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**First/Second Semester B.E. Degree Examination, Dec.2019/Jan.2020**  
**Basic Electrical Engineering**

Time: 3 hrs.

Max. Marks:100

*Note: Answer any FIVE full questions, choosing at least two from each part.*

**PART - A**

- 1 a.** Choose the correct answers for the following : (04 Marks)
- If 110V is applied across a 220V, 100W bulb the power consumed by it will be  
 A) 100W                      B) 50W                      C) 25W                      D) 12.5W
  - The general unit of electrical energy is  
 A) KWh                      B) kW-sec                      C) Watt-hour                      D) Watt-sec
  - The unit of inductance is  
 A) Henry                      B) V/A-S                      C) Wb/second                      D) Farads
  - The maximum value of coefficient of coupling is  
 A) More than 100%                      B) 90%                      C) 100%                      D) 35%
- b.** State and explain Kirchoff's laws as applied to D.C. circuit. (06 Marks)
- c.** A resistance of  $10\Omega$  is connected in series with two resistance each of  $15\Omega$  arranged in parallel. What resistance must be connected in parallel across this parallel combination so that total current takes shall be 1.5A with 20V applied. (04 Marks)
- d.** A coil consists of 750 turns and a current of 10A in the coil gives rise to a magnetic flux of  $1200 \mu$  wb. Calculate the emf induced and energy stored when the current is reversed in 0.01 second. (06 Marks)
- 2 a.** Choose the correct answers for the following : (04 Marks)
- A sinusoidal voltage is expressed as  $V = 20 \sin (314t + \frac{\pi}{3})$  its frequency and phase angle respectively are  
 A) 314 Hz,  $60^\circ$                       B) 60Hz,  $60^\circ$                       C) 50Hz,  $60^\circ$                       D) 50Hz,  $-60^\circ$
  - The power factor of a pure resistive circuit is  
 A) Zero                      B) Unity                      C) Lagging                      D) Leading
  - In a pure capacitive circuit, the current  
 A) lag behind voltage by  $90^\circ$                       B) leads the voltage by  $90^\circ$   
 C) remains in phase with voltage                      D) shifts voltage by  $180^\circ$
  - The reactive power in a single phase a.c. circuit is given by  
 A)  $VI \cos \phi$                       B)  $VI$                       C)  $VI \sin \phi$                       D)  $VI \tan \phi$
- b.** Derive an expression for the (i) average value (ii) rms value and (iii) form factor of a sinusoidally varying alternating quantity (06 Marks)
- c.** A resistance of  $20\Omega$ , an inductance of 0.2H and a capacitance of  $100\mu$ F are connected in series across 220V, 50Hz main. Determine: i) Impedance of the circuit ii) Current taken from the mains and iii) Power and power factor of the circuit. (06 Marks)
- d.** Two impedances  $Z_1 = 6 - j8$  ohms and  $Z_2 = 16 + j12$  ohm are connected in parallel. If the total current of the combination is  $20 + j10$ . A, find the branch currents. (04 Marks)
- 3 a.** Choose the correct answers for the following : (04 Marks)
- A 3 phase, 4 wire system supplies power to a balanced star connected load, current in each phase is 15A. The current in neutral will be  
 A) 15A                      B) 30A                      C) 45A                      D) 0

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.

- ii) In a  $\Delta$  connected system, the relation between line current  $I_L$  and phase current  $I_{ph}$  is  
 A)  $I_L = I_{ph}$                       B)  $I_L = I_{ph}/\sqrt{3}$                       C)  $I_L = \sqrt{3} \cdot I_{ph}$                       D)  $I_L = 3 \cdot I_{ph}$
- iii) In a three phase system, the emf in each phase are  
 A)  $30^\circ$  apart                      B)  $60^\circ$  apart                      C)  $90^\circ$  apart                      D)  $120^\circ$  apart
- iv) In a three phase power measurement by two wattmeter method reading of one of the wattmeter is zero. The power factor is  
 A) unity                      B) 0.8                      C) 0.5                      D) 0
- b. Derive the relations between line and phase values for a delta connected system. (06 Marks)
- c. Define the terms (i) Phase sequence (ii) Active power and reactive power in a 3 phase system. (04 Marks)
- d. Two Wattmeters connected to measure the input to a balanced three-phase circuit indicate 2500 watts and 500 watts respectively. Find the power and power factor of the circuit (i) when both the readings are positive and ii) When the latter reading is obtained after reversing the connections to the current coil of the wattmeter. (06 Marks)
- 4 a.** Choose the correct answers for the following : (04 Marks)
- i) In a dynamometer wattmeter, the fixed coil is  
 A) Current coil                      B) Potential coil  
 C) Current or potential coil                      D) Voltage coil
- ii) The average torque acting on the aluminium disc of an energymeter is proportions to the \_\_\_\_\_ consumes by the circuit  
 A) Current                      B) Voltage                      C) Power                      D) None of the above
- iii) A good earthing should provide \_\_\_\_\_ resistance is earth path  
 A) low                      B) high                      C) medium                      D) very high
- iv) 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.
- b. With the help of neat diagram, explain the construction and principle of operation of a single phase induction energy meter. (08 Marks)
- c. Explain how a single lamp is controlled at two different places. (04 Marks)
- d. Explain with a neat sketch pipe earthing provided for an installation. (04 Marks)

**PART - B**

- 5 a.** Choose the correct answers for the following : (04 Marks)
- i) The emf generated by a given d.c. generator depends upon  
 A) Flux only                      B) Speed only  
 C) Flux and speed                      D) Terminal voltage
- ii) A commutator is made up of \_\_\_\_\_  
 A) Iron laminations                      B) Copper segments  
 C) Both iron laminate copper segments                      D) Mild-steel
- iii) The back emf of a motor at the moment of starting is  
 A) Zero                      B) Maximum                      C) Low                      D) Optimum
- iv) For a 'P' pole lap wound armature of a D.C. machine the number of parallel paths are equal to  
 A) 2                      B) 2P                      C) P                      D) P/2
- b. Explain with a neat sketch, constructional features of a d.c. machine. (08 Marks)
- c. A 4 pole, 1500 rpm d.c. generator has a lap wound armature having 24 slots with 10 conductors per slot. If the flux per pole is 0.04 Wb, calculate the emf generated in the armature. What would be the generated emf, if the winding is wave connected? (08 Marks)

- 6 a. Choose the correct answers for the following : **(04 Marks)**
- i) The core of a transformer is laminated to reduce
 

A) eddy current loss	B) Hysteresis loss
C) Copper loss	D) Friction loss
  - ii) The copper loss of certain transformer at half full load is measured as 200W. Then copper loss at full load will be
 

A) 100W	B) 200W	C) 400W	D) 800W
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  - iii) If an Ammeter in the secondary of 100/10V transformer reads 10A, the current in primary would be
 

A) 1A	B) 2A	C) 10A	D) 100A
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  - iv) A transformer works on the principle of
 

A) Kirchoff's laws	B) Mutual induction
C) Dynamically induced emf	D) Super position.
- b. Derive the emf equation of a single phase transformer. **(06 Marks)**
- c. What are the losses taking place in a transformer? **(04 Marks)**
- d. A 40 KVA transformer has iron loss of 500 watts and full load copper loss of 800 watts. If the power factor of the load is 0.6 lagging, calculate: (i) full load efficiency **(06 Marks)** (ii) load at which maximum efficiency occurs and (iii) the maximum efficiency. **(06 Marks)**
- 7 a. Choose correct answers for the following : **(04 Marks)**
- i) The stator core of a synchronous machine is built of laminations of
 

A) Stainless steel	B) Silicon steel	C) Cast steel	D) Cast iron
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  - ii) A salient pole field alternator is used for alternator having
 

A) Low and medium speed	B) Large speed
C) Very large speed	D) None of these
  - iii) An 8 pole alternator, runs at 600rpm. The frequency of induced emf is
 

A) 40Hz	B) 50Hz	C) 60Hz	D) 70Hz
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  - iv) When an alternator is loaded its terminal voltage
 

A) Increases	B) Decreases
C) Does not change	D) Falls rapidly to zero
- b. Explain the constructional features of a synchronous generator and explain its working principle. **(10 Marks)**
- c. A three phase star connected synchronous generator driven at 900 rpm is required to generate a line voltage of 460 volts at 60Hz on open circuit. The stator has 16 slots per phase, with 4 conductors per slot. Calculate: (i) the number of poles and (ii) the useful flux per pole. Assume  $K_p = 1$  and  $K_d = 1$ . **(06 Marks)**
- 8 a. Choose the correct answers for the following : **(04 Marks)**
- i) The slip of an induction motor at standstill is
 

A) Zero	B) One	C) Infinity	D) -1
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  - ii) 4 poles, 50Hz induction motor runs at 1440 for the frequency of rotor induced emf is
 

A) 3Hz	B) 2.5Hz	C) 2Hz	D) 1.0Hz
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  - iii) The stator of a three phase induction motor produce \_\_\_ magnetic field
 

A) Steady	B) Alternating	C) Rotating	D) Pulsating
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  - iv) The direction of rotation of an induction motor depends on
 

A) Phase sequence	B) Supply voltage	C) Supply frequency	D) Slip
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- b. State and explain rotating magnetic field theory and hence explain the principle of torque production in an induction motor. **(10 Marks)**
- c. A 3 phase induction motor is wound for 4 poles and is supplied from 50Hz system. Calculate: (i) the synchronous speed (ii) speed of the motor when slip is 4% and (iii) the rotor current frequency when the motor runs at 1440 rpm. **(06 Marks)**