BASIC ELECTRICAL ENGINEERING

Subject Code : EE103ES
Regulations : R18 - JNTUH
Class : I Year B.Tech II Semester

Department of Science and Humanities

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

Ibrahimpatnam - 501 510, Hyderabad

BASIC ELECTRICAL ENGINEERING (EE103ES)

COURSE PLANNER

I. COURSE OVERVIEW

This course introduces the basic concepts of circuit analysis which is the foundation for all subjects of the Electrical Engineering discipline. The emphasis of this course if laid on the basic analysis of circuits which includes, DC machines, transformers, AC machines, and batteries.

II. PRE REQUISITES:

The knowledge of following subjects is essential to understand the subject:

1. Mathematics
2. Physics

III. COURSE OBJECTIVE:

1	To introduce the concepts of electrical circuits and its components
2	To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
3	To study and understand the different types of Transformers
4	To study and understand the different types of DC/AC machines
5	To introduce various switches & batteries

IV. COURSE OUTCOMES:

At the end of the course the student will be in a position to –

S. No	Description	Bloom's taxonomy level
1	To analyze and solve electrical circuits using network laws and theorem	Knowledge, Understand (Level 1, Level 2)
2	To understand and analyze basic Electric and Magnetic circuits	Apply, Analyze (Level 3, Level 4)
3	To study the working principles of Electrical Machines	Knowledge, Apply (Level 1, Level 3)
4	To introduce various switches & batteries	Knowledge, Understand (Level 1, Level 2)

V. HOW PROGRAM OUTCOMES ARE ASSESSED

Program Outcomes		Level	Proficiency assed by
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering	3	Mock tests

	problems.		
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Assignments, Mock tests
PO3	**Design/development of solutions:** Design solutions for complex engineering problems 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.	1	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.	1	Assignments
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	Assignments, 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 professional engineering practice.	1	Project models
PO7	**Environment and sustainability:** Understand the impact of the 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.	--	- -
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	-

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

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED

Program Specific Outcomes		Level	Proficiency assed by
PSO1	Talented to analyze, design and implement electrical & electronics systems and deal with the rapid pace of industrial innovations and developments	2	Assignments, Mock tests

PSO2	Skillful to use application and control techniques for research and advanced studies in Electrical and Electronics engineering domain	2	Assignments, Mock tests

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

VII. COURSE CONTENT:

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. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT-II: 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 consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance in series RL-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III: Transformers

Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT-IV: Electrical Machines

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

UNIT-V: 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.

Suggested Text-Books/Reference-Books:

1. Basic Electrical Engineering - D.P. Kothari and I.J. Nagrath, 3rd edition 2010, Tata McGraw Hill.

2. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L.S. Bobrow, Fundamentals of Electrical Engineering", Oxford University Press, 2011
4. Electrical and Electronics Technology, E. Hughes, 10th Edition, Pearson, 2010
5. Electrical Engineering Fundamentals, Vincent Deltoro, Second Edition, Prentice Hall India, 1989.

VIII. LESSON PLAN-COURSE SCHEDULE:

Lecture No.	Week No.	TOPIC	Course learning outcomes	Reference
UNIT-I: D.C. Circuits				
1	1	Introduction	**Define** basic terms like current , voltage	Text Book: 1,3,5
2		Electrical circuit elements (R, L and C)	**Know** about basic electrical circuit elements	
3		Electrical circuit elements (R, L and C)	**Know** about basic electrical circuit elements	
4		voltage and current sources	**Know** about electrical sources	
5		KVL&KCL	**Understanding** the laws	
6	2	analysis of simple circuits with dc excitation	**Analyze** various responses in electrical circuits	
7		problems	**Evaluate** voltage drop and power loss calculations	
8		Superposition Theorem	**Applying** alternative method to calculate responses	
9		Problems	**Evaluate** the circuit response using superposition theorem	
10		Thevenin and Norton Theorems	**Applying** alternative method to calculate responses	
11	3	Problems	**Evaluate** the circuit response using Thevenin & Norton theorem	
12		Time-domain analysis of first-order RL and RC circuits.	**Analyze** the circuit response with d	

			variations in circuit elements	
13		Time-domain analysis of first-order RL and RC circuits.	**Analyze** the circuit response with d variations in circuit elements	
14		Problems	**Evaluate** the circuit response with d variations in circuit elements	
15		**Mock test 1**	____	
UNIT-II: A.C. Circuits				
16	4	Representation of sinusoidal waveforms	**Know** about AC quantities	Text Book:1,2
17		peak and rms values, phasor representation	**How** to represent AC quantities in phasors	
18		Problems	**Evaluate** the RMS values of various AC waveform	
19		Problems	**Evaluate** the average values of various AC waveform	
		Bridge class 1	____	
20	5	real & reactive power, apparent power, power factor	**Know** various powers in AC circuits	
21		Analysis of single-phase ac circuits consisting of R, L, C	**Analyze** the circuit response with different elements connected in a circuit	
22		Problems	**Evaluate** the impedance & current response of AC circuit	
23		Analysis of single-phase ac circuits of RL,RC, RLC combinations	**Analyze** the circuit response with the combination of elements connected in AC circuit	
		Bridge class 2	____	
24		Problems	**Evaluate** the impedance & current response of AC circuit	
25		Problems	**Evaluate** the	

	6		impedance & current response of AC circuit	
26		resonance in series RL-C circuit	**Know** about the condition of resonance	
27		Problems	**Evaluate** the value of resonant frequency	
		Bridge class 3	____	
28		Three-phase balanced circuits	**Understanding** the three phase circuits	
29		voltage and current relations in star and delta	**Know** the relation between phase & line quantities	Text Book:1,2
30	7	Problems	**Evaluate** the value of phase, line voltages & currents in a three phase circuit	
31		Problems	**Evaluate** the value of phase, line voltages & currents in a three phase circuit	
		Bridge class 4	____	
UNIT-III: Transformers				
32		Introduction to transformer	**How** transformer works	
33	8	Ideal and practical transformer	**Distinguish** two types of transformer techniques	Text Book:1,2,4
34		equivalent circuit	**Analyze** the electrical equivalent model of transformer	
35		losses in transformers	**Know** about various losses	
		Bridge class 5	____	
(Week 9)		**Mid I Examinations**		
36		regulation and efficiency	**Know** the value of voltage drop	
37		Problems	**Evaluate** the efficiency & voltage regulation of a transformer	
38	10	Auto-transformer	**Distinguish**	Text

			between transformer & auto transformer	Book:1,2,4
39		Three-phase transformer connections.	**Know** about various types of three phase transformers	
		Bridge class 6	____	
UNIT-IV: Electrical Machines				
40	11	Generation of rotating magnetic fields	**How** generator works	
41		Construction and working of a three-phase induction motor	**What** are the various parts of three-phase induction motor	
42		Significance of torque-slip characteristic	**How** motor torque varies when it is subjected to speed variations	
43		Loss components and efficiency	**Know** about various losses	
		Bridge class 7	____	
44	12	starting methods of induction motor	**How** to start an induction motor	Text Book:1,2,4
45		speed control of induction motor	**How** to control the speed of induction motor	
46		Single-phase induction motor	**Understanding** the working principle of induction motor	
47		Construction and working of induction motor	**Know** about various parts of induction motor	
		Bridge class 8	____	
48	13	Construction of separately excited dc motor	**Understanding** the constructional details of DC motors	
49		working of separately excited dc motor	**Know** the working principle of DC motor	
50		torque-speed characteristics	**How** torque varies with the changes in the speed	
51		speed control of separately excited dc motor	**How** to vary the speed of a DC	

			motor	
		Bridge class 9	____	
52	14	Construction of synchronous generators	**Understanding** the constructional details of generators	
53		working of synchronous generators	**How** generator operates	
54		Types of synchronous generators	**Distinguish** various types of AC generators	
		Mock test 2	____	
		Bridge class 10	____	
UNIT-V: Electrical Installations				
55	15	Components of LT Switchgear	**Know** about switch purpose & **how** it operates	Text Book:1,2,5
56		Switch Fuse Unit (SFU), MCB, ELCB, MCCB	**Understanding** about the functions of various switches	
57		Types of Wires and Cables	**Classify** different types of wires & cables	
58		Earthing	**How** to do earthing	
		Bridge class 11	____	
59	16	Types of Batteries	**Classify** different types of batteries	
60		Important Characteristics for Batteries	**Know** about battery characteristics	
61		Elementary calculations for energy consumption	**How** to Calculate energy consumed by various loads	
62		Problems	**Evaluate** the energy consumed by various loads	
		Bridge class 12	____	
63	17	power factor improvement and battery backup	**Understanding** the power factor improving methods	
64		Revision	____	
65		Previous question papers solving	____	
66		Previous question papers solving	____	
		Bridge class 13	____	
(Week 18)		**Mid II Examinations**		

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

CO	Program Outcomes (PO)	Program

													Specific Outcomes (PSO)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	2	-	-	-	-	-	-	1	2	1
CO2	2	2	-	1	1	-	-	-	-	-	-	1	2	2
CO3	3	-	-	-	-	-	-	-	-	-	-	1	-	1
CO4	2	-	-	-	-	2	-	-	-	-	-	-	2	2
Avg	2.25	1.25	0.5	0.75	0.75	0.5	-	-	-	-	-	0.75	1.5	1.5

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

X. JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW(1)/ MEDIUM(2)/ HIGH(3)	JUSTIFICATION
CO1-PO1	2	Student learns basic knowledge about electrical circuits.
CO1-PO2	3	Students analyze electrical circuits using theorems.
CO1-PO3	2	Students design mathematical models of electrical circuits.
CO1-PO4	2	Students investigate complex problems.
CO1-PO5	2	Students analyze circuits using software tools.
CO1-PO12	1	Students can be able to apply his knowledge on various engineering problems and learn advanced technologies.
CO1-PSO1	2	Students can design and analyze different electrical circuits.
CO1-PSO2	1	Students can apply their knowledge to conduct research.
CO2-PO1	2	Student acquires knowledge about rms and average values of ac signals.
CO2-PO2	2	Students apply his knowledge to analyze problems.
CO2-PO4	1	Students conduct investigation on solving complex problems.
CO2-PO5	1	Students use matlab/simulink or pspice to understand circuits.
CO2-PO12	1	Students can be able to apply his knowledge on various engineering problems and learn advanced technologies.
CO2-PSO1	2	Students can analyze problems.
CO2-PSO2	2	Students can apply his knowledge on analytical techniques to conduct research.
CO3-PO1	3	Students acquire knowledge about working principles of electrical machines.
CO3-PO12	1	Students can learn working principles of latest machines.
CO3-PSO2	1	Students can apply their knowledge to conduct research in developing cost effective electrical machines.
CO4-PO1	2	Students acquire knowledge on electrical installations.
CO4-PO6	2	Students learn safety measures regarding installations.
CO4-PSO1	2	Students can understand and design components of electrical installations.
CO4-PSO2	2	Students can apply their knowledge to conduct research in developing cost effective components for electrical installations.

XI. QUESTION BANK: (JNTUH)

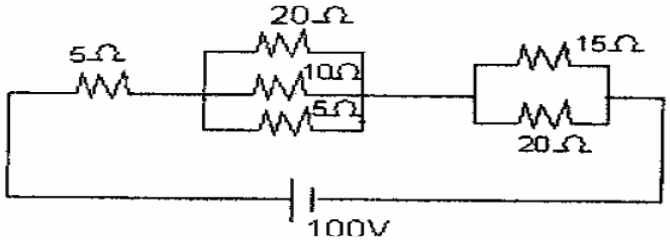
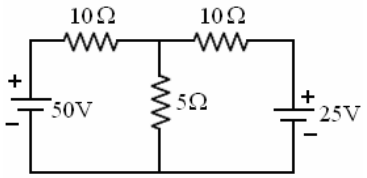
DESCRIPTIVE QUESTIONS:

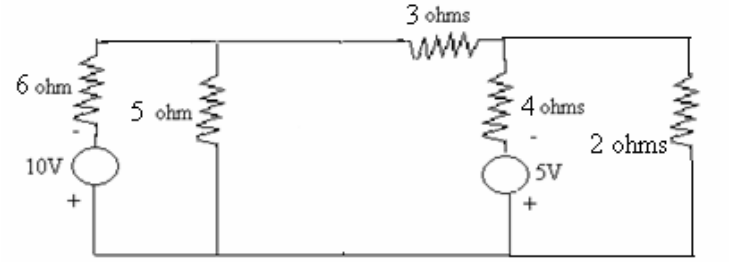
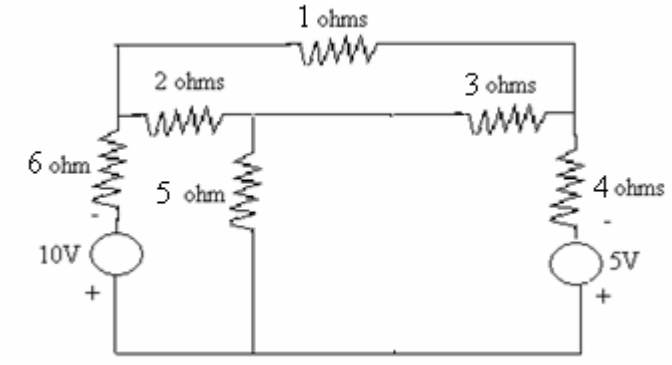
UNIT-I

Short Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Demonstrate Thevinin's & Nortons Therorem	Understanding	1
2	The voltage across 5 ohm resistor is 10 Volts. Find the current and power dissipated in the resistor	Remembering	1
3	Explain ohms law and write the properties of resistance	Understanding	1
4	Demonstrate Superposition Theorem	Understanding	1
5	State & explain Kirchoffs laws with an example	Understanding	1

Long Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	For the circuit shown in figure, evaluate the total current, individual currents in each branch. Find the total power consumed 	Evaluating	1
2	Evaluate the current through 5 Ω resistor using superposition theorem 	Evaluating	1
3	a) State and explain Ohm's law. b) Two coils connected in parallel across 100 V DC supply, takes 10 A current from the Supply. Power dissipated in one coil is 600 W. Find: i) What is the resistance of that coil? ii) What is the	Remembering	1

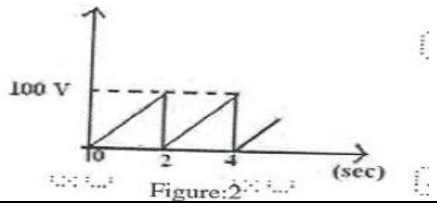
	current flowing through that coil? iii) What is the current in the other coil? iv) What is the resistance of the other coil?		
4	By using nodal analysis find the current flowing through 3 ohms resistor. 	Remembering	1
5	By using loop analysis find the current flowing through 5 ohms resistor. 	Remembering	1

UNIT-II

Short Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Define Average value, RMS Value, Form Factor and peak factor	Remembering	2
2	Classify the types of AC waveforms.	Understanding	2
3	Write the significance of J operator.	Remembering	2
4	Define an alternating quantity and explain the phasor representation of AC waveform.	Remembering	2
5	Write about addition and multiplication of phasors.	Remembering	2

Long Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Find the Average value, RMS value and form factor of the saw-tooth wave shown  Figure:2	Remembering	2
2	An a.c circuit consists of a resistance of **5 Ω,** an inductance of 0.1 H, and a capacitance of 100 µF, all in series. Determine for this circuit: a) Total reactance b) Impedance c) Admittance d) Susceptance and e) Conductance	Evaluating	2
3	A 20 ohms resistor is connected across a voltage source V (t) = 200 Sin ωt. Find the current I (t) and the instantaneous power P(t) and also the average power. Draw the relevant waveforms	Remembering	2
4	A 230 V, 50 Hz voltage is applied to a coil of **L= 0.5 H** and **R=200 Ω i**n series with a capacitor C. What value must C have in order that the total voltage across the coil shall be 250V?	Remembering	2
5	A circuit consisting of variable resistance in series with a capacitance of 80 µF, is connected across a 120 V, 50Hz supply. Find the value of resistance so that the power absorbed is 100W.	Remembering	2

UNIT-III

Short Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain why transformer rating is in KVA but not KW?	Understanding	3
2	Define Efficiency and Regulation of a transformer.	Remembering	3
3	Write the Principle of a Transformer and define turns ratio	Remembering	3
4	Classify the types of losses in a transformer	Analyze	3
5	Define ideal and practical transformer.	Remembering	3

Long Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain the construction of a single phase transformer.	Understanding	3
2	Discuss in detail the difference between the core type and shell type transformer.	Creating	3
3	a) Derive an emf equation of a single phase transformer. b) The maximum flux density in the core of 250/3000 Volts 50 Hz single phase transformer is 1.2 webers per square meter. If the emf per turn is 8 volts determine primary and secondary turns and area of the core	Evaluating	3
4	A 1-φ phase transformer takes 10A on no-load at a power factor of 0.1. The turn's ratio is 4:1. If a load is supplied by the secondary at 200 A, and a power factor of 0.8, find the primary current, and the power factor. Neglect the internal voltage drops in a transformer and also draw the phasor diagram.	Remembering	3
5	(a) The design requirement of a 11,000 / 415 V, 50 Hz, single phase, core-type transformer are approximate emf/ turn is 15 V, maximum flux density 1.5 T. Find a suitable number of primary, and secondary turns and the net cross sectional area of the core. (b) Explain different losses in case of transformer.	Remembering	3

UNIT-4

Short Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Define Slip of Induction Motor	Remembering	3
2	How can the direction of 3 phase induction motor be reversed	Remembering	3
3	Why single phase induction motors are not self starting	Remembering	3
4	Define back emf.	Understand	3
5	Draw torque-slip characteristics of induction motor	Understand	3

Long Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome

1	Explain briefly how rotating magnetic field is developed	Remembering	3
2	Explain the construction of 3 phase induction motor	Remembering	3
3	Explain the working principle of 3 phase induction motor	Remembering	3
4	State & Explain the typical torque-slip characteristics of 3 phase induction motor	Remembering	3
5	List the various losses that take place in induction motor	Remembering	3

UNIT-5

Short Answer Questions-

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

Long Answer Questions-

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

OBJECTIVE QUESTIONS:

JNTUH:

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) Ampere-Second could be the unit of_____.

8) The resistance of a conductor having a length 'l', area of cross-section 'a' and resistivity 'ρ' is given as R = _____.

UNIT-2

1. A sine wave has a frequency of 50 Hz. Its angular frequency is _____ radians per second.
2. The standard supply frequency in India is _____.
3. The form factor is the ratio of _____.
4. The Inductor behavior at steady state condition is _____
5. In R-L circuit current _____ the Voltage.
6. Form Factor is the ratio of [ ]

A) RMS Value/Peak Value B) Mean value/Peak value

C) RMS value/Mean Value D) Mean Value/RMS Value

7. A 60Hz power line voltage of 120V is applied across a resistance of 10 ohms. The RMS value of current [ ]

A) 168A B) 8.48A C) 16.8A D) 12A

8. OHM is the unit of following except [ ]

A) Resistance B) Capacitance C) Capacitive reactance D) Inductive reactance

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) The frame of an induction motor is usually made of _____.

A) Silicon steel B) Cast Iron C) Aluminium D) Bronze

2) In an induction motor, on no- load the slip is generally ____.

A) Less than 1% B) 1.5% C) 2% D) 4%

3) In inductor motor, starting torque is _____ proportional to the square of the applied voltage.

A) Directly B) inversely C) independently D) not

4) Slip rings are usually made of _____ material.

5) The difference between the synchronous speed and rotor speed is known as _____.

6) A 3- phase slip ring induction motor has _____ rotor.

7) Emf equation of generator is _____

8) Yoke is made of which material_____

UNIT-5

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

5) A certain appliance uses 350 W. If it is allowed to run continuously for 24 days, how many kilowatt-hours of energy does it consume? a) 20.16 kWh b) 201.6 kWh c) 2.01 kWh d) 4 kWh

6) What type of earthing is used by transmission lines _____
a)plate earthing b)rod earthing c) strip earthing b)both a & c e) all of the above

7) Power factor can be improved by connecting which among these?
a) Static capacitors b) Resistors c) Synchronous condensers d) Both (a) and (c).

8) The cell which is used as standard cell is:
a) Dry cell b) Solar cell c) Mercury-Cadmium cell d) Zinc-Carbon cell

WEBSITES:

1. http://en.wikipedia.org/wiki/Electric_circuits
2. http://www.ieee.org/pes IEEE Power Engineering Society

EXPERT DETAILS:

1) A.S. Pabla retired engineer
2) Prof S.Siva Naga raju JNTUK
3) Prof V.Sankar JNTUA

JOURNALS:

Fundamentals of Electrical engineering (IEEE Press Series on Power Engineering).

LIST OF TOPICS FOR STUDENT SEMINARS:

1. Classification of sources.
2. Types of AC waveforms
3. Working principle of transformer & types
4. Working principle of motor & types
5. Working principle of generator & types.
6. Types of batteries.

CASE STUDIES / SMALL PROJECTS:

1. How to make earthing.
2. Testing transformer efficiency.