INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY, SHIBPUR

B.TECH 1st SEMESTER (Gr I/Gr II/Gr III/Gr IV) FINAL-SEMESTER EXAMINATION, MARCH 2021

BASIC ELECTRICAL ENGINEERING (EE-1101)

FULL MARKS: 50   TIME: 1 hour 30 minutes

(i) Use a single answer –script for all the questions
(ii) All parts of a question MUST be answered together

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Part – A
Answer Q. No. (1) and any TWO from the rest

1. Write short notes on: (**any two**) $(2\frac{1}{2} \times 2 = 5)$
    a) Thevenin's Theorem
    b) B-H curve of a magnetic material
    c) Short circuit test of a single-phase transformer

2. a) State Maximum Power Transfer Theorem and find the efficiency at maximum power transfer condition.   (5)

2. b) Calculate the power which would be dissipated in a 50 Ω resistor connected across points '***x***' and '***y***' in the network shown in Fig. 1.   (5)

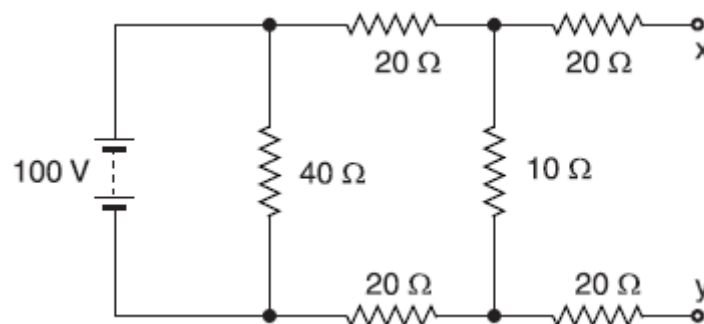

Fig. 1

3. a) Derive an expression for the e.m.f. induced in a single-phase two-winding transformer.   (5)

3.b) A 200 kVA rated transformer has a full-load copper loss of 1.5 kW and an iron loss of 1 kW. Determine the transformer efficiency at half full-load and 0.85 power factor.

                                                                   (5)

4. (a) What are the different methods of excitation of d.c machines?   (5)

   (b) An 8-pole d.c. motor has a wave-wound armature with 900 conductors. The useful flux per pole is 25 mWb. Determine the torque exerted when armature current is 30 A.

                                                                   (5)

Part-B

Answer Question 5 and Any two from the rest

5. Write short notes on : (**any two**)

    i.   Root-Mean-Square (r.m.s) value of a sinusoidal wave
    ii. Series resonance
    iii. Rotating magnetic field of a 3-phase induction motor   ($2\frac{1}{2} + 2\frac{1}{2}$)

6. a) Two voltages given by

$$v_1 = 50sin(377t - 30^o), \text{ and}$$
$$v_2 = 20sin(377t + 45^o)$$

    act in a series circuit. Determine the r.m.s value of the total voltage. Draw the phasor diagram.   (5)

  b) Show that for a sinusoidal wave, the half-cycle average is equal to 0.673 times the maximum value.   (5)

7. a) For a sinusoidal system, when a current is leading the voltage by $\frac{\pi}{2}$, find out the expression of the instantaneous power. Draw the waveforms of current, voltage and power. Show that the average power to the load is zero.   (5)

  b) A resistance of 60Ω connected in series with a 120 µF capacitor across a 230V, 50 Hz supply.
    i.   Draw the circuit and phasor diagram of the given system.
    ii.   Determine the current through the circuit.
    iii. Find out the phase-difference between the supply voltage and the current
    iv. Power consumed in the circuit.   (5)

8. a) State the principle of operation of a 3-phase squirrel-cage induction motor.   (5)

  b) A 3-phase, 6-pole, 50 Hz induction motor has a slip of 1% at no-load, and 3% at full-load. Determine
    i.   Synchronous speed of the motor
    ii.   No-load speed of the motor
    iii. Full-load speed of the motor
    iv. Frequency of the rotor current at stand-still.
    v.   Frequency of the rotor current at full-load.   (5)

[Moderator: Aparajita Sengupta]