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17ELE15/25

**First/Second Semester B.E. Degree Examination, Feb./Mar. 2022**  
**Basic Electrical Engineering**

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, choosing ONE full question from each module.**

**Module-1**

- 1 a. State and explain Kirchoff's Laws as applied to D.C circuits. (06 Marks)  
b. Define the co-efficient of coupling and find its relation with  $L_1$ ,  $L_2$  and  $M$ . (06 Marks)  
c. In the circuit shown in Fig Q1(c), what is the voltage across AB if (i) Switch S in open and (ii) Switch S is closed.

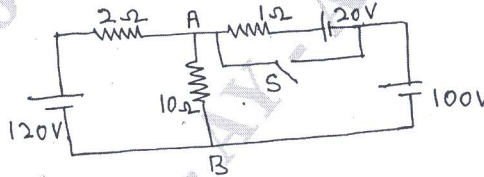


Fig Q1(c)

(08 Marks)

**OR**

- 2 a. State and explain Faraday's Laws of Electro-magnetic inductions. (06 Marks)  
b. Derive an expression for the energy stored in an inductive coil. (06 Marks)  
c. A circuit consists of two parallel resistors having resistances of  $20\Omega$  and  $30\Omega$  respectively connected in series with  $15\Omega$ . If the current through  $15\Omega$  resistor is  $3A$ , find : i) Current in  $20\Omega$  and  $30\Omega$  resistor ii) The voltage across the whole circuit iii) The total power and power consumed in all resistances. (08 Marks)

**Module-2**

- 3 a. Define back emf of D.C motor. What is its significance? (04 Marks)  
b. With a neat sketch, explain the construction of the various parts of a D.C generator. (08 Marks)  
c. With a neat figure, explain the construction and working principle of a dynamometer type Wattmeters. (08 Marks)

**OR**

- 4 a. Derive the Torque equations of a D.C motor. (06 Marks)  
b. Sketch the various characteristics of D.C shunt and D.C series motor. (06 Marks)  
c. A 4 pole  $220V$ , lap connected D.C shunt motor has 36 slots, each slot containing 16 conductors; it draws a current of  $40A$  from the supply. The field resistance and armature resistances are  $110\Omega$  and  $0.1\Omega$  respectively. The motor develops an output power of  $6kW$ . The flux per pole is  $40mwb$ . Calculate: i) The speed ii) The Torque developed by armature and iii) The shaft torque. (08 Marks)

**Module-3**

- 5 a. Define and derive an expression for root mean square value of an alternating quantity. (06 Marks)  
b. Derive an equation for the power consumed by an R-L series circuit. Draw the waveform of voltage, current and power and draw the phasor diagram, (08 Marks)  
c. With a neat figure, explain pipe earthing. (06 Marks)

OR

- 6 a. With a circuit diagram, explain the working of a two way control of a Lamp. (06 Marks)
- b. A circuit consists of a resistance of a  $10\Omega$ , an inductance of  $16\text{mH}$  and a capacitance of  $150\mu\text{F}$  connected in series. A supply of  $100\text{V}$  at  $50\text{Hz}$  is given to the circuit. Find the current, p.f and power consumed by the circuit. Draw the vector diagram. (06 Marks)
- c. Two circuits A and B connected in parallel across  $200\text{V}$ ,  $50\text{Hz}$  supply circuit. A consists of  $10\Omega$  resistance of  $0.12\text{H}$  inductance in series while circuit B consists of  $20\Omega$  resistance in series with  $40\mu\text{F}$  capacitance. Calculate i) current in each branch ii) Supply current iii) Total power factor. Draw the phasor diagrams. (08 Marks)

Module-4

- 7 a. Derive the emf equation of A.C generator. (06 Marks)
- b. Show that the two Wattmeters are sufficient to measure three phase power. Also derive an expression for the power factor in terms of wattmeter readings. (08 Marks)
- c. When three balanced impedance are connected in star across a 3 phase  $415\text{V}$ ,  $50\text{Hz}$  supply. The line current drawn is  $20\text{A}$ , at a Lagging p.f of  $0.4$ . Determine the parameters of the impedance in each phase. (06 Marks)

OR

- 8 a. In a three phase Delta connection, find the relation between line and phase values of current and voltages. Also derive the equation for three phase power. (06 Marks)
- b. With neat sketches, explain the construction of salient pole alternator. (06 Marks)
- c. A 24 pole turbo alternator has star connected armature winding with 144 slots and 10 conductors per slot, it is driven by a low speed Kaplan turbine at a speed of  $250\text{ rpm}$ . The winding has full pitched coils with a distribution factor of  $0.966$ . The flux per pole is  $67.3\text{mwb}$ . Determine: i) The frequency and magnitude of line voltage ii) The output KVA of the machine, if the total current in each phase is  $50\text{A}$ . (08 Marks)

Module-5

- 9 a. Derive EMF equation of transformer. (06 Marks)
- b. Derive the condition for which the efficiency of a transformer is maximum. (06 Marks)
- c. A 3 phase, 6 pole,  $50\text{Hz}$  Induction motor has a slip of  $1\%$  at no-load, and  $3\%$  at full load. Determine : i) Synchronous speed ii) no-load speed iii) Full load speed iv) Frequency of rotor current at stand still v) Frequency of rotor current at full load. (08 Marks)

OR

- 10 a. Explain clearly the working principle of a three phase induction motor. (06 Marks)
- b. A single phase  $20\text{KVA}$  transformer has  $1000$  primary turns and  $2500$  secondary turns. The net cross sectional area of the core is  $100\text{cm}^2$ . When the primary winding is connected to  $500\text{V}$   $50\text{Hz}$  supply, calculate: i) The maximum flux density in the core ii) The voltage induced in the secondary winding iii) The primary and secondary full load currents. (06 Marks)
- c. A single phase transformer working at  $0.8\text{p.f}$  has an efficiency of  $94\%$  at both three fourth full load of  $600\text{kW}$ . Determine the efficiency at half full load, unity power factor. (08 Marks)

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