BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (EE401ES)

B.TECH II Year II Sem
COURSE PLANNER

I. COURSE OVERVIEW:

The main objective of this subject is to understand and to know the following concepts:

- To introduce the basic principles and operation of all electrical and electronics components
- To deal with the measurement of voltage, current, Power factor, power, energy and Magnetic measurements.
- To understand the basics on switches.

II. PREREQUISITES:

Level	Credits	Periods/ Week	Prerequisites
UG	3	3	1. Basic Electrical Engineering 2. Intermediate Mathematics. 3. Intermediate physics.

III. COURSEOBJECTIVES:

At the end of the course, the students will be able to:

- To introduce the concepts of electrical circuits and its components
- To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
- To study and understand the different types of DC/AC machines and Transformers. To import the knowledge of various electrical installations.
- To introduce the concept of power, power factor and its improvement.
- To introduce the concepts of diodes & transistors.
- To impart the knowledge of various configurations, characteristics and applications.

IV. COURSE OUTCOME:

S.No	Description	Bloom's Taxonomy Level
CO1	***Analyze*** and solve electrical circuits using network laws and theorems	Knowledge, Understand (Level 1, Level 2)
CO2	***Analyze*** basic Electric and Magnetic circuits	Knowledge, Understand (Level 1, Level 2)
CO3	***Study*** the working principles of Electrical Machines	Apply(Level 3)
CO4	***Understand characterize diodes and various types of transistors***	Understand, Apply (Level2, Level 3)

V. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (PO)		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems related to Electrical and Electronics Engineering.	2	**Lectures, Mock tests**
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems related Electrical and Electronics Engineering and reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	1.5	**Assignments and** **Mock tests**
PO3	**Design/development of solutions**: Design solutions for complex engineering problems related to Electrical and Electronics Engineering and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2	**Case studies**
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	-	
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	1.25	**Assignments and** **Mock tests**
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Electrical and Electronics Engineering professional engineering practice	-	
PO7	**Environment and sustainability**: Understand the impact of the Electrical Engineering professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.		--

PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.		--
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.		--
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.		--
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	1.25	**Assignments**
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	**Assignments**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: None

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSO)		Level	Proficiency assessed by
PSO1	**Talented to Analyze,Design and implement electrical & electronics systems and deal with the rapid pace of indusrial innovations and developments**	1.75	Assignments, Mock tests
PSO2	**Skillful to use application and control techniques for research and advanced studies in Electrical & Electronics Engineering domain**	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: None

VII. SYLLABUS:
JNTUH SYLLABUS

UNIT - I: D.C. CIRCUITS Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation. A.C. CIRCUITS Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits , Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT - II: ELECTRICAL INSTALLATIONS: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

UNIT - III: ELECTRICAL MACHINES Working principle of Single-phase transformer, equivalent circuit, losses in transformers, efficiency, Three-phase transformer connections. Construction and working principle of DC generators, EMF equation, working principle of DC motors, Torque equations and Speed control of DC motors, Construction and working principle of Three-phase Induction motor, Torques equations and Speed control of Three-phase induction motor. Construction and working principle of synchronous generators.

UNIT - IV: P-N JUNCTION AND ZENER DIODE: Principle of Operation Diode equation, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Zener diode characteristics and applications.
RECTIFIERS AND FILTERS: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters.

UNIT - V: BIPOLAR JUNCTION TRANSISTOR (BJT): Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations. **FIELD EFFECT TRANSISTOR (FET):** Construction, Principle of Operation, Comparison of BJT and FET, Biasing FET.

SUGGESTED BOOKS:

TEXT BOOKS:

1. ""“M S Sukija , TK Nagasarkar”, “Basic Electrical and electronics Engineering”, Oxford University.
2. “-D P Kothari. I J Nagarath”, “Electrical Basic Electrical and electronics Engineering”, BS McGraw Hill Education.

REFERENCE BOOKS:

3. “– R. L. Boylestad and Louis Nashelsky”, “Electronic Devices and Circuits”, PEI/PHI, 9th Ed, 2006.

4. “J. Millman and C. C. Halkias”, “Millman’s Electronic Devices and Circuits”, TMH, 2/e, 1998.

5. “William Hayt and Jack E. Kemmerly”, “Engineering circuit analysis”, McGraw Hill Company, 6th edition.

6. “N. C. Jagan& C. Lakshminarayana,”, “Network Theory”, B.S. Publications..

7. “Sudhakar, Shyam Mohan Palli”, “Network Theory”, TMH.

VIII. COURSE PLAN (lecture wise):

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

LESSON PLAN ACADEMIC YEAR 2020-2021 II SEM

Course Instructor : Mr.V.Sampath Kumar **Class: II CIVIL**

Subject: BEEE **WEF : 26/03/2021**

Lecture No.	Unit No.	Topic to be Covered	Link for PPT	Link for PDF		Course learning outcomes	Bloom's Taxonomy	Teaching Methodology	Reference
1	I	**UNT-I DC CIRCUITS Introduction**	https://drive.google.com/drive/folders/1_VkB-oFbX_Kgn2PXXwXTaCHe0hlT6HZd?usp=sharing	https://drive.google.com/drive/folders/1_VkB-oFbX_Kgn2PXXwXTaCHe0hlT6HZd?usp=sharing		CO1	Understand	chalk & talk	T1 & T2
2		Electrical circuit elements (R, L and C)					Understand		
3		Electrical circuit elements (R, L and C)					Understand		
4		voltage and current sources					Understand		
5		KVL & KCL					Understand		
6		Problems					Analyze		
7		Problems					Analyze		
8		analysis of simple circuits with dc excitation					Understand		
9		Problems					Understand		
10		Intoduction to AC Circuits					Understand		
11		Representation of sinusoidal waveforms					Understand		
12		peak and rms values, phasor representation					Understand		
13		real power, reactive power, apparent power, power factor					Understand		

14		Problems					Analyze		
15		analysis of single phase ac circuits					Understand		
16		Three phase balanced circuits					Understand		
17		voltage and current relations in star and delta connections					Understand		
18		Problems					Analyze		
19		Problems					Analyze		
20		**Mock Test – I**							
21	**II**	**UNIT-2 Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB**	https://drive.google.com/drive/folders/1_VkB-oFbX_Kgn2PXXwXTaCHe0hlT6HZd?usp=sharing	.com/drive/folders/1_VkB-aCHe0hlT6HZd?usp=sharing	**NA**	**CO 2**	Understand		
22		Types of Wires and Cables, Earthing			**NA**		Understand		
23		Types of Batteries, Important Characteristics for Batteries			**NA**		Understand		
24		A.C Potentiometers: polar and coordinate type			**NA**		Understand		
25		Elementary calculations for energy consumption power factor improvement and battery backup			**NA**		Understand		
26		Numerical Problems			**NA**		Analyze		
		I Mid Examinations							
27	**III**	**Unit-III Working principle of Single-phase transformer, equivalent circuit**	https://drive.google.com/drive/folders/1_VkB-oFbX_Kgn2PXXwXTaCHe0hlT6HZd?usp=sharing	https://drive.google.com/drive/folders/1_VkB-oFbX_Kgn2PXXwXTaCHe0hlT6HZd?usp=sharing		**CO 3**	Apply		**T1 & T2**
28		losses in transformers, efficiency, Three-phase transformer connections			**NA**		Apply		

29		Construction and working principle of DC generators			**SMALL GENERATOR DEVEOPMENT**		Apply	
30		EMF equation and numerical problems			**NA**		Apply	
31		working principle of DC motors,			**SMALL DC MOTOR DEVELOPMENT**		Apply	
32		Torque equations and Speed control of DC motors			**NA**		Apply	
33		Construction and working principle of Three-phase Induction motor					Apply	
34		Torques equations and Speed control of Three-phase induction motor			**NA**		Apply	
35		Construction and working principle of synchronous generators			**NA**		Apply	
36	**IV**	**Unit-IV Principle of Operation Diode equation**	https://drive.google.com/drive/folders/1_VkB-oFbX_Kgn2PXXwXTaCHe0hlT6HZd?usp=sharing	https://drive.google.com/drive/folders/1_VkB-oFbX_Kgn2PXXwXTaCHe0hlT6HZd?usp=sharing	**NA**		Understand	
37		Volt-Ampere characteristics, Temperature dependence			**DIODE CHAR.**		Understand	
38		Ideal versus practical, Static and dynamic resistances			**NA**		Understand	
39		Equivalent circuit, Zener diode characteristics and applications			**NA**		Understand	
40		P-N junction as a rectifier - Half Wave Rectifier			**NA**	**CO 4**	Understand	

41		Ripple Factor - Full Wave Rectifier, Bridge Rectifier			**NA**		Under stand		
42		Harmonic components in Rectifier Circuits			**NA**		Under stand		
43		Filters – Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters			**NA**		Under stand		
44		Problems			**NA**		Analyze		
45		***Problems***			**NA**		Analyze		
46		**Mock Test – II**			**NA**				
47	**V**	**Unit-V Construction, Principle of Operation of BJT**	https://drive.google.com/drive/folders/1_VkB-oFbX_Kgn2PXXwXTaCHe0hlT6HZd?usp=sharing	https://drive.google.com/drive/folders/1_VkB-oFbX_Kgn2PXXwXTaCHe0hlT6HZd?usp=sharing	**NA**	**CO 5**	Understand		**T1 & T2**
48		Amplifying Action, Common Emitter			**STUDY OF CHAR.**		Understand		
49		Amplifying Action, Common Base			**STUDY OF CHAR.**		Understand		
50		Amplifying Action, Common Source			**STUDY OF CHAR.**		Understand		
51		Comparison of CE, CB and CC configurations			**STUDY OF CHAR.**		Understand		
52		Construction, Principle of Operation of FET			**STUDY OF CHAR.**		Understand		
53		Comparison of BJT and FET, Biasing FET			**STUDY OF CHAR.**		Understand		
54		problems			**NA**		Analyze		
55		Problems			**NA**		Analyze		
56		**Revision**							
57		**Revision**							
58		***Contents beyond Syllabus**							
MID EXAM-II									

*** Topics beyond Syllabus**

TEXT BOOKS:

1. ""M S Sukija , TK Nagasarkar", "Basic Electrical and electronics Engineering", Oxford University.
2. "-D P Kothari. I J Nagarath", "Electrical Basic Electrical and electronics Engineering", BS McGraw Hill Education.

REFERENCE BOOKS:

1 "– R. L. Boylestad and Louis Nashelsky", "Electronic Devices and Circuits", PEI/PHI, 9th Ed, 2006.

2 "J. Millman and C. C. Halkias", "Millman's Electronic Devices and Circuits", TMH, 2/e, 1998.

3 "William Hayt and Jack E. Kemmerly", "Engineering circuit analysis", McGraw Hill Company, 6th edition.

4 "N. C. Jagan& C. Lakshminarayana,", "Network Theory", B.S. Publications..

5 "Sudhakar, Shyam Mohan Palli", "Network Theory", TMH.

IX. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OFPROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Cour s e Obj ecti ves	Program Outcomes (PO)												Program Specific Outcomes (PSO)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PS 03
I	2	2	2	-	1	--	--	--	--	--	2	1	1	-	-
II	2	2	2	-	2	--	-	--	--	--	1	1	2	-	-
III	2	1	3	-	1	--	-	--	--	--	1	1	2	-	-
IV	2	1	1	-	1	--	-	--	--	--	1	1	2	-	-
AV G	2	1.5	2	-	1.25	-	-	-	-	-	1.25	1	1.75	-	-

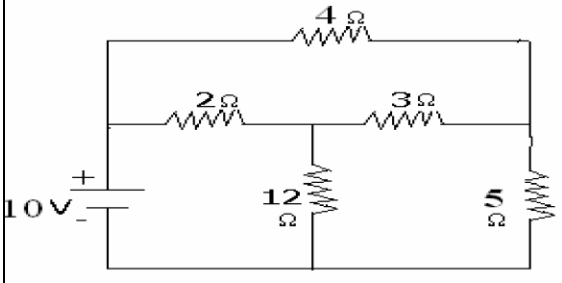
1: Slight(Low) **2: Moderate (Medium)** **3: Substantial (High)** **- : None**

X. QUESTION BANK (JNTUH):

Short Answer Questions
UNIT I

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain about Resistor, Inductor and Capacitor	Understand	2
2	Explain voltage and current source and draw characteristics	Understand	1
3	Explain about KVL and KCL?	Knowledge	2
4	Define peak and rms value?	knowledge	2
5	Name different types of powers?	Knowledge	2

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain about linear elements with necessary equations?	Knowledge	2
2	Nam different types of electrical sources and explain with necessary graphs?	Understand	2
3	Find the voltages at the nodes for the below figure	Understand	1
4	Find the Loop currents for the circuit shown below. 	Understand	2
5	Find current in each branch for the circuit in question number 4?	Understand	2
6	Find power dissipation across every resistor for the circuit in question number 4	Understand	3
7	Derive average and rms value of sinusoidal voltage waveform?	Understand	1

8	Draw 3 phase power source with wave form having 120^0 phase shift and also indicate voltage equations in sinusoidal quantities?	Knowledge	1
9	Convert voltage and current relations from star to delta connections and delta to star?	Understand	2
10	For the circuit diagram belongs to question number 4 minimize using start to delta conversation?	Understand	1

UNIT II

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain the causes and effects of low power factor?	Understand	**2**
2	Define MCB	Knowledge	**2**
3	Define MCCB	Understand	**2**
4	Define ELCB	Knowledge	**2**
5	What are different types of cables?	Understand	**2**

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain various types of batteries along with their characteristics?	Understand	**2**
2	Explain the following devices SFU, MCB, ELCB & MCCB	Understand	**2**
3	Compare &explain different types of wires and cables.	Understand	**2**
4	Explain earthing and its importance.	Understand	**2**

UNIT III

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	What is the principle of operation Transformer?	Understand	2
2	Write the types of losses in transformer?	Understand	2
3	What is the principle of operation of DC generator?	Apply	3
4	What is the principle of operation of DC motor?	Understand	2

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	Explain about working principal of single phase transformer with equivalent circuit diagram.	Understand	**3**
2.	Derive the emf equation of single phase transformer.	Apply	**3**
3.	Explain in detail about losses in transformer	Understand	**3**
4.	Construction and working principle of DC generators	Understand	**2**
5.	Derive emf equation of DC generators.	Understand	**2**
6.	working principle of DC motors and also derive Torque equations	Apply	**3**
7.	Explain about Speed control of DC motors	Understand	**2**
8.	Construction and working principle of Three-phase Induction motor	Understand	**3**
9.	Torques equations and Speed control of Three-phase induction motor	Understand	**2**
10.	Construction and working principle of synchronous Generators	Understand	**2**

UNIT IV

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	List different types of switches?	Understand	**2**
2	Difference between PN and Zeenar diode?	Understand	**2**
3	What is rectifier?	Apply	**3**
4	Difference between half and full wave rectifier?	Understand	**2**
5	List types of filters?	Understand	**2**

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain about Principle of Operation Diode equation.	Understand	**2**
2	Draw the Volt-Ampere characteristics of PN junction diode.	Understand	**2**
3	Explain about Temperature dependence, Ideal versus practical of diode.	Understand	**2**
4	Explain about Static and dynamic resistances?.	Apply	**3**
5	Draw Zener diode characteristics and mention some applications?	Understand	**2**
6	Explain about how P-N junction diode used as a rectifier.	Understand	**2**
7	Draw the circuit diagram of Half Wave Rectifier with necessary derivation and also find Ripple Factor	Understand	**2**
8	Draw the circuit diagram of Full Wave Rectifier with necessary derivation	Understand	**2**
9	Draw Bridge Rectifier with necessary derivation?	Understand	**2**
10	Explain about Harmonic components in Rectifier Circuits and also explain about different types of filters	Apply	**3**

UNIT V

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Difference between BJT and MOSFET.	Understand	**2**
2	What is CS configuration	Understand	**2**
3	What is CE configuration	Apply	**3**

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Construction and Principle of Operation of BJT?	Understand	**2**
2	Explain how BJT acts like Amplifying Action.	Understand	**2**
3	Draw circuit diagram of Common Emitter, Common Base configurations with necessary derivations.	Apply	**3**
4	Draw circuit diagram of Common Collector configurations with necessary derivations.	Apply	**3**
5	Comparison of CE, CB and CC configurations.	Understand	**2**
6	Explain about Construction, Principle of Operation of FET?	Apply	**3**

OBJECTIVE QUESTIONS:

UNIT-1

1) _____elements are capable of delivering power to some external device.
A) Active B) Passive C) Inductor D) Resistor

2) The unit of Inductance is_____.
(A) Ohms (B) Henry (C) Farads (D) Watts

3) _____law states that the sum of the currents entering into any node is equal to the sum of the currents leaving that node.
(A) Kirchhoff's Voltage (B) Faradays (C) Kirchhoff's Current (D) Electromagnetic

4) The flow of electric current in a conductor is due to flow of_____.
(A) Electrons (B) protons (C) electrons & ions (D) charged particles

5) The unit of capacitance is_____.

6) _____law states that the algebraic sum of all branch voltages around any closed path in a circuit is always zero at all instants of time.

7.A sine wave has a frequency of 50 Hz. Its angular frequency is_____radians per second.

8. The standard supply frequency in India is_____.

9. The form factor is the ratio of_____.

10. The Inductor behavior at steady state condition is _____

UNIT 2 :

1. Which of the following insulation is used in cables?

A) Varnished Cambric B) Rubber C) Paper D) Any of the Above

2.In case of three core flexible cable the colour of the neutral is_____

A) Blue B) Black C) Brown D)None of the Above

3. Low tension cables are generally used upto

A) 200V B) 500V C) 700V D) 1000V

4) What is the amount of charcoal and salt needed for GI Pipe earthing_____

a) Charcoal 5kg, salt 8kg b) charcoal 10kg, salt 8kg c) charcoal 10kg, salt 10kg d) charcoal 5kg, salt 5kg

UNIT-3

1) A transformer core is laminated to reduce_____losses.
A) Hysteresis B) Eddy current C) copper D) Windage

2) The no-load current drawn by transformer is usually_____percent of the full load current.
A) 0.2 to 0.5 B) 2 to 5 C) 12 to 15 D) 20 to 30

3) Open circuit test on transformers is conducted to determine losses.
A) Hysteresis B) copper C) core D) Eddy current
4) The path of a magnetic flux in a transformer should have_____reluctance.
5) _____material is used for the construction of transformer core.

6) A 4-pole, 440v induction motor is running at a slip of 4%. The speed of the motor is_____.

7) Short circuit test on transformers is conducted to determine_____losses.

8) In a Transformer Core is laminated to reduce_____

UNIT -4

1. A crystal diode has ……

1. one pn junction
2. two pn junctions
3. three pn junctions
4. none of the above

Answer : 1

2. A crystal diode has forward resistance of the order of ……

1. kΩ
2. Ω
3. MΩ
4. none of the above

Answer : 2

3. If the arrow of crystal diode symbol is positive w.r.t. bar, then diode is..... biased.

1. forward
2. reverse
3. either forward or reverse
4. none of the above

Answer : 1

4. The reverse current in a diode is of the order of …….

1. kA
2. mA
3. μA
4. A

Answer : 3

5. The forward voltage drop across a silicon diode is about ……

1. 2.5 V
2. 3 V
3. 10 V
4. 0.7 V

Answer : 4

6. A crystal diode is used as ……

1. an amplifier
2. a rectifier
3. an oscillator
4. a voltage regulator

Answer : 2

7. The d.c. resistance of a crystal diode is ..... its a.c. resistance

1. the same as
2. more than
3. less than
4. none of the above

Answer : 3

8. An ideal crystal diode is one which behaves as a perfect ..... when forward biased.

1. conductor
2. insulator
3. resistance material
4. none of the above

Answer : 1

9. The ratio of reverse resistance and forward resistance of a germanium crystal diode is about …….

1. 1 : 1
2. 100 : 1
3. 1000 : 1
4. 40,000 : 1

Answer : 4

10. The leakage current in a crystal diode is due to …….

1. minority carriers
2. majority carriers
3. junction capacitance
4. none of the above

Answer :1

UNIT -5

1. A transistor has ……

1. one pn junction
2. two pn junctions
3. three pn junctions
4. four pn junctions

Answer : 2

2. The number of depletion layers in a transistor is ……

1. four
2. three
3. one
4. two

Answer : 4

3. The base of a transistor is ..... doped

1. heavily
2. moderately
3. lightly
4. none of the above

Answer : 3

4. The element that has the biggest size in a transistor is ……..

1. collector
2. base
3. emitter
4. collector-base-junction

Answer : 1

5. In a pnp transistor, the current carriers are …….

1. acceptor ions
2. donor ions
3. free electrons
4. holes

Answer : 4

6. The collector of a transistor is.....doped

1. heavily
2. moderately
3. lightly
4. none of the above

Answer : 2

7. A transistor is a.....operated device

1. current
2. voltage
3. both voltage and current
4. none of the above

Answer : 1

8. In a npn transistor,..... are the minority carriers

1. free electrons
2. holes
3. donor ions
4. acceptor ions

Answer : 2

9. The emitter of a transistor is .....doped

1. lightly
2. heavily
3. moderately
4. none of the above

Answer : 2

10. In a transistor, the base current is about .....of emitter current

1. 25%
2. 20%
3. 35 %
4. 5%

XI. WEBSITES:

1. **www.ni.com**
2. **www.rohde-schwarz.com/Test&Measurement**
3. **http://ieee-ims.org/publications/transactions-tim**
4. **http://www.hpindia.com**
5. **www.isa.org**

XII.JOURNALS:

1. www.ieee.org
2. www.worldscientific.com
3. www.springer.com
4. www.sciencedirect.com

XIII. LIST OF TOPICS FOR STUDENT SEMINARS:

1. Analysis of single-phase ac circuits
2. voltage and current relations in star and delta connections
3. Static and dynamic resistances
4. Comparison of BJT and

XIV. CASE STUDIES/SMALL PROJECTS

1. Zener diode characteristics and applications.
2. Harmonic components in Rectifier