CSM : 22

ELECTRICAL ENGINEERING

PAPER - I

Time Allowed : 3 hours | Full Marks : 100

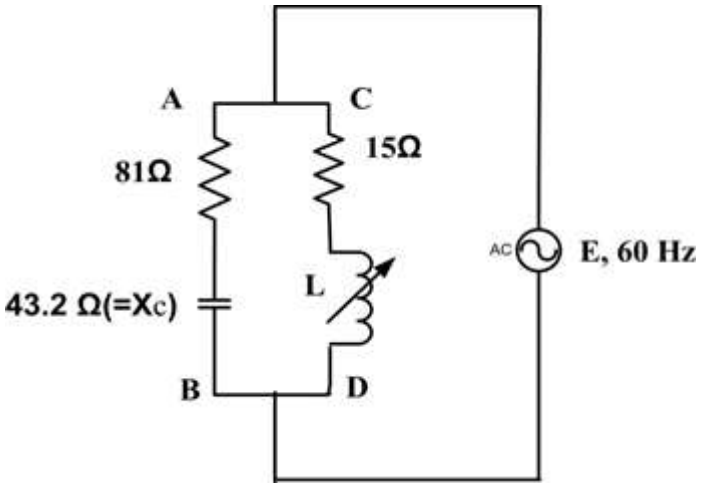
Marks for each question is indicated against it.
Attempt any 5 (five) questions taking not more than 3 (three) questions from each Part.

PART - A

1. (a) Prove that under maximum power transfer condition the power transfer efficiency of the circuit is only 50%. **(5)**

(b) Three star connected impedance, Z_1= 15+j25 Ω per phase are connected in parallel with three delta connected impedance Z_2=20-j30 Ω per phase. The line voltage is 440 V. Find the line current, the power factor, the active power and the reactive power taken by the combination. **(8)**

(c) Find the value of L so that the circuit shown in Figure resonates. **(7)**



Figure

2. (a) Derive the boundary conditions for dielectric-dielctric material placed in an existing E field. **(6)**

(b) Drive with the help of the relevant Maxwell's equation, the expression for the magnetic field $\vec{H}$ for a uniform plane wave propagating along z ($E_z = H_z = 0$; $\partial/\partial x = \partial/\partial y = 0$) in free space if the electric field is given by $\vec{E} = (20\vec{a}_x + 30\vec{a}_y)\cos(3\pi \times 10^{10t} - 100\pi z)$. **(14)**

3. (a) Explain hunting phenomenon of a synchronous machine. What are the various causes of hunting? How can it be reduced? **(10)**

(b) A single phase transformer has 1000 turns on the primary and 200 turns on the secondary. The no load current is 3 A at a pf of 0.2 lagging. Calculate the primary current and power factor when the secondary current is 280A at a pf of 0.8 lagging. **(10)**

4. (a) Describe the construction and working principle of a single-phase 'Electrodynamic Power Factor meter'. Compare its working with a 'moving iron type power factor meter'. **(12)**

(b) Explain the phenomena of 'creeping'. If an energy meter disc makes 10 revolutions in 100 seconds when a load of 360 W is connected to it, determine the meter constant in revolutions/kWh. **(8)**

PART - B

5. (a) Derive an expression for the driving point and transfer impedance of a radial transmission line which is terminated at the receiving end by its characteristic impedance. **(10)**

(b) A three phase 400 kV 50 Hz transmission line has a series inductive reactance of 0.30 Ω/km and a shunt admittance of 3.75×10^{-6} S/km. If the line is 300 km long, determine its surge impedance, propagation constant, ABCD constants, wavelength and surge impedance loading. **(10)**

6. (a) Explain the control structures of SVS type FACTS controller with block diagrams. **(6)**

(b) Explain with necessary diagrams the different kinds of HVDC links used in HVDC systems. Also explain the relative advantages and disadvantages of using these links. What are the precautions needed for series and parallel connection of thyristors to construct a HVDC system? **(14)**

7. (a) Differentiate between (i) load frequency control and economic dispatch control, and (ii) unit commitment and economic load dispatch. **(8)**

(b) Why is DC used for high voltage transmission of electric power? What are the precautions needed for series and parallel connection of thyristors to construct a HVDC system? **(12)**

8. (a) Derive the expression for the collector current of a transistor in common emitter configuration. **(6)**

(b) Draw the circuit diagram of a double tuned amplifier. Explain briefly its working. How such amplifiers are better than single tuned amplifier? **(8)**

(c) Design a fixed biased circuit using silicon transistor having β_{dc} value of 100. V_{CC} is 10V and dc bias conditions are to be $V_{CE} = 5V$ and $I_C = 5$ mA. **(6)**

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