Ref. No. Ex/FTBE/EE/T/126/2017

Name of the Examinations: B.E. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING FIRST YEAR SECOND SEMESTER - 2017

Subject: FUNDAMENTALS OF ELECTRICAL ENGINEERING

Group A (68 marks)

Part I – Attempt any three questions (Each carry 16 marks)

1a) Draw vector diagram for phase voltages and phase currents in a star connected 3 phase balanced system. Show the line voltages also. (5)

b) What are expressions for total active and reactive power ? (3)

c) A star connected load of impedance (6 + j8) in each phase is being supplied by a balanced 3-ph. 3 wire system of line voltage, 230 volts. Find the line current and power absorbed by each phase. (8)

2a) How to arrive at the general e.m.f. equation of a d.c. generator? (8)

b) A 4-pole d.c. shunt generator has 16 slots with 10 conductors in each slot. Calculate the e.m.f. generated if the armature is i) lap connected and ii) wave connected when flux is 0.03 webers and speed is 750 r.p.m (8)

3a) Why do we need a starter for a d.c. motor ? (4)

b) Draw the internal circuit diagram of a 3-point starter. (6)

c) A 4-pole d.c. motor takes an armature current of 50 A at 440 volts. If its armature circuit has a resistance of 3 Ω, what will be the value of back e.m.f.? (6)

4a) How to conduct open-circuit and short-circuit tests on a transformer. (8)

b) A 2000/400 Volts 10 KVA single-phase transformer has:
$R_1 = 5.5\ \Omega$ $R_2 = 0.2\ \Omega$ $X_1 = 12\Omega$ $X_2 = 0.45\ \Omega$
Calculate the secondary voltage on full-load at 0.8 p.f. lagging when the primary supply voltage is 2000 V. (8)

5a) Derive the expression of Torque in an Induction motor. (8)

b) A 12-pole 3-phase alternator driven at a speed of 500 r.p.m supplies power to an 8-pole 3-phase Induction motor. If the slip of the motor at full-load is 3%, calculate the full load speed of the motor. (8)

Part II – Attempt any four (Each carry 5 marks) (20)

Short Notes:

1. Use of multipliers in a M.I. voltmeter
2. Megger
3. Transformer equivalent circuit
4. Back e.m.f in a d.c. motor
5. O.C.C. of a d.c. generator
6. Transformer core loss

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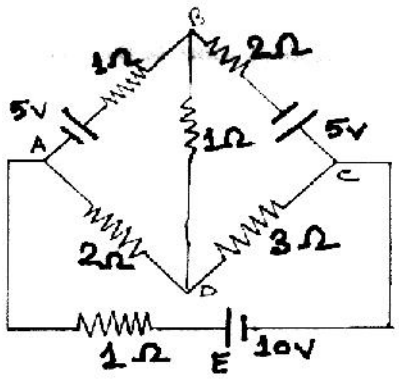
Group B (32 marks)

Answer any Two Questions

Each questions carry equal marks

1. a) State Thevenin's theorem & explain the procedure to Thevenize a given network. (8)

   b) Determine the branch currents of the given network using Maxwell's loop current method. (8)



2. a) State maximum power transfer theorem. Derive the expressions to convert the star and delta connected resistances from one to another. (2+8=10)

   b) A ring has mean diameter of 40 cm and cross sectional area of 10 cm^2. The ring is made up of semi circular sections of cast iron and cast steel, with each joint having a reluctance equal to an air gap of 0.5 mm. Find the ampere-turn required to produce a flux of 12×10^{-4} Wb. The relative permeability of cast iron and cast steel are 166 and 800 respectively. (6)

3. a) Show that the power consumed by a pure capacitor over a full cycle of applied sinusoidal voltage is zero. (4)

   b) Show that current lags the voltage by 90° in case of a pure inductor connected across sinusoidal voltage. (4)

   c) The half cycle of an alternating signal is as follows- it increases uniformly from zero at 0° to 230V at $\alpha°$, remain constant at 230V upto$(180 - \alpha)°$, then decreases uniformly from 230V to zero at 180°. Calculate the average and r.m.s. values of the signal. (8)

4. a) Deduce the magneto motive force (m.m.f.) and reluctance of a solenoid having magnetic path of l m, cross-sectional area of A m^2 and a coil of N turns wound on it and carrying a current of I *amperes*. (6)

   b) Deduce the condition at which an RLC series circuit behaves like a resistive circuit. (4)

   c) Calculate the active and reactive power when a voltage represented by $v = 325sin100\pi t$ volts is applied across a coil of 50Ω resistance and 0.15 H inductance. (6)