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B. M. S. College of Engineering, Bengaluru - 560019

Autonomous Institute Affiliated to VTU

October / November 2021 Supplementary Examinations

Programme: B.E. **Semester : I / II**
Branch : ALL **Duration: 3 hrs.**
Course Code: 18EE1ESELE / 18EE2ESELE **Max Marks: 100**
Course: ELEMENTS OF ELECTRICAL ENGINEERING **Date: 06.11.2021**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may suitably assumed.

UNIT - I

1. a) State Superposition Theorem and determine the current flowing through the 4Ω resistance and potential difference across 4Ω resistance using superposition theorem for the circuit shown in Figure 1. **10**

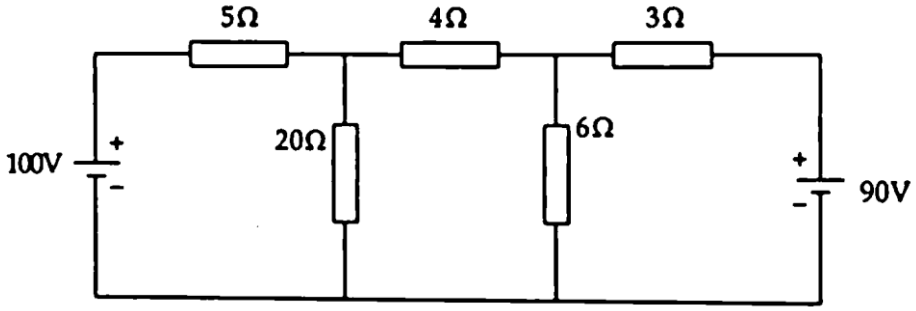

Figure 1.

b) Find the useful flux per pole of a 250 V, 6 pole DC shunt motor having a wave connected armature winding with 220 conductors. At normal working temperature, the armature resistance is 0.2 Ω. The armature current is 13.3 A, at a no load speed of 908 RPM. **05**

c) Derive an expression for the torque developed in a DC motor. **05**

OR

2. a) For the Figure 2 shown, Find the value of EMF of source E_2 so that the current 'I', flowing through the 4Ω resistor becomes zero. Use Branch Current method, Kirchhoff's Current Law and Kirchhoff's Voltage Law as applicable. **07**

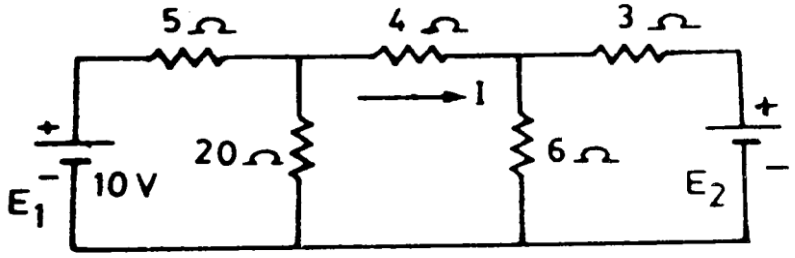

Figure 2

b) Explain the Speed versus Armature current and Armature torque versus Armature current characteristics of a DC Series motor with relevant equations and graph. **05**

c) Draw a neat labelled diagram, of a DC Machine. Also, explain the function of each part. **08**

UNIT - II

3. a) A series RLC circuit is supplied with an AC voltage 'v' at a frequency of 'f'. Derive an expression for the impedance and give an expression for current in the circuit for the following conditions **07**

(i) $X_L > X_C$

(ii) $X_L < X_C$

Draw the phasor diagram indicating voltage and drops across different elements in the circuit.

b) Define average value of a sinusoidal wave. Arrive at an expression for the average value of a sinusoidal voltage wave. **05**

c) A current of 0.9A flows through a series combination of a resistor of 120 Ω and a capacitor of reactance 250 Ω. Find the impedance, power factor, supply voltage, voltage across resistor, voltage across capacitor, apparent power, active power and reactive power. **08**

UNIT – III

4. a) Derive an expression for the phase EMF and line EMF of a three phase star connected AC synchronous generator. **06**

b) Derive the relation between line and phase quantities in a 3Ø balanced star connected system using phasor diagram. **07**

c) A three phase star connected alternator (or synchronous generator) is driven at 900 rpm is required to generate a line voltage of 460V at 60Hz on open circuit. The stator has 2 slots per pole per phase and four conductors per slot. The winding factor is 0.966. Compute (i) the number of poles (ii) flux per pole. **07**

OR

5. a) Three similar coils connected in star take a total power of 1.5kW at a power factor of 0.2 lagging from a 3Φ, 400V, 50Hz supply. Calculate the resistance and inductance of each coil. **07**

b) With a neat circuit diagram and phasor diagram, prove that two wattmeters are sufficient to measure total real power and reactive power in a balanced three phase star connected system. **08**

c) Enumerate five differences between Salient pole type and Non – Salient pole type rotor. **05**

UNIT - IV

6. a) Explain various power losses in a transformer. **05**

b) Explain principle of operation of a single phase transformer and derive the expression for emf equation of a transformer. **07**

c) A transformer is rated at 100kVA. At full load, its copper loss is 850W and its iron loss is 450W. Calculate (i) the efficiency at full load and UPF (ii) the efficiency at half load and 0.9 pf (iii) the load kVA at which maximum efficiency occurs (iv) maximum efficiency at 0.95 pf. **08**

UNIT - V

7. a) Sketch and explain the block diagram of Residential/ Domestic wiring for lighting and heating applications. **06**

b) Define Earthing. Why Earthing is necessary? Explain with the help of neat diagram the Pipe Earthing. **07**

c) Define slip. A 6 pole induction motor is supplied by a 10 pole alternator which is driven at 600 RPM. If the motor is running at 970 RPM, determine the frequency of the generated emf of the alternator and percentage slip of the induction motor. **07**

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