

Hi-Tech Institute of Engineering & Technology	
DEPARTMENT OF ELECTRICAL ENGINEERING	
MODEL PAPER-2, ODD SEMESTER-2023-24,	
Semester: 1st	Course/Branch: B.Tech
Subject Code: BEE101	Subject Name: Fundamentals of Electrical Engineering
Faculty Name: Rashmi Tayal/ Omkar Singh	
Time: 3: 00 Hours	Total Marks: 70

Note: Attempt all Sections. If you require any missing data, then choose suitably.

SECTION A

1. Attempt all questions in brief. 2X7=14

Q No.	Question	Marks	CO
a.	Draw the V-I characteristics for ideal voltage source and Ideal current source.	2	1
b.	Explain true power, reactive power and apparent power.	2	2
c.	A series circuit has $R= 10\Omega$, $L= 0.02H$ and $C= 3\mu F$. Calculate Q-factor of the circuit.	2	2
d.	Why synchronous motor is doubly excited?	2	4
e.	Why earth pin is made bigger and thicker than other?	2	5
f.	Why DC cannot be applied to a transformer?	2	3
g.	Differentiate between node and junction.	2	1

SECTION B

2. Attempt any three of the following: c7X3= 21

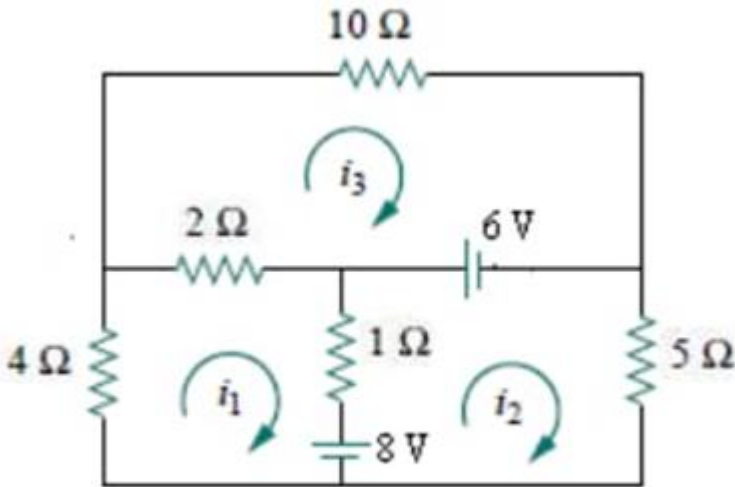
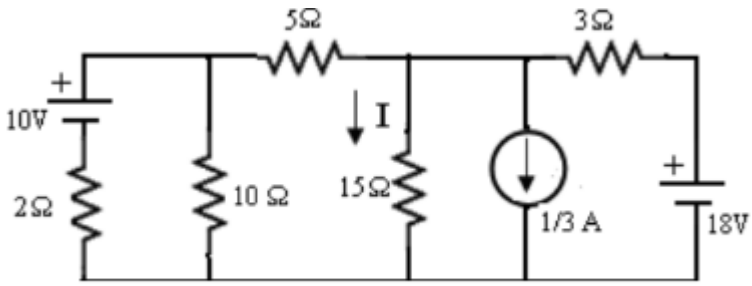
Q No.	Question	Marks	CO
a.	Explain KVL and KCL. Calculate the node voltage in the circuit shown in figure1 <div style="text-align: center;"> <p style="text-align: center;">Fig. 1</p> </div>	7	1
b.	Derive the expressions of resonance frequency and dynamic impedance for parallel resonance circuit. A 46 mH inductive coil has a resistance of 10Ω . How much current will it draw if connected across a 100V, 60Hz supply? Also calculate the value of capacitor that must be connected across the coil to make the power factor of overall circuit unity.	7	2
c.	Derive the condition for maximum efficiency of Transformer. The maximum efficiency of a 100 kVA transformer is 98.40% when it operates at 90% of full load at unity power factor. Calculate the efficiency of a transformer at 33.33% of full load with 0.5 lagging power factor.	7	3

d.	Derive the torque equation for DC motor. A 4-pole dc shunt generator with a wave-wound armature has to supply a load of 500 lamps each of 100W at 250V allowing drop of 1V/brush, calculate the speed at which the generator should be driven. The flux per pole is 30mWb and the armature and shunt field resistance are respectively 0.05Ω and 62.5Ω . The number of armature conductors is 390.	7	4
e.	Differentiate between primary and secondary battery. What are the factors that affect the capacity of battery? What is the composition and application of lithium ion battery?	7	5

SECTION C

3. Attempt any *one* part of the following:

7X1= 7

Q No.	Question	Marks	CO
a.	Apply Mesh analysis to calculate the mesh currents as shown in figure 2:  <p style="text-align: center;">Fig.2.</p>	7	1
b.	Determine the current in 15 ohm branch of the circuit shown in figure 3 by nodal Analysis.  <p style="text-align: center;">Figure 3</p>	7	1

4. Attempt any *one* part of the following: 7X1= 7

Q No.	Question	Marks	CO
a.	Derive the mathematical relationship between phase and line quantities (current and voltage) in a 3-phase star configuration with the help of phasor diagram..	7	2
b.	A circuit consists of two impedance $(3 + j4)\Omega$ and $(5 - j12)\Omega$ connected in parallel across a 200 V, 50 Hz supply. Calculate: (i) Total current drawn by the circuit (ii) Overall power factor (iii) Total Power absorbed by the whole circuit.	7	2

5. Attempt any one part of the following: 7X1= 7

Q No.	Question	Marks	CO
a.	Draw and explain the phasor diagram of an actual transformer for lagging pf. Write proper circuit equations.	7	3
b.	A 20 kVA, 2000V/ 200V, single phase, 50 Hz transformer has a primary resistance of 1.5Ω and reactance of 2Ω . The secondary resistance and reactance are 0.015Ω and 0.02Ω respectively. The no load current of transformer is 1 A at 0.2 power factor. Determine: (i) Equivalent resistance, reactance and impedance referred to secondary (ii) Total copper losses.	7	3

6. Attempt any one part of the following: 7X1= 7

Q No.	Question	Marks	CO
a.	Draw and explain the slip-torque characteristics of 3-phase induction motor. A 3-phase, 50 Hz induction motor has 6 poles and operates with a slip of 5% at a certain load. Determine (i) The speed of the rotor with respect to the stator (ii) The frequency of rotor current (iii) The speed of the rotor magnetic field with respect to rotor.	7	4
b.	Explain why a single phase Induction motor is not self-starting? Enlist various starting methods. Explain any one method in detail.	7	4

7. Attempt any one part of the following: 7X1= 7

Q No.	Question	Marks	CO
a.	What is the main purpose of earthing? Enlist the different methods of earthing? Explain any one in detail.	7	5
b.	What are the various types of wires and cables used in electrical installations? Explain four core armoured XLPE cable with diagram.	7	5