Total Number of Pages: 03

Course: B.Tech/IDD
Sub_Code: 23ES1001

1st Semester Regular/Back Examination: 2024-25
SUBJECT: BASIC ELECTRICAL ENGINEERING
BRANCH(S): AEIE, AUTO, BIOTECH, CHEM, CIVIL, CE, CST, CSEAI, CSEDS, CSE, CSEAIME, EEE, ELECTRICAL, ECE, ETC, MANUTECH, MECH, MME, METTA, MINERAL, PLASTIC
Time: 3 Hours
Max Marks: 100
Q.Code: R582
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1	**Answer the following questions:**	**(2 x 10)**

a) The nodal analysis and mesh analysis of an electrical circuit is based on which laws?

b) Explain how current source with a source resistance can be converted into an equivalent voltage source with simple example.

c) State Super-position theorem.

d) If two incandescent lamp of rating 100W, a fan rated 80W and a heater rated at 1000W are operated for 5 hr/day, calculate the total energy consumption in 7 days.

e) A 250 V, 50 Hz supply is connected to a pure inductor. The resulting current is 1.5 A. Calculate the value of the inductance.

f) The Magneto Motive Force of magnetic circuit is analogous to which quantity of electrical circuit? What is the reciprocal of permeability?

g) What is the function of commutator in DC machines?

h) What is the purpose of using core in a transformer and what are its features?

i) What will happen if the slip of induction motor becomes zero?

j) What are the different sources of electrical power?

Part-II

Q2	**Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**	**(6 x 8)**

a) What are the types of DC machine based on their excitation? Explain with circuit diagram.

b) A 220 V shunt motor having armature resistance of 0.4 ohms takes an armature current of 30 A on a certain load. By how much must the main flux be reduced to raise the speed by 30% if the developed torque is constant? Neglect saturation and armature reaction.

c) Explain the principle of operation of a single-phase transformer.

d) Draw the vector diagram of a single-phase transformer for resistive, inductive, and capacitive loads considering winding resistances and magnetic leakage.

e) Explain about layout of distribution system with neat sketch.

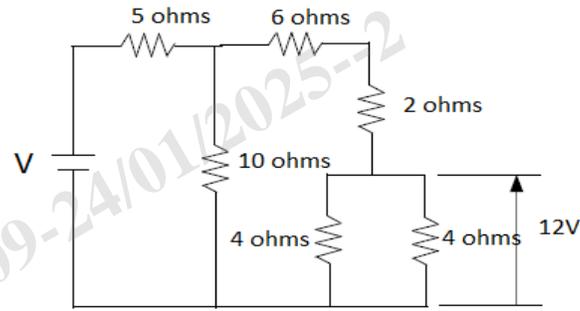**f)** Calculate the supply voltage V in the circuit shown in Figure 1.

Fig. 1

g) Determine the voltage v in the circuit shown in Figure 2. Use nodal analysis method.
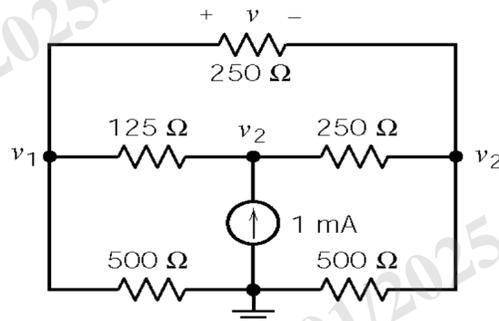

Fig. 2

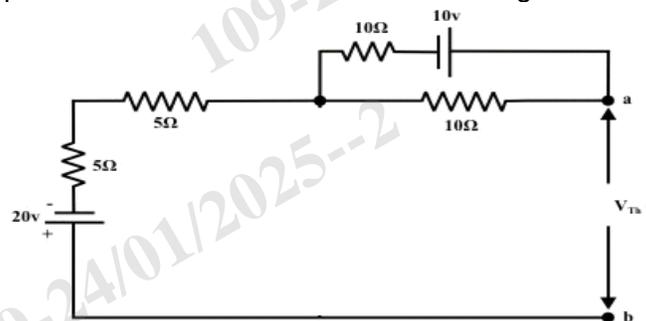**h)** Draw Thevenin's equivalent circuit of the circuit shown in Figure 3.

Fig. 3

i) A total current of 1 A is drawn by the circuit shown in Figure 4 fed from an ac voltage, V of 50 Hz. Find the input voltage.
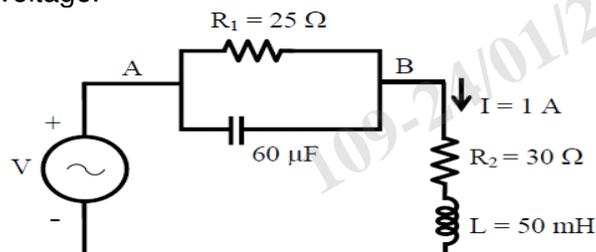

Fig. 4

j) Explain the concept of resonance in series RLC circuit and derive the expression for resonance frequency. Also, plot the related curves.

k) Three identical impedances connected in star fashion draw a line current of $(5\angle-30^0)$ A, when connected across a 400V, 50 Hz, three phase AC supply. Find the resistance, reactance, and impedance per phase.

l) Explain the term "coefficient of coupling". Two coils having self-inductances of 250 µH and 150 µH are magnetically coupled and connected in series opposition. Determine the effective inductance if the coefficient of coupling is 0.1.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Derive the formula for conversion of star connected resistances to delta connected resistances and vice-versa. Also, find the equivalent resistance R_{ab} in the circuit shown in Figure 5. **(16)**
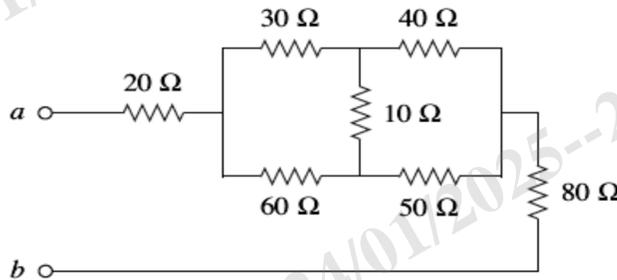

Fig. 5

Q4 Define average value, RMS value, form factor and peak factor. Find the average value, RMS value, form factor and peak factor of the waveform shown in Figure 6. **(16)**
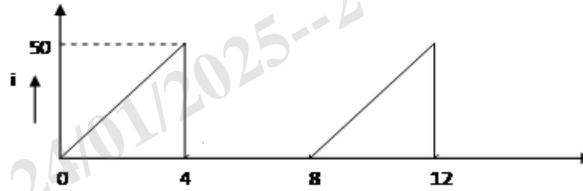

Fig. 6

Q5 a) Explain the operating principle of a three phase induction motor and draw its torque-slip characteristic. **(8x2)**

b) A 3-phase, 400 V, 50 Hz, 6 pole induction motor while rotating has frequency of rotor EMF 2 Hz. Calculate the slip, the rotor speed, and speed of stator field with respect to rotor.

Q6 Draw the layout of electric power supply system. With neat diagram explain the layout of hydro-electric power plant. **(16)**