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06ELE15/25

First/Second Semester B.E. Degree Examination, Dec.09/Jan.10

Basic Electrical Engineering

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, choosing at least two from each part.*
2. Answer all objective type questions only in OMR sheet page 5 of the Answer Booklet.
3. Answer to objective type questions on sheets other than OMR will not be valued.

PART – A

1 a. Choose the correct answers :

i) The resistance of a 200 W, 250 V lamp is _____.
A) 625 Ω B) 1250 Ω
C) 312.5 Ω D) 31.25 Ω

ii) The voltage applied across an electric iron is halved. The power consumption of the iron reduces to _____.
A) One half B) Three fourth
C) One fourth D) 0.707 times.

iii) The practical unit of electrical energy is _____.
A) KW-hr B) Watt-hr
C) Watt-second D) Joule-second

iv) Which of the following statements is true both for a series and a parallel circuit?
A) Resistances are additive B) Powers are additive
C) Currents are additive D) Voltage drops are additive. **(04 Marks)**

b. A resistance R is connected in series with a parallel circuit comprising of two resistances of 12 Ω and 8 Ω respectively. The total power dissipation in the circuit is 70 W when the applied voltage is 20 V. Calculate R. **(06 Marks)**

c. Explain dynamically and statically induced emfs. **(06 Marks)**

d. A coil consists of 750 turns. A current of 10 A in the coil gives rise to a magnetic flux of 1200 μwb. Determine the inductance of the coil and the average emf induced in the coil when this current is reversed in 0.01 second. **(04 Marks)**

2 a. Choose the correct answers :

i) A sinusoidal voltage varies from zero to maximum of 250 V. The voltage at the instant of 60° of the cycle will be _____.
A) 150 V B) 216.5 V
C) 125 V D) 108.25 V

ii) In a purely resistive circuit, the average power P_{av} is _____ the peak power, P_{max}.
A) Double B) One-half of
C) One-fourth D) Equal to.

iii) An a.c voltage is given by V = 40 sin 314 t. The frequency is _____.
A) 75 Hz B) 50 Hz
C) 25 Hz D) 100 Hz.

iv) In a pure capacitive circuit, the current
A) Lags behind the voltage by 90° B) Leads the voltage by 90°
C) Remains in phase with voltage D) None of these **(04 Marks)**

b. Prove that the current in a purely inductive circuit lags behind the applied voltage by 90°. **(08 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

2 c. Two circuits A and B are connected in parallel across 200 V, 50 Hz supply. Circuit A consists of 10 Ω resistance and 0.12 H inductance in series while circuit B consists of 20 Ω resistance in series with 40 μF capacitance. Calculate : i) Current in each branch ii) Supply current iii) Total power factor. Draw the phasor diagram. **(08 Marks)**

3 a. Choose the correct answers :

i) In a 3ϕ balanced star connected load, the neutral current is equal to :
A) Zero B) I_{phase}
C) I_{Line} D) Unpredictable

ii) The relationship between the line and phase voltage of a Δ - connected circuit is given by,
A) $V_L = V_P$ B) $V_L = \sqrt{3}V_P$
C) $V_L = V_P/\sqrt{2}$ D) $V_L = \frac{2}{\pi}V_P$

iii) W_1 and W_2 are the readings of two Wattmeters used to measure power of a 3ϕ balanced load. The active power drawn by the load is,
A) $W_1 + W_2$ B) $W_1 - W_2$
C) $\sqrt{3}(W_1 + W_2)$ D) $\sqrt{3}(W_1 - W_2)$

iv) In the measurement of 3ϕ power by two Wattmeters, if the two Wattmeter readings are equal, the power factor of the circuit is
A) 0.8 lagging B) 0.8 leading
C) Zero D) Unity **(04 Marks)**

b. Obtain the relationship between line currents and phase currents in a balanced 3ϕ delta connected system. **(06 Marks)**

c. Discuss the effect of the variation of power factor on Wattmeter readings. **(06 Marks)**

d. Three similar impedances are connected in delta across a 3ϕ supply. The two Wattmeters connected to measure the input power indicate 12 kW and 7 kW. Calculate :
i) Power input ii) Power factor of the load. **(04 Marks)**

4 a. Choose the correct answers :

i) An electrodynamometer type instrument can be employed for measurement of,
A) d.c voltages
B) a.c voltages
C) d.c as well as a.c voltages
D) d.c voltages but for a.c voltages, rectification is necessary

ii) In an energy meter, the moving system attains the steady speed when,
A) Braking torque is zero B) Braking torque is equal to operating torque
C) Braking torque is maximum D) Operating torque is constant.

iii) The material used for fuse wire should be of
A) Low resistivity and high melting point
B) High resistivity and high melting point
C) High resistivity and low melting point.
D) Low resistivity and low melting point.

iv) The earth wire should be
A) Good conductor of electricity
B) Mechanically strong
C) Both (a) and (b)
D) Mechanically strong but bad conductor of electricity. **(04 Marks)**

b. With a neat diagram, explain the working of an induction type of energymeter. **(08 Marks)**

c. With relevant circuit diagrams and switching tables, explain two-way and three-way control of lamps. **(08 Marks)**

PART – B

5 a. Choose the correct answers :

i) The nature of current flowing in the armature of a d.c. machine is
A) a.c. B) d.c.
C) Pulsating D) d.c. superimposed over a.c

ii) The components of a d.c generator which plays vital role in providing direct current is
A) Dummy coils B) Equalizer rings
C) Commutator D) Brushes

iii) The speed of a d.c shunt motor ____ from no load to full load.
A) Falls slightly B) Improves slightly
C) Remains unchanged D) Falls rapidly

iv) The function of a starter in a d.c motor is to
A) Control its speed
B) Increase its starting torque
C) Limit the starting current to a safer value
D) Reduce armature reaction effect. **(04 Marks)**

b. Derive an expression for the armature torque developed in a d.c motor. **(06 Marks)**

c. Sketch and explain : i) torque-armature current characteristics ii) Speed-armature current characteristics for a d.c shunt motor. **(04 Marks)**

d. A 200 V, 4 pole, lap wound, d.c shunt motor has 800 conductors on its armature. The resistance of the armature winding is 0.5 Ω and that of shunt field winding is 200 Ω. The motor takes a current of 21 A, the flux/pole is 30 mWb. Find the speed and gross torque developed in the motor. **(06 Marks)**

6 a. Choose the correct answers :

i) A transformer steps up the voltage by a factor of 100. The ratio of current in the primary to that in the secondary is
A) 1 B) 100 C) 0.01 D) 0.1

ii) The losses which vary with load in a power transformer are
A) Friction and windage losses B) Copper losses
C) Eddy current losses D) Hysterisis losses

iii) The regulation of a transformer is defined as
A) Rise in terminal voltage when loaded
B) Fall in terminal voltage when loaded
C) Change in secondary terminal voltage from no-load to full-load as a percentage of secondary no load terminal voltage.
D) Change in flux from no-load to full-load.

iv) The copper loss of a certain transformer at half full load is measured as 200 W. Then the copper loss at full load is :
A) 800 W B) 200 W C) 100 W D) 400 W . **(04 Marks)**

b. Explain the various losses that occur in a transformer. **(06 Marks)**

c. A 1ϕ transformer has 1000 turns on its primary and 400 turns on the secondary side. An a.c voltage of 1250 V, 50 Hz is applied to its primary side, with the secondary open circuited. Calculate : i) The secondary emf ii) Maximum value of flux density, given that the effective cross-sectional area of core is 60 cm^2. **(04 Marks)**

d. A 250 kVA, 1ϕ transformer has 98.135% efficiency at full load and 0.8 lagging p.f. The efficiency at half load and 0.8 lagging p.f is 97.751%. Calculate the iron loss and full-load copper loss. **(06 Marks)**

7 a. Choose the correct answers :

i) The frequency of emf generated by an alternator depends upon the alternator speed, N(rpm) and number of poles on the alternator, P and is given by

A) $\frac{PN}{60}$ B) $\frac{60N}{P}$ C) $\frac{PN}{120}$ D) $\frac{120N}{P}$

ii) The salient pole type rotors have

A) Smaller diameter B) Larger diameter
C) Smaller axial length D) Both (b) and (c)

iii) The most suitable rotor for a turbo-alternator designed to operate at high speed is

A) Salient pole type rotor B) Smooth cylindrical type rotor
C) Squirrel cage rotor D) Either of the above.

iv) The ratio of the phasor sum of the emfs induced in all the coils distributed in a number of slots under one pole to the arithmetic sum of the emfs induced is known as

A) Breadth or distribution factor B) Coil-span factor
C) Pitch factor D) Winding factor. **(04 Marks)**

b. With neat diagrams, explain the constructional features of a 3ϕ - alternator. **(08 Marks)**

c. A 3ϕ, 16 pole, Y-connected alternator has 144 slots on the armature periphery. Each slot contains 10 conductors. It is driven at 375 rpm. The line value of emf available across the terminals is observed to be 2.657 kV. Find the frequency of the induced emf and flux per pole. **(08 Marks)**

8 a. Choose the correct answers :

i) The rotor of a 3ϕ induction motor rotates in the same direction as that of stator rotating field. This can be explained by

A) Faraday's laws of electromagnetic induction.
B) Lenz's law.
C) Newton's law of motion
D) Flemming's right hand rule.

ii) A 3ϕ, 440 V, 50 Hz, induction motor has 4% slip. The frequency of rotor emf is

A) 200 Hz B) 50 Hz
C) 2 Hz D) 0.2 Hz

iii) If N_S is the synchronous speed and 's' is the slip, then actual running speed of an induction motor will be

A) N_S B) sN_S
C) $(1-s)N_S$ D) $(N_S - 1)\,s$

iv) The number of poles in a 3ϕ induction motor is determined by the

A) Supply frequency B) Motor speed
C) Supply voltage D) Both (a) and (b) **(04 Marks)**

b. Explain the production of torque in a 3ϕ induction motor. **(04 Marks)**

c. Explain the terms pitch factor, distribution factor and winding factor as applied to an alternator. **(06 Marks)**

d. A 4 pole , 3ϕ, 50 Hz induction motor runs at a speed of 1470 rpm. Find the synchronous speed, the slip and frequency of the induced emf in the rotor under this condition. **(06 Marks)**

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