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Code : 100201

B.Tech 2nd Semester Exam., 2021

(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 answer of the following
(any seven) : $2 \times 7 = 14$

(a) Lamps in street lighting are all connected in

- (i) series
- (ii) parallel
- (iii) series-parallel
- (iv) end-end

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(Turn Over)

(2)

- (b) The rotor slots in a 3-phase induction motor are kept inclined. This phenomenon is known as
- (i) skewing
 - (ii) crawling
 - (iii) cogging
 - (iv) hardening
- (c) An alternator with higher value of SCR has
- (i) poor voltage regulation and lower stability limit
 - (ii) better voltage regulation and higher stability limit
 - (iii) poor voltage regulation and higher stability limit
 - (iv) better voltage regulation and lower stability limit
- (d) If the flux of a DC motor approaches zero, its speed will
- (i) approach infinity
 - (ii) approach zero
 - (iii) remain unchanged
 - (iv) between zero and infinity

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(Continued)

(3)

- (e) The core flux of a practical transformer with a resistive load
- (i) is strictly constant with load changes
 - (ii) increases linearly with load
 - (iii) increases as the square root of the load
 - (iv) decreases with increase in load
- (f) A transformer has a percentage resistance of 2% and percentage reactance of 4%. What are its voltage regulations at 0.8 lagging and 0.8 leading respectively?
- (i) 4.8% and -0.6%
 - (ii) 3.2% and -1.6%
 - (iii) 1.6% and -3.2%
 - (iv) 4% and -0.8%
- (g) Higher the Q of a series circuit, narrower its
- (i) pass band
 - (ii) resonance curve
 - (iii) bandwidth
 - (iv) All of the above

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$\uparrow \phi \propto \frac{1}{f} \propto \frac{1}{\omega} \propto \frac{1}{L}$

(4)

$$V = \frac{1}{\sqrt{2}} \frac{d\psi}{dt}$$

(h) A 10 mH inductor carries a sinusoidal current of 1 A r.m.s. at a frequency of 50 Hz. The average power dissipated by the inductor is

- (i) 0 W
- (ii) 0.25 W
- (iii) 0.5 W
- (iv) 1 W

(i) Which of the following statements is incorrect?

- (i) Resistance is a passive element.
- (ii) Inductor is a passive element.
- (iii) Current source is a passive element.
- (iv) Voltage source is an active element.

(i) Which of the following is not bilateral element?

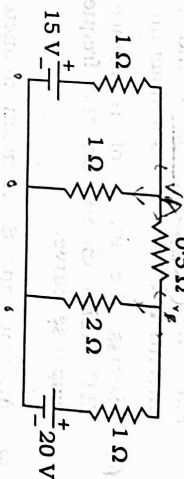
- (i) Constant current source
- (ii) Resistor
- (iii) Inductor
- (iv) Capacitor

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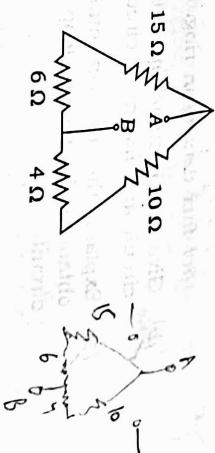
(5)

2. (a) Find the current through each resistor of the following circuit using nodal analysis :



(b) Explain the concept of superposition theorem applied to the electric circuit by taking a 3-element T-network and two batteries.

(c) Find the equivalent resistance between points A and B in the following circuit :



3. (a) An iron cored coil draws 2 A at 0.5 p.f. lag against a 50 Hz, 100 V supply. Iron core being then removed, the voltage applied being 50 V, the current rises to 5 A at 0.78 lag. Find the inductance of each case.

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(Turn Over)



(6)



- (b) A resistance of $10\ \Omega$, an inductance of 150 mH and a capacitor of $100\ \mu\text{F}$ are connected across a 50 V , 50 Hz source. Find the branch currents and total current. Draw the phasor diagram. 4
- (c) Discuss the effect of resistance of RLC series circuit on the frequency response curve. 4
4. (a) An iron ring 8 cm mean diameter is made up of round iron diameter 1 cm and permeability of 900 has an air gap of 2 mm wide. It consists of winding with 400 turns carrying a current of 3.5 A . Determine—
 (i) MMF;
 (ii) total reluctance;
 (iii) the flux;
 (iv) flux density in ring. 4
- (b) Give the comparison between electric circuit and magnetic circuit. 4
- (c) Explain the experimental method of obtaining hysteresis loop of magnetic circuit. 6
5. (a) The open-circuit and short-circuit tests on a 10 kVA , $125/250\text{ V}$, 50 Hz single-phase transformer gave the following results :
 OC test : 125 V , 0.6 A , 50 W on LV side
 SC test : 15 V , 30 A , 100 W on HV side
 Calculate (i) copper loss on full load, 6

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(Continued)

(7)

- (ii) full-load efficiency at 0.8 leading p.f.,
 (iii) half-load efficiency at 0.8 leading p.f. and (iv) voltage regulation at full load, 0.9 leading p.f. 8
- (b) Explain the various three-phase transformer connections with neat circuit and phasor diagrams. 6
6. (a) Draw the speed-torque characteristics of DC shunt motors and series motors. 4
- (b) Explain the constructional details of alternators. 4
- (c) The lap wound armature of a 4 -pole DC shunt motor has 600 armature turns and it takes 100 Amps when running at 600 r.p.m. . The flux per pole is 100 mWb . Calculate the gross mechanical torque developed and the net power output if the torque lost in friction, windage and core losses is 60 N-m . 6
7. (a) A 4 -pole, 50 Hz , 3 -phase induction motor running on full load develops a useful torque of 200 N-m when the rotor e.m.f. makes 120 complete cycles per minute. If the mechanical torque lost in friction and rotor core loss is 15 N-m , calculate the—
 (i) shaft power output; 6

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$$V = \omega L I_m \cos \phi$$

$$(8) \quad V = (2\pi f) (L) I \cos \phi$$

- (ii) rotor copper losses; 4
- (iii) stator input; 4
- (iv) motor efficiency. 4
- (b) Differentiate the principle of operation of induction and synchronous motors. 4
- (c) Draw the speed-torque characteristics of an induction motor. 3
- (d) List the various types of DC generators and draw their electrical circuits. 3
8. (a) Define cold ranking ampere and specific power in batteries. 6
- (b) Describe the various devices used to improve the system power factor. 4
- (c) Explain the various types of earthing systems. 4
9. (a) Explain maximum power transfer theorem applied in a DC network. 7
- (b) Why a DC series motor cannot be started on no load? Explain your answer with the help of basic speed-torque equation and necessary diagrams. 7
