Max marks: 10 Time: 30 min

1. A voltage $V = V_0 \sin\omega t$ is applied to a series LCR circuit. Derive the expression for the average power dissipated over a cycle. Under what condition is (i) no power dissipated even though the current flows through the circuit, (i) maximum power dissipated in the circuit?
   Define rms current
   A light bulb is rated at 125 W for a 250 V ac supply. Calculate the resistance of the bulb.(5 marks)

OR

(a)Draw a schematic diagram of a step-up transformer. Explain its working principle. Deduce an expression for the secondary to primary voltage in terms of the number of turns in the two coils. In an ideal transformer, how is this ratio related to the currents in the two coils? How is the transformer used in large scale transmission and distribution of electrical energy over long distances?
(b) Write any two sources of energy loss in a transformer.
(c) A step-up transformer converts a low input voltage into a high output voltage. Does it violate law of conservation of energy? Explain (5 marks) (Both to be done)

2. A series LCR circuit C= 80μF, R = 40 Ω, L= 5.0 H connected to a variable frequency ,230 V source.,
   (a) Determine the source frequency which drives the circuit in
   (b) Obtain the impedance of the circuit and the amplitude of current at the resonating frequency.
   (c) Determine the rms potential drops across the three elements of the circuit. Show that the potential drop across the LC combination is zero at the resonating frequency (3 MARKS)

OR

No power is dissipated across a purely inductive circuit. Justify this statement with the help of voltage, current graph across one complete cycle when connected across ac source (3 Marks) (Both to be done)

3. (a) For circuits used for transporting electric power, a low power factor implies large power loss in transmission. Explain
   (b) Power factor can often be improved by the use of a capacitor of appropriate capacitance in the circuit. Explain.(2 MARK)