

## ANSWER-KEY

### Assignment 3

#### MULTIPLE CHOICE QUESTION

1. (d)  $10 \Omega$
2. (a) 500 rad/sec
3. (b) 0.16 amp
4. (b)  $R / (R^2 + \omega^2 L^2)^{\frac{1}{2}}$
5. (a) 0.35 mH
6. (d) 400 W
7. (c) C
8. (d) d
9. (b) 40 V, 40 A
10. (b) 0.4 A

#### SHORT ANSWER TYPE I (2MARKS EACH)

11(i) As the current leads the voltage by  $\pi/4$ , the element used in black box is a capacitor.

$$\text{ii) } \tan(\pi/4) = V_C/V_R = 1 = V_C/V_R \quad \text{gives } X_C = R$$

$$\text{Impedance } Z = \sqrt{R^2 + X_C^2} \quad \text{Gives } Z = \sqrt{2} R$$

12. Here  $P_L = 60 \text{ W}$ ,  $I_L = 0.54 \text{ A}$ .  $V_L = 60/0.54 = 111.1 \text{ V}$

The transformer is step-down and have  $1/2$  input voltage.

$$\text{Hence } I_P = 1/2 \quad I_L = 0.27 \text{ A}$$

13. Frequency  $\nu = C/\lambda = 10^6 \text{ Hz}$ .

$$u^2 = 1/4\pi^2 LC \quad \text{Gives } L = 1.055 \times 10^{-8} \text{ H}$$

14.  $I_2 = E_2/Z_2 = 0.1 \text{ A}$

$$I_1 = E_2 I_2/E_1 = 0.01 \text{ A.}$$

$$I_1 = E_2 I_2/E_1 = 0.1 \text{ A}$$

## SHORT ANSWER TYPE II (3MARKS EACH)

15. (i)  $R = V_R/I = 30\Omega$      $X_C = V_C/I = 40\Omega$      $Z = \sqrt{R^2 + X_C^2} = 50\Omega$

(ii)  $X_L = X_C$      $\omega L = 40$      $L = 40 / 2\pi f = 2/5\pi$  H.

16. Ans. (a) A

(b) Zero

(c) L or C or LC Series combination of L and C

## Long Questions (Each carry 5 marks)

17. Derivation same as Question B2

(i) Condition for No power loss is  $P_{av} = V_{rms} I_{rms} \cos\phi$

$\cos\phi = 0$  i.e.  $\phi = 90^\circ$  No resistor used in circuit.

(ii) For Maximum power loss  $X_C = X_L$  i.e. at resonance.  $\cos\phi = 1$  and power lost is maximum.

18.(b) Demand of electric power = 1200 kW

Distance of town from power station = 20 km

Two wire =  $20 \times 2 = 40$  km

Total resistance of line =  $40 \times 0.5 = 20 \Omega$

The town gets a power of 4000 volts Power = voltage  $\times$  current

$$I = \frac{1200 \times 10^4}{4000} = 1200/4 = 300 \text{ A}$$

The line power loss in the form of heat =  $I^2 \times R$

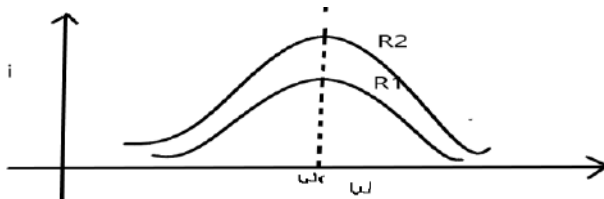
$$= (300)^2 \times 20 = 9000 \times 20 = 1800 \text{ kW}$$

19.

$\omega L = \frac{1}{\omega C}$      $\omega^2 = \frac{1}{LC}$      $2\pi u^2 = \frac{1}{LC}$      $u = 39.80 \text{ Hz}$  the frequency is called resonance frequency.

ii. Maximum current at resonance  $I_m^{max} = \frac{V_m}{R} = \frac{200}{100} = 2 \text{ A}$

iii.



$R_1$  is greater than  $R_2$

20. Ans  $N_s = \frac{V_s}{V_p} N_p = 300 \text{ turns}$

### **CASE STUDY TYPE QUESTIONS (4 MARKS EACH)**

21. Answer1. Electromagnetic induction

Answer2. Plane of coil become parallel to magnetic field so  $\theta = 90$ ,  $\sin\theta = 1$

Answer3.  $\varepsilon_{max} = NBA \omega = 136V$

Answer4.  $I_{max} = \frac{\varepsilon_{max}}{R} = 11.3$