Virtual labs, Multisim

7. Complete Theory course coverage plan:

Session No.	Topic(s)	Recommended Books (B)
1	Unit-1: Semiconductor Diodes and Applications Introduction to Electronics, Familiarization with basic electronic components and measuring instruments.	B1
2	Semiconductor Theory, Review of PN junction operation, Forward and Reverse V-I Characteristics of PN-Junction Diode.	B1
3	Use of Diodes in Rectifiers, Half Wave, Full Wave Centre-tap and Bridge Rectifier (Circuit diagram, Waveforms, RMS value, DC value and Peak value, PIV, Ripple Factor, Efficiency).	B1
4	Zener diode and its application as Voltage Regulator,	B1 and B2
5	Special Purpose Diodes: Light Emitting Diode (LED), Photodiode.	
6	Unit-2: Transistors and Applications Introduction to Bipolar Junction Transistor (BJT), Types, Construction of BJT,	B1
7	Transistor Biasing and Working, Characteristics of BJT in Common Emitter (CE) Configuration	B1
8	Introduction to Junction Field Effect Transistor (JFET)	B1
9	Metal Oxide Semiconductor Field Effect Transistor (MOSFET): Structure and Working.	
10	Comparison of BJT, JFET and MOSFET.	B1
ST1		
11	Unit 3: Number Systems and Logic Gates Number Systems: Decimal, Binary, Octal and Hexadecimal,	B2
12	Representation of signed binary numbers. Binary codes - BCD code, Gray code, Excess-3 code.	B2
13	Digital and analog systems, logic levels & pulse waveform. Review of Logic Gates, Laws of Boolean algebra	B2
14	De Morgan's Theorems, Realization of logic expressions using basic and Universal gates (AND, OR, NOT, NAND, NOR, Ex-OR gates).	B2
15	Boolean Functions and their representation: Sum of Product (SOP), Product of Sum (POS), canonical forms	B2
16	Unit-4: Digital Circuits Introduction to Combinational and Sequential Logic. Minimization of Boolean Expressions, Karnaugh map (upto 4 variables),	B2
17	Design of Arithmetic circuits – Binary Adders & Subtractors (half, Full), Magnitude Comparator (1-bit, 2-bit),	B2

18	Multiplexer (2:1, 4:1), Demultiplexer (1:2, 1:4),	B2
ST2		
19	Encoder, Decoder, Code Converter.	B2
20	Latch as memory element, Construction and operation of NOR gate and NAND gate latch.	B2
21	Introduction to flip flops: Circuit Diagram and Truth Table.	B2
End Term		

8. Delivery/Instructional Resources:

Session No.	Topic(s)	Web References	Audio – Video
1	Unit-1: Semiconductor Diodes and Applications Introduction to Electronics, Familiarization with basic electronic components and measuring instruments.	https://www.electronics-notes.com/articles/basic_concepts/ https://www.tutorialspoint.com/basic_electronics/index.htm	https://nptel.ac.in/courses/122106025 https://nptel.ac.in/courses/108101091
s2	Semiconductor Theory, Review of PN junction operation,	https://www.electronics-notes.com/articles/basic_concepts/conductors-semiconductors-insulators/what-is-a-semiconductor.php	https://nptel.ac.in/courses/122106025
	Forward and Reverse V-I Characteristics of PN-Junction Diode.	https://www.tutorialspoint.com/basic_electronics/basic_electronics_junction_diodes.htm	https://nptel.ac.in/courses/122106025
3	Use of Diodes in Rectifiers, Half Wave, Full Wave Centre-tap and Bridge Rectifier (Circuit diagram, Waveforms, RMS value, DC value and Peak value, PIV, Ripple Factor, Efficiency).	https://www.tutorialspoint.com/basic_electronics/basic_electronics_diodes.htm	https://nptel.ac.in/courses/122106025 https://nptel.ac.in/courses/108101091
4	Zener diode and its application as Voltage Regulator	https://www.tutorialspoint.com/basic_electronics/basic_electronics_junction_diodes.htm	https://nptel.ac.in/courses/122106025
5	Special Purpose Diodes: Light Emitting Diode (LED), Photodiode.	https://www.tutorialspoint.com/basic_electronics/basic_electronics_special_purpose_diodes.htm	https://nptel.ac.in/courses/122106025

6	Unit-2: Transistors and Applications Introduction to Bipolar Junction Transistor (BJT), Types, Construction of BJT,	https://www.tutorialspoint.com/basic_electronics/basic_electronics_transistors.htm	https://nptel.ac.in/courses/122106025 5 https://nptel.ac.in/courses/108101091
7	Transistor Biasing and Working, Characteristics of BJT in Common Emitter (CE) Configuration	https://www.tutorialspoint.com/basic_electronics/basic_electronics_transistors.htm	https://nptel.ac.in/courses/122106025
8	Introduction to Junction Field Effect Transistor (JFET)	https://www.tutorialspoint.com/basic_electronics/basic_electronics_jfet.htm	https://nptel.ac.in/courses/108101091
9	Metal Oxide Semiconductor Field Effect Transistor (MOSFET): Structure and Working.	https://www.tutorialspoint.com/basic_electronics/basic_electronics_mosfet.htm	https://nptel.ac.in/courses/108101091
10	Comparison of BJT, JFET and MOSFET.	https://www.tutorialspoint.com/basic_electronics/basic_electronics_mosfet.htm	https://nptel.ac.in/courses/108101091
11	Unit 3: Number Systems and Logic Gates Number Systems: Decimal, Binary, Octal and Hexadecimal,	https://www.tutorialspoint.com/digital_electronics/index.asp	https://nptel.ac.in/courses/108101091
12	Representation of signed binary numbers. Binary codes - BCD code, Gray code, Excess-3 code.	https://www.tutorialspoint.com/digital_electronics/index.asp	https://nptel.ac.in/courses/108101091
13	Digital and analog systems, logic levels & pulse waveform. Review of Logic Gates, Laws of Boolean algebra	https://www.tutorialspoint.com/digital_electronics/index.asp	https://nptel.ac.in/courses/108101091
14	De Morgan's Theorems, Realization of logic expressions using basic and Universal gates (AND, OR, NOT, NAND, NOR, Ex-OR gates).	https://www.tutorialspoint.com/digital_electronics/index.asp	https://nptel.ac.in/courses/108101091
15	Boolean Functions and their representation: Sum of Product (SOP), Product of Sum (POS), canonical forms	https://www.tutorialspoint.com/digital_electronics/index.asp	https://nptel.ac.in/courses/108101091
16	Unit-4: Digital Circuits Introduction to Combinational and Sequential Logic. Minimization of Boolean	https://www.tutorialspoint.com/digital_electronics/index.asp https://www.electronics-	https://nptel.ac.in/courses/108101091

	Expressions, Karnaugh map (upto 4 variables),	tutorials.ws/combination/comb_1.html	
17	Design of Arithmetic circuits – Binary Adders & Subtractors (half, Full), Magnitude Comparator (1-bit, 2-bit),	https://www.tutorialspoint.com/digital_electronics/index.asp	https://nptel.ac.in/courses/108101091
18	Multiplexer (2:1, 4:1), Demultiplexer (1:2, 1:4),	https://www.tutorialspoint.com/digital_electronics/index.asp	https://nptel.ac.in/courses/108101091
19	Encoder, Decoder, Code Converter.	https://www.tutorialspoint.com/digital_electronics/index.asp	https://nptel.ac.in/courses/108101091
20	Latch as memory element, Construction and operation of NOR gate and NAND gate latch.	https://www.tutorialspoint.com/digital_electronics/index.asp	https://nptel.ac.in/courses/108101091
21	Introduction to flip flops: Circuit Diagram and Truth Table.	https://www.tutorialspoint.com/digital_electronics/index.asp	https://nptel.ac.in/courses/108101091

9. Action plan for different types of learners:

Slow Learners	Average Learners	Fast Learners
Remedial Classes	Doubt Sessions	Advanced Quiz/ Projects

10. Evaluation Scheme & Components:

Evaluation Component	Type of Component	No. of Assessments	Weightage of Component	Mode of Assessment
#Component 1	Lab Evaluations	03*	30%	Offline
Component 2	Sessional Tests (STs)	02**	20%	Offline
#Component 3	End Term Examination	01***	50%	Offline
Total		100%		

#Component 1 and component 3 are mandatory components and require 40% marks in each for clearing the subject.

*Lab Evaluation have 2 Lab performances- LP1 and LP2 and one Internal viva which shall be considered for evaluation based on experiments.

**Out of 02 STs, the ERP system automatically picks the best 01 ST.

***Further, as per Academic Guidelines, minimum 75% attendance is required to become eligible for appearing in the End Semester Examination.

11. Complete Lab Course Coverage plan

Session No.	Lab Session	Virtual lab link/ Multisim link
1	(i) Familiarization with basic electronic components and measuring instruments.	Resistor: http://vlabs.iitkgp.ernet.in/be/exp1/index.html Capacitor: http://vlabs.iitkgp.ernet.in/be/exp2/index.html

	(ii) Plot and analyze the forward and reverse characteristics of PN junction Si / Ge diode and determine the knee voltage.	http://vlabs.iitkgp.ernet.in/be/exp5/index.html
2	Analyze the NPN / PNP transistors in common emitter configuration and plot their input and output characteristics.	http://vlabs.iitkgp.ernet.in/be/exp11/index.html
3	Study and observe the output waveform of half-wave and full wave rectifiers on CRO and calculate the average and rms values of output voltage.	Oscilloscope: http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAE/exp1/oscilloscope_functioning.html Hwr: http://vlabs.iitkgp.ernet.in/be/exp6/index.html FWR: http://vlabs.iitkgp.ernet.in/be/exp7/index.html
LP1		
4	Logic gate is a basic building block of a digital circuit. So verify the truth tables of all the logic gates on trainer kit using TTL ICs. Also verify them using multisim.	https://www.multisim.com/content/QjHzebdxnCntHyQ6BEdcc/verification-of-logic-gates-1/
5	(i) Mr. Vivek wants to add two numbers in computer but computer only understands the binary numbers i.e. 0&1. So design a circuit that adds binary equivalent of two decimal numbers.	https://www.multisim.com/content/VhGr7RZtWkJCoSesvYA7Ek/half-adder/ https://www.multisim.com/content/xGSfz8KgJHySBQNPypHw2/full-adder/
	(ii) Considering two numbers (each two bit), Design a circuit which produces the output that compares whether the number is greater than, less than or equal to the second number.	https://www.multisim.com/content/wqCxtiTYdwSfc2LTScijs6/1-bit-comparator/
LP2		
6	(i) Suppose one input is to be selected from n inputs. Implement the circuit using IC 74150.	https://www.multisim.com/content/mwAfQP9FNem24ZJrd8bcad/41-multiplexer-circuit/
	(ii) A circuit distributes one input into n output lines. Design the circuit using IC 74154.	https://www.multisim.com/content/nywc2CqzhS5eoMgUNtUXyT/14-demultiplexer/
	A code represents each number in the sequence of integers $\{0 \dots 2^N - 1\}$ as a binary string of length N in an order such that	https://www.multisim.com/content/4UYZSqjQuMmXuY2HvgwXLA/binary-to-gray-code-converter/

	adjacent integers have code representations that differ in only one bit position. Design a convertor that has above property.	
7	Assignment Project- Implement a circuit and verify its operation that requires power-supply, inputs (push buttons/DIP switches) and outputs (LED/7-segment display).	https://www.multisim.com/help/components/bcd-to-7-seg-decoders/#:~:text=74LS47N%20is%20a%20BCD%20to,a%207%2Dsegment%20display%20indicator. https://www.multisim.com/content/2Zs8XvR6R8r2bRpzrE2gsP/bcd-decoder-circuit-7-segment-led/
INTERNAL VIVA		

12. Syllabus of the Course:

Name of the course: Basic Electronics	Subject Code: EC22001
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Contents	No. of Lectures	Weightage
Unit-1: Semiconductor Diodes and Applications Introduction to Electronics, Familiarization with basic electronic components and measuring instruments. Semiconductor Theory, Review of PN junction operation, Forward and Reverse V-I Characteristics of PN-Junction Diode. Use of Diodes in Rectifiers, Half Wave, Full Wave Centre-tap and Bridge Rectifier (Circuit diagram, Waveforms, RMS value, DC value and Peak value, PIV, Ripple Factor, Efficiency). Special Purpose Diodes: Light Emitting Diode (LED), Zener diode and its application as Voltage Regulator, Photodiode.	10	28%
Unit-2: Transistors and Applications Introduction to Bipolar Junction Transistor (BJT), Types, Construction of BJT, Transistor Biasing and Working, Characteristics of BJT in Common Emitter (CE) Configuration Introduction to Junction Field Effect Transistor (JFET) and Metal Oxide Semiconductor Field Effect Transistor (MOSFET): Structure and Working.	8	22%

Unit 3: Number Systems and Logic Gates Number Systems: Decimal, Binary, Octal and Hexadecimal, Representation of signed binary numbers. Binary codes - BCD code, Gray code, Excess-3 code. Digital and analog systems, logic levels & pulse waveform. Review of Logic Gates, Laws of Boolean algebra, DeMorgan's Theorems, Realization of logic expressions using basic and Universal gates (AND, OR, NOT, NAND, NOR, Ex-OR gates). Boolean Functions and their representation: Sum of Product (SOP), Product of Sum (POS), canonical forms.	6	17%
Unit-4: Digital Circuits Introduction to Combinational and Sequential Logic. Minimization of Boolean Expressions, Karnaugh map (upto 4 variables), Design of Arithmetic circuits – Binary Adders & Subtractors (half, Full), Magnitude Comparator (1-bit, 2-bit), Multiplexer (2:1, 4:1), Demultiplexer (1:2, 1:4), Encoder, Decoder and Code Converter. Latch as memory element, Construction and operation of NOR gate and NAND gate latch.	12	33%

13. Academic Honesty policy:

Chitkara University ensures the implementation of the highest level of academic integrity in all the documents being prepared / adopted by its Faculty members and students.

Any breach of the same will be tantamount to severe academic penalties.

This Document is approved by:

Designation	Name	Signature
Course Coordinator	Dr. Geetanjali	
Program Incharge	Dr. Isha Gupta	
Dean	Dr. Shivani Malhotra	
DD/MM/YYYY	10/10/2022	