Code : 100201

B.Tech 2nd Semester Exam., 2019

(New Course)

BASIC ELECTRICAL ENGINEERING

Time : 3 hours   Full Marks : 70
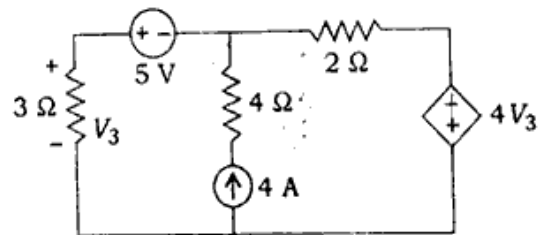
Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are **NINE** questions in this paper.

(iii) Attempt **FIVE** questions in all.

(iv) Question No. **1** is compulsory.

1. Choose the correct alternative from any seven of the following :   2×7=14

(a) The current through $2\,\Omega$ resistor is

    (i) 1·2343 A

    (ii) 0·2343 A

    (iii) 4·2343 A

    (iu) 3·2343 A

(b) A 500 V, 3-phase induction motor has an output of 50 hp and operates at a power factor of 0·85 lagging with an efficiency of 90%. The readings of the two wattmeters respectively are

    (i) 31·44 kW and 10 kW

    (ii) 20 kW and 21·44 kW

    (iii) 15 kW and 26·44 kW

    (iv) 28·15 kW and 13·29 kW

(c) A coil takes 2·5 A when connected across 200 V, 50 Hz mains. The power consumed by the coil is found to be 400 W. The coil inductance and power factor respectively are

    (i) 0·153 H and 0·8 lag

    (ii) 3·32 H and 0·9 lag

    (iii) 3·32 H and 0·8 lag

    (iv) 0·153 H and 0·9 lag

(d) Which among the following is/are the main characteristic(s) of a fuse element?

    (i) Low melting point

    (ii) High conductivity

    (iii) Least deterioration due to oxidation

    (iv) All of the above

(e) A resistance, a condenser and a variable inductance are connected in series across a 200 V, 50 Hz supply. The maximum current which can be obtained by varying the inductance under resonance is 314 mA and the voltage across the condenser is then 300 V. The values of R-L-C respectively are

(i) 6·37 Ω, 3·04 H and 3·33 μF

(ii) 6·37 Ω, 30·4 H and 33·3 μF

(iii) 637 Ω, 3·04 H and 3·33 μF

(iv) 637 Ω, 3·04 H and 33·3 μF

(f) Three similar coils, each of resistance 20 Ω and inductance of 0·5 H, are connected in delta to a 3-phase, 50 Hz, 400 V supply. The line current and total powers absorbed respectively are

(i) 146 A and 127·8 W

(ii) 1·46 A and 127·8 W

(iii) 4·38 A and 383·4 W

(iv) 2·52 A and 383·4 W

(g) A 440/110 transformer has an effective primary resistance of 0·3 Ω and secondary resistance of 0·02 Ω. Its iron losses at normal input are 150 W. What would be the secondary current at which the maximum efficiency will occur?

(i) 86·60 A

(ii) 62·22 A

(iii) 5·56 A

(iv) 12·56 A

(h) For high current and low voltage rating, which winding is employed to DC machine?

(i) Lap winding

(ii) Wave winding

(iii) Both lap and wave windings

(iv) None of the above

(i) When the mechanical power developed by a DC motor is maximum

    (i) back emf is equal to applied voltage

    (ii) iron losses are equal to copper losses

    (iii) back emf is equal to half of the applied voltage

    (iv) back emf is equal to zero

(j) In two-wattmeter method of power measurement, if one of the wattmeters gives negative reading, then it can be concluded that the load

    (i) power factor is unity

    (ii) power factor is zero

    (iii) power factor is 0·5 lagging

    (iv) power factor is 0·5 leading

2. (a) The efficiency of a 1000 kVA, 110/220 V, 50 Hz, single-phase transformer is 98·5% at half full-load at 0·8 pf leading and 98·8% at full-load upf. Determine—

    (i) iron-loss;

    (ii) full-load copper loss;

    (iii) maximum efficiency at upf;

    (iv) kVA at which maximum efficiency occurs.   8

(b) In a 440 V, 50 c/s transformer, the total iron loss is 2500 W. When the applied voltage is 220 V at 25 c/s, the corresponding loss is 850 W. Calculate the eddy-current loss at normal frequency and voltage.   6

3. (a) A 3-ϕ, 4-pole, 50 Hz, star-connected induction motor running on full-load develops a useful torque of 300 N-m. The rotor EMF is completing 120 cycles per minute. If torque lost in friction is 50 N-m, calculate—

    (i) slip;

    (ii) net output power;

(iii) mechanical power developed;

(iv) rotor copper losses/phase;

(v) rotor efficiency;

(vi) rotor resistance per phase if rotor current is 60 A in running condition. https://www.akubihar.com

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(b) Explain the torque speed characteristics of 3-phase induction motor by considering the zones of operation.

8

4. (a) A 440 V, 3-φ, 8-pole, 50 Hz, 40 kW, star-connected induction motor has the following parameters :

Stator resistance = 0·1 Ω

Stator reactance = 0·4 Ω

Equivalent rotor resistance referred to stator = 0·15 Ω

Equivalent rotor resistance referred to stator = 0·44 Ω

The stator core loss is 1250 W while mechanical loss is 1000 W. It draws a no-load current of 20 A at a pf of 0·09 lagging. While at a speed of 727·5 RPM, calculate—

(i) input line current and pf;

(ii) torque developed;

(iii) mechanical power developed;
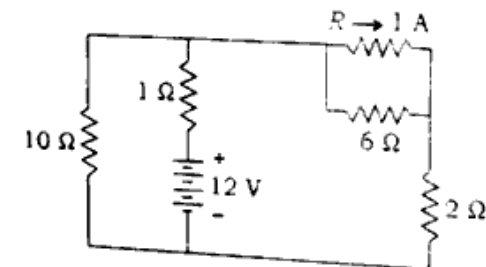
(iv) efficiency.

Use approximate equivalent circuit.
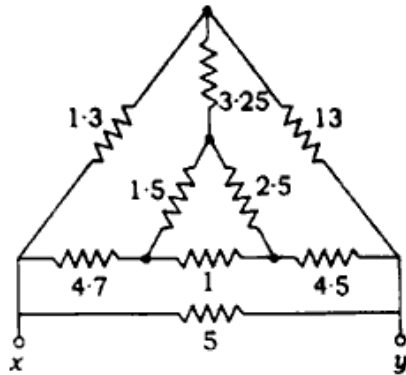
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(b) Explain the operating principle of alternator.

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5. (a) Find the value of R such that 1 A would flow in it for the network shown in the following figure :

7

(b) Find the resistance between terminals x and y from the following figure : 7

6. (a) A 4 mH inductor is connected in series with a 230 V sinusoidal 50 Hz supply. Find peak, RMS and average values of current and power consumed. 7

(b) Explain the effect of power factor on two wattmeter readings in a two-wattmeter method of power measurement. 7

7. (a) A steel ring has a diameter of 20 cm, a cross-section of 25 cm^2 and radial air-gap of 0·8 mm cut across it.

When excited by a current of IA through a coil of 1000 turns wound on the ring core, it produces an air-gap flux of 1 mWb. Neglecting leakage and fringing, calculate (i) relative permeability of steel and (ii) total reluctance of the magnetic circuit. 8

(b) What are the various ferromagnetic materials? Write their applications and properties. 3

(c) Explain the terms 'fringing' and 'leakage flux'. 3

8. (a) Describe the various types of batteries. 6

(b) Define the following terms : 8

(i) Switch fuse unit

(ii) MCB

(iii) ELCB

(iv) MCCB

9. (a) What value of equivalent resistance exists between points A and B? 7
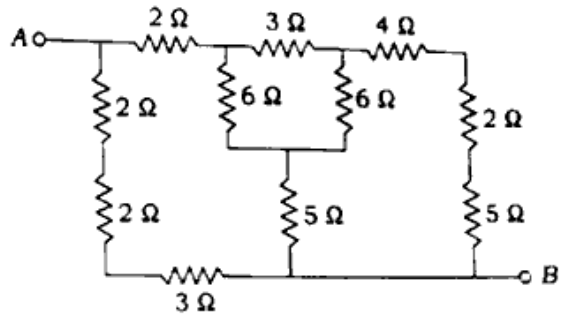
(b) Draw the resonance curve for a series resonance circuit and compare with it a parallel resonance. 7

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