VIT
Vellore Institute of Technology

Final Assessment Test – June 2023

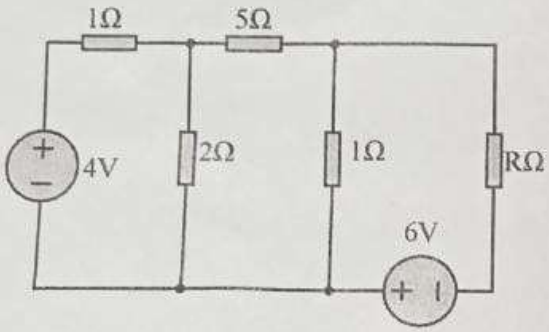
Course: BEEE102L - Basic Electrical and Electronics Engineering
Class NBR(s):4570 Slot: A1+TA1
Time: Three Hours Max. Marks: 100

KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE

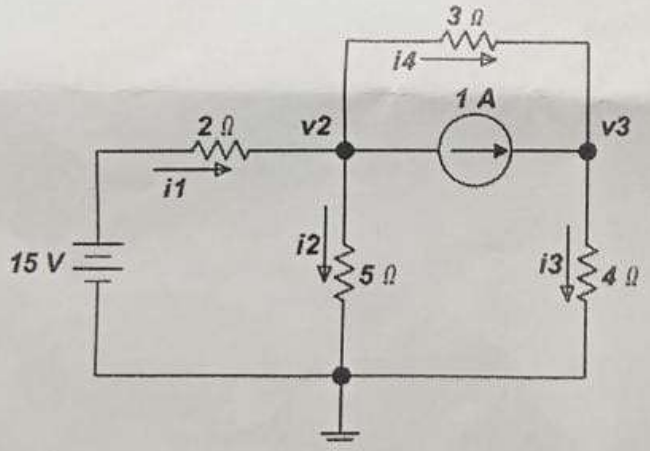
General Instructions: Assume suitable data if required.

Answer any FIVE Questions
(5 X 20 = 100 Marks)

1. a) Apply maximum power transfer theorem to calculate maximum power transferred through the load (RΩ) for the circuit given below. **[10]**



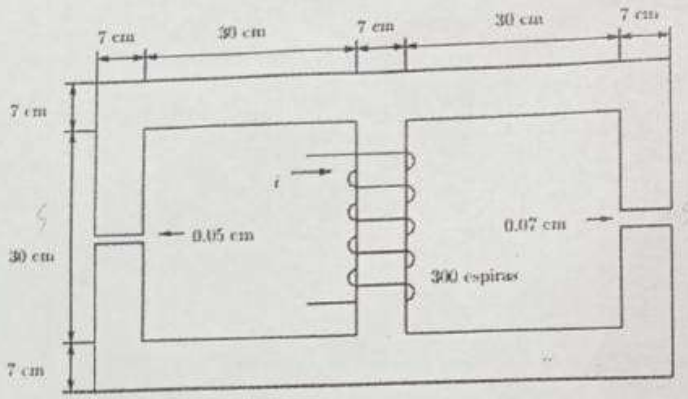
b) Calculate node voltages (***v2*** and ***v3***) and branch currents (***i1***, ***i2***, ***i3*** and ***i4***) currents for the circuit given below. **[10]**



2. a) A 240 V, 50 Hz AC supply is applied to a coil of 0.08 H inductance and 4 Ω resistance connected in series with a capacitor of 8 μF. Calculate the following (i) Impedance, (ii) Circuit current, (iii) Phase angle between voltage and current, (iv) Power factor (v) Power consumed, and (vi) Q-factor of the circuit at resonant frequency. Draw phasor diagram of the circuit. **[10]**

b) Three identical coils, each of resistance 10Ω and inductance 42mH are connected (a) in star and (b) in delta to a 415V, 50 Hz, 3-phase supply. Determine the total power dissipated in each case. **[10]**

3. a) The figure below shows an iron core whose relative permeability is 2,000. The dimensions of the core are shown in the figure. The width of the core is 7 cm. The lengths of the air gaps are 0.05 cm and 0.07 cm, respectively. The cross section in the air gaps is 5% bigger than that of the iron core. The coil has 300 turns and its current is 1.0 A. Determine the magnetic flux in each column of the iron core and the magnetic induction in the air gaps. [10]



b) Two coils connected in series-aiding fashion have a total inductance of 250 mH. When connected in a series-opposing configuration, the coils have a total inductance of 150 mH. If the inductance of one coil (L1) is three times the other, find L1, L2, and M. What is the coupling coefficient? [10]

4. a) Explain working principle of single-phase AC transformers. A single-phase transformer has 500 primary and 1000 secondary turns. The net cross-sectional area of the core is 50 cm^2. If the primary winding is connected to a 50 Hz supply at 400 V, compute: (i) Peak value of the flux density in the core (ii) Voltage induced in the secondary winding. [10]

b) Initially a d.c shunt motor having $r_a = 0.5\ \Omega$ and $R_f = 220\ \Omega$ is running at 1000 rpm drawing 20 A from 220 V supply. If the field resistance is increased by 5%, calculate the new steady state armature current and speed of the motor. Assume the load torque to be constant. [10]

5. Simplify the given 3-variable Boolean equation by using k-map. [20]
$F = X'\,Y\,Z + X'\,Y'\,Z + X\,Y\,Z' + X'\,Y'\,Z' + X\,Y\,Z + X\,Y'\,Z'$
Construct the truth table of original and simplified function. From the truth table of original function, obtain the POS form of the function. Realize the original and simplified functions with logic gates.

6. a) List the differences between P-N junction and Zener diodes. Sketch their V-I characteristics and explain their respective behaviour. [10]

b) An a.c. voltage of peak value 20 V is connected in series with a silicon diode and load resistance of 500 Ω. If the forward resistance of diode is 10 Ω, find : (i) peak current through diode (ii) peak output voltage. What will be these values if the diode is assumed to be ideal? [10]

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