USN ☐☐☐☐☐☐☐☐☐☐   **10ELE15/25**

First/Second Semester B.E. Degree Examination, Dec.2018/Jan.2019
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 :
   i) The resistance of a conductor increases, when
        A) its length increases   B) its area increases
        C) both its length and area increases   D) its length decreases.
   ii) The rating of an electric lamp is 220V, 100W. If it is operated at 110V, the power consumed by it will be,
        A) 50W   B) 75W   C) 90W   D) 25W
   iii) KVL states that in a closed circuit of an electric network.
        A) $\Sigma E = 0$ B) $\Sigma I = 0$ C) $\Sigma V = 0$ D) $\Sigma E + \Sigma V = 0$.
   iv) An emf of 6 volts is induced in a coil of 6mH. The rate of change of current is,
        A) 36 A/S   B) 1000 A/S   C) 1200 A/S   D) 100 A/S.   **(04 Marks)**

   b. The current in the 6Ω resistance of the network shown in Fig.Q.1(b) is 2A. Determine the current in all the branches and the applied voltage.   **(05 Marks)**

Fig.Q.1(b)
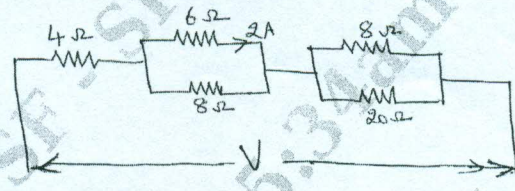
   c. State and explain Faraday's laws of electromagnetic induction and Leng's law.   **(05 Marks)**
   d. A coil 'A' of 1000 turns and another coil 'B' of 600 turns lie near each other, so that 70 percent of the flux produced in one links with the other. It is found that a current of 4A in coil 'A' produces a flux of 0.2 m wb, while the same current in coil B produces a flux of 0.12 m wb. Determine the mutual inductance and co-efficient of coupling between the coils.   **(06 Marks)**

2 a. Choose the correct answers for the following :   **(04 Marks)**
   i) The power factor of pure resistive circuit is
        A) zero   B) unity   C) lagging   D) leading
   ii) An alternating voltage is given by V = 100 sin (314t - 30°) volts, The frequency is ____
        A) 25 Hz   B) 50 Hz   C) 60 Hz   D) 100 Hz
   iii) The reactive power of a single phase A.C. circuit is given by
        A) VI Cos ϕ B) VI   C) VI Sin ϕ D) None of these
   iv) The impedance of an a.c. circuit is given by $15.5 \underline{|-30°}$. It means the circuit is,
        A) Capacitive   B) Inductive   C) Resistive   D) None of these

   b. Show that the current lags behind the voltage in a series R-L circuit.   **(04 Marks)**
   c. A coil of resistance 10Ω and inductance 0.1H is connected in series with a condenser of capacitance 150μF across a 200V, 50Hz supply. Determine: i) Impedance; ii) Current; iii) Power factor; iv) Voltage across the coil and v) Voltage across the condenser.   **(08 Marks)**
   d. An inductive coil having negligible resistance and 0.2H inductance is connected across 220V, 50Hz supply. Write the equations for voltage and current along with values.   **(04 Marks)**

3 a. Choose the correct answers for the following :

   i) In a 3 phase balanced, star connected load, the neutral current is equal to
   A) Zero   B) I_{ph} C) I_L D) None of these

   ii) In a three phase power measurement by two wattmeter method, both wattmeters read the same value. The power factor of the load must be
   A) 0.707 lagging   B) unity   C) 0.707 leading   D) zero

   iii) In a delta connected system, the relation between the line current I_L and phase current I_{ph} is,

   A) $I_L = I_{ph}$ B) $I_L = \dfrac{I_{ph}}{\sqrt{3}}$ C) $I_L = \sqrt{3}\, I_{ph}$ D) $I_L = 3\, I_{ph}$

   iv) In a three phase system, the emf's are
   A) 30° apart   B) 60° apart   C) 90° apart   D) 120° apart.
   (04 Marks)

   b. With relevant diagrams, show that two wattmeters are enough to measure three phase power. **(08 Marks)**

   c. A 3 phase delta connected balanced load consumes a power of 50kW taking a current of 180A, lagging at line voltage of 400V, 50Hz. Find the parameters of each phase. If now load is connected in star, what will be the power consumed. **(08 Marks)**

4 a. Choose the correct answers for the following :

   i) The earth wire should be
   A) Mechanically strong   B) Good conductor of electricity
   C) An insulator   D) Both (a) and (b)

   ii) A fuse is a
   A) Current limiting device   B) Protective device
   C) Voltage limiting device   D) None of these

   iii) 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) None of these

   iv) The pointer in the dynamometer type wattmeter is mode of
   A) Copper   B) Aluminium   C) Phosphor bronze   D) Platinum
   (04 Marks)

   b. With a circuit diagram and a suitable table, explain 2-way control of lamp. **(04 Marks)**
   c. With a neat figure, explain any one method of earthing. **(04 Marks)**
   d. Explain with a neat sketch, the working principle of a dynamometer type wattmeter. **(08 Marks)**

PART – B

5 a. Choose the correct answers for the following :

   i) The number of parallel paths in a wave connected generator is
   A) 1   B) 2   C) 3   D) 4

   ii) The nature of current flowing in armature of a d.c. machine is
   A) ac   B) dc   C) pulsating   D) None of these

   iii) The armature of a d.c. generator is laminated, to reduce
   A) eddy-current loss   B) hystoric loss   C) friction loss   D) copper loss

   iv) The back emf of a d.c. shunt meter is given by
   A) $V + I_a R_a$ B) $V - I_a R_a$ C) V D) $I_a R_a$
   (04 Marks)

   b. With usual notation, obtain an expression for emf generated in a D.C. generator. **(05 Marks)**
   c. Explain the principle of operations of a D.C. motor. **(05 Marks)**
   d. A 6-pole lap wound shunt motor has 500 conductors in the armature. The resistance of armature path is 0.05ohm. The resistance of shunt field is 25ohm. Find the speed of the motor, when it takes 120A from a d.c. mains of 100 V supply. Flux per pole is 2×10^{-2}Wb. **(06 Marks)**

6 a. Choose the correct answers for the following :
    i)   An ideal transformer does not change
        A) Voltage   B) Current   C) Power   D) None of these
    ii)   Losses which do not occur in transformers are
        A) frictional losses   B) magnetic losses   C) copper losses   D) none of these
    iii) The flux in transformer core
        A) increases with load   B) Decrease with load
        C) remains constant irrespective of load   D) none of these
    iv) Copper losses in a transformer are also known as
        A) Variable losses   B) Constant losses
        C) Eddy current losses   D) Frictional losses.
                                                  (04 Marks)
   b. Derive the emf equation of a transformer.   **(05 Marks)**
   c. Define voltage regulation of a transformer.   **(04 Marks)**
   d. A 600 kVA transformer has an efficiency of 92% at full load and unity p.f. The p.f. is 0.9 at half load. Determine the efficiency at 75% of full load and 0.9 p.f.   **(07 Marks)**

7 a. Choose correct answers for the following :
    i)   Salient pole machines usually have
        A) long cores   B) Small number of poles
        C) Small diameters   D) Large number of poles.
    ii)   Turbo alternators are usually driven at
        A) 500 rpm   B) 750 rpm   C) 1000 rpm   D) 3000 rpm
    iii) A 4-pole, 1200 rpm alternator generates emf at a frequency of
        A) 25 Hz   B) 40 Hz   C) 50 Hz   D) 60 Hz
    iv) The field winding of an alternator is excited by
        A) d.c.   B) a.c.   C) both d.c. and a.c.   D) None of these
                                                  (04 Marks)
   b. Explain the constructional feature of an alternator with the help of figure.   **(05 Marks)**
   c. What are the advantages of having stationary armature in an alternator?   **(05 Marks)**
   d. A 3-phase, 16 pole alternator has a star connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03wb and the speed is 375 rpm. Find the frequency, the phase emf and line emf. Assume pitch factor $K_p = 1$ and distribution factor $K_d = 0.96$.   **(06 Marks)**

8 a. Choose the correct answers for the following :
    i)   In a 3 phase induction motor, the slip speed is given by,
        A) N_S B) N   C) $N_S - N$ D) $N - N_S$
    ii)   When an induction motor is standstill, its slip is
        A) Zero   B) 0.5   C) 1   D) infinity
    iii) The relation between rotor frequency (f ′) and stator frequency (f) is
        A) $f' = sf$ B) $f' = f/s$ C) $f' = \sqrt{sf}$ D) $f' = (1-s)f$
    iv) Synchronous speed of 3 phase inductor motor is
        A) $N_S = 120fp$ B) $N_S = 120f/p$ C) $N_S = \dfrac{120p}{f}$ D) $N_S = fp/120$
                                                  (04 Marks)
   b. Explain the principle of operation of 3 phase induction motor.   **(08 Marks)**
   c. An 8-pole alternator runs at 750rpm and supplier power to a 4-pole induction motor. The frequency of the motor is 1.5Hz. What is the speed of the motor? What is its slip? **(08 Marks)**

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