ANSWERS-Assignment 2

MULTIPLE CHOICE QUESTION

1. Ans. (c) L / 4

2. Ans. (a) Bulb will give more intense light

3. Ans. (b)

4. Ans. (b) If both assertion and reason are true but reason is not the correct explanation of the assertion.

5.Ans. (b) If both assertion and reason are true but reason is not the correct explanation of the assertion.

6. Ans. (b) Two times

7. Ans. (d) Zero

8. Ans. (b) 10 V, 5 amp

9. Ans. (a) If both assertion and reason are true and the reason is the correct explanation of the assertion.

SHORT ANSWER TYPE I (2MARKS EACH)

10. The power factor (cos φ) is the ratio of resistance and impedance of an ac circuit i.e., Power factor, cos φ= R/ Z Maximum power factor is 1 when Z = R i.e., when circuit is purely resistive. Minimum power factor is 0 when R = 0 i.e., when circuit is purely inductive or capacitive

11. Irms = Vrms/ Z

Here $Z=\sqrt{R^2 + (Xc - XL)^2}$ $X_L = \omega L = 100\Omega$ and $Xc = 1/\omega C = 500\Omega$
Z= 500Ω Irms = 0.1A

12. $I_2=P_2/E_2 = 1A$

SHORT ANSWER TYPE II (3MARKS EACH)

13. Ans.(i) $V_{eff} = V_R + V_L + V_C = 200\ V + 250\ V + 250\ V = 700V$ which is greater than 200V . This is due to V_R,V_L and V_C are vectors and cannot add like a numbers

Thus Veff = $\sqrt{V_R^2 + (V_L - V)^2}$ Veff = $\sqrt{(200)^2 + (250 - 250)^2}$

Veff= 200V.

14. (i) When the number of turns in the inductor is reduced, the self-inductance of the coil decreases; so impedance of circuit reduces and so current in the circuit increases. Thus, the brightness of the bulb increases. (ii) When iron (being a ferromagnetic substance) rod is inserted in the coil, its inductance increases and in turn, impedance of the circuit increases. As a result, a larger fraction of the applied ac voltage appears across the inductor, leaving less voltage across the bulb. Hence, brightness of the bulb decreases. (iii) When capacitor of reactance $X_C = X_L$ is introduced, the net reactance of circuit becomes zero, so impedance of circuit decreases; it becomes Z = R; so current in circuit increases; hence brightness of bulb increases. Thus brightness of bulb in both cases increases

LONG ANSWER TYPE (5MARKS EACH)

15. (a) Refer Answer Section A1

(b) Case1. When $X_L = R$ then $Z = \sqrt{2}R$ thus power factor $P1 = \frac{R}{Z}$ becomes $P1 = 1/\sqrt{2}$

Case 2. When $X_L = X_C$ then power factor $P_2 = 1$

Thus $P_1/P_2 = 1/\sqrt{2}$

16. In LCR series circuit

$V = V_m \sin\omega t$ and $i = i_m \sin(\omega t+\varphi)$

Thus instantaneous power $P = Vi = (V_m \sin\omega t)(i_m \sin(\omega t+\varphi))$

$= (V_m i_m \sin\omega t)[\sin\omega t \cos\varphi + \cos\omega t \sin\varphi] = V_m i_m [\sin^2\omega t \cos\varphi + \cos^2\omega t \sin\varphi]$

Thus Average power over a complete cycle

$P_{av} = \frac{1}{T}\int_0^T P dt = \frac{1}{T}\int_0^T V_m i_m [\sin 2\omega t \cos\varphi + \cos 2\omega t \sin\varphi] t$

Solving

$\int_0^T \sin^2\omega t \cos\phi dt = T/2 \cos\varphi$ and $\int_0^T \cos^2\omega t \sin\phi dt = 0$

Thus $P_{av} = V_m i_m \cos\varphi /2 = V_{rms} I_{rms} \cos\varphi$

(b) $P_{av} = V_{rms} I_{rms} \cos\varphi$

For small power factor $\cos\varphi$, I_{rms} increases for constant V_{rms} and power loss is $= I^2_{rms} R$ increases.

17. Derivation is same as answer of Section A5.

The large scale transmission and distribution of electrical energy over long distances is done withthe use of transformers. The voltage output of the generator is stepped-up (so that current is reduced and consequently, the I^2R loss is cut down). It is then transmitted over long distances toan area sub-station near the consumers. There the voltage is stepped down. It is further stepped down at distributing sub-stations and utility poles before a power supply of 240 V reaches our homes.

CASE STUDY TYPE (4 MARKS EACH)

18. Ans1. In LCR series circuit when inductive reactance become equal to capacitive reactancethen the current in a circuit become maximum called resonance.

Ans2. Resonance frequency depends on value of inductor L and capacitor CAns3. Graph should be sharper for unique resonance frequency.

Ans4. At resonance impedance is minimum i.e. Z= R