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(b) Show that $V_L = \sqrt{3} V_{ph}$, $I_L = I_{ph}$ in a three phase star connected system.

6 + 6 = 12

Group – E

8. (a) Derive the emf equation of a transformer.

- (b) The open circuit (0.C.) and short circuit (S.C.) tests conducted on a 230/115 V, 1000 VA transformer gave the following readings:
 0.C. Test : 230 V
 0.45 A
 30 W
 S.C. Test : 19.1 V
 8.7 A
 42.3 W
 Find the parameters of the equivalent circuit and the efficiency of the transformer at 0.8 power factor and full load.
- (c) Draw the phasor diagram of a single phase transformer at no load. 3 + 7 + 2 = 12
- 9. (a) Explain the principle of operation of a three phase induction motor.
 - (b) A 3 phase, 4 pole, 50 Hz induction motor has a slip of 2% at no load and 4% at full load. Calculate (i) Synchronous speed (ii) No load speed (iii) Full load speed (iv) Frequency of rotor current at full load and (iv) Frequency of rotor current at standstill.

4 + (2 + 2 + 2 + 2) = 12

B.TECH/AEIE/CSE/ECE/IT/1ST SEM/ELEC 1001(BACKLOG)/2019

BASIC ELECTRICAL ENGINEERING (ELEC 1001)

Time Allotted : 3 hrs

Full Marks: 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and <u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A (Multiple Choice Type Questions)

- 1. Choose the correct alternative for the following: $10 \times 1 = 10$
 - (i) If $I_N = 5 A$, $R_N = 2 \Omega$ and $R_L = 3 \Omega$, then current through R_L is (a) 5 A (b) 3.33 A (c) 2 A (d) 10 A.

 - (iii) Power factor of an A.C. circuit is equal to (a) R/X_L (b) R/X_c (c) R/Z (d) Z/R.
 - (iv) The DC motor needs a starter during starting to control
 (a) speed
 (b) armature current
 (c) field current
 (d) flux.
 - (v) 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 .
 - (vi) For additive flux of two coils connected in series the equivalent inductance can be expressed as (a) L_1+L_2-M (b) L_1+L_2+2M (c) L_1+L_2+M (d) L_1+L_2-2M .

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B.TECH/AEIE/CSE/ECE/IT/1ST SEM/ELEC 1001/2019

- (vii) The rating of transformer may be expressed in _____ (d) Horse power (a) kW (b) kVAR (c) kVA
- (viii) The efficiency of a transformer is maximum when
 - (a) copper loss is zero
 - (b) iron loss is zero
 - (c) copper loss is 50% of the iron loss
 - (d) copper loss is equal to iron loss.
- The number of parallel paths in lap connected armature winding (ix) of a 4 pole dc machine is (a) number of poles (b) half the number of poles (d) four. (c) two
- (x) What is the value of slip for a three-phase, 50 Hz, 6-pole induction motor running at 950 rpm? (a) 4% (b) 5% (c) 3% (d) 1.11%.

Group – B

2. (a) Find the current through 5 Ω resistance using Superposition Theorem for the circuit shown in Fig.1.



State and prove Maximum Power Transfer theorem for a DC (b) network.

7 + (2 + 3) = 12

- Deduce the expression for the emf developed in a dc motor. 3. (a)
 - (b) A 6-pole Lap wound dc shunt generator has a useful flux per pole of 0.03 Wb. The armature has 400 conductors and resistance of 0.4 Ω . Calculate the terminal voltage when the armature is rotating at 1000 rpm and armature current is 40 A.

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B.TECH/AEIE/CSE/ECE/IT/1ST SEM/ELEC 1001/2019

Draw and explain the open circuit characteristic of dc generator. (c) 4 + 5 + 3 = 12

Group - C

- 4. (a) State and prove Gauss's Law.
 - Derive the expression of Capacitance of Parallel plate capacitor. (b)
 - Three capacitors A, B and C are connected in series across 100 V (c) d.c. supply. The voltages across the capacitors are 20 V, 30 V and 50 V respectively. If the capacitance of A is 10 μ F, calculate the capacitances of B and C.

(2+3)+3+(2+2)=12

- 5. (a) Write down similarities and dissimilarities of magnetic circuit and electric circuit.
 - The combined inductance of the two coils connected in series is 0.8 (b) H and 0.3 H, depending on the relative directions of currents in the coils. If one of the coils, when isolated, has a self inductance of 0.15 H, then calculate (i) mutule inductance (ii) coefficient of coupling.
 - State and proof the Ampere's circuital Law. (c)

4 + (2 + 2) + 4 = 12

Group - D

- 6. (a) A resistance of 100 Ω is connected with an inductance of 1.2 H and capacitance of 10 microfarad in series. The combination is connected across 100 V, 50 Hz supply. Find, (i) Current in the circuit (ii) Voltage across the capacitance (iii) Power consumed (iv) Power factor (v) Draw the phasor diagram.
 - Show that for a purely inductive circuit under AC supply current (b) lags the voltage.

(2+2+2+1+2)+3=12

Explain with the help of neat circuit diagram, the two-wattmeter 7. (a) method for the measurement of power of 3-phase balanced load. **ELEC 1001**

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