Assignment-2

Basic Electrical & Electronics Engineering

Topic: Single Phase AC Circuit

1. Define the following terms: (i) Time period (ii) Phase difference (iii) Form factor & (iv) Crest factor.

2. What is the r.m.s value of an AC quantity? Obtain expression for the R.M.S. value of a sinusoidal current in terms of its maximum value

3. An alternating current varying sinusoidally with a frequency of 50 Hz has an RMS value of 20 A. Write down the equation for the instantaneous value and find this value (a) 0.0025 second (b) 0.0125 second after passing through a positive maximum value. At what time, measured from a positive maximum value, will the instantaneous current be 14.14 A?

4. An alternating current of frequency 50 Hz has a maximum value of 100 A. Calculate (a) its value 1/600 second after the instant the current is zero and its value decreasing thereafter (b) how many seconds after the instant the current is zero (increasing thereafter wards) will the current attain the value of 86.6 A?

5. Determine the r.m.s. value of the voltage defined by e = 5 + 5 sin (314 t + π/6)

6. The following three vectors are given: A = 20 + j20, B = 30 ∠−120 and C = 10 + j0. Perform the following indicated operations : (i) AB/C and (ii) .BC/A

7. Two impedances of Z_1 = (5 + j7) Ω and Z_2 = (8-j2) Ω are connected in parallel. Find out the net impedance of the combination in polar form.

8. An a.c. voltage (80 + j 60) volts is applied to a circuit and the current flowing is (− 4 + j 10) amperes. Find (i) impedance of the circuit (ii) power consumed and (iii) phase angle.

9. A 50-μF capacitor is connected across a 230-V, 50-Hz supply. Calculate (a) the reactance offered by the capacitor (b) the maximum current and (c) the R.M.S. value of the current drawn by the capacitor.

10. Define power factor.

11. Deduce an expression for the avg. power in a 1-phase series R-L circuit.

12. A choke coil takes a current of 2 A lagging 60° behind the applied voltage of 200 V at 50 Hz. Calculate the inductance, resistance and impedance of the coil. Also, determine the power consumed when it is connected across 100-V, 25-Hz supply.

13. When a voltage of 100 V at 50 Hz is applied to a choking coil A, the current taken is 8 A and the power is 120 W. When applied to a coil B, the current is 10 A and the power is 500 W. What current and power will be taken when 100 V is applied to the two coils connected in series?

14. A current of 5 A flows through a non-inductive resistance in series with a choking coil when supplied at 250-V, 50-Hz. If the voltage across the resistance is 125 V and across the coil 200 V, calculate (a) impedance, reactance and resistance of the coil (b) the power absorbed by the coil and (c) the total power. Draw the vector diagram.

15. Two coils A and B are connected in series across a 240-V, 50-Hz supply. The resistance of A is 5 Ω and the inductance of B is 0.015 H. If the input from the supply is 3 kW and 2 kVAR, find the inductance of A and the resistance of B. Calculate the voltage across each coil.

16. The voltage applied to a circuit is V= 230 sin (wt + 30⁰) and the current through the circuit is I = 10 sin

(wt - 30^0). Determine the parameter of the circuit, power consumed in the circuit and also the power factor of the circuit?

17. A 120-V, 60-W lamp is to be operated on 220-V, 50-Hz supply mains. Calculate what value of (a) non-inductive resistance (b) pure inductance would be required in order that lamp is run on correct voltage. Which method is preferable and why?

18. In a circuit, the applied voltage is 100 V and is found to lag the current of 10 A by 30°. (i) Is the p.f. lagging or leading? (ii) What is the value of p.f.? (iii) Is the circuit inductive or capacitive ? (iv) What is the value of active and reactive power in the circuit? (c) Draw the phasor diagram of the circuit.

19. A pure resistance of 50 ohms is in series with a pure capacitance of 100 microfarads. The series combination is connected across 100-V, 50-Hz supply. Find (a) the impedance (b) current (c) power factor (d) phase angle (e) voltage across resistor (f) voltage across capacitor. Draw the vector diagram.

20. A 240-V, 50-Hz series R-C circuit takes an R.M.S. current of 20 A. The maximum value of the current occurs 1/900 second before the maximum value of the voltage. Calculate (i) the power factor (ii) average power (iii) the parameters of the circuit.

21. A two-element series circuit consumes 700 W and has a p.f. = 0.707 leading. If applied voltage is v = 141.1 sin (314 t + 30°), find the circuit constants.

22. A resistance of 20Ω, an inductance of 0.2H and a capacitance of 100µF are connected in series across 220V, 50Hz mains. Determine the following (a) impedance (b) current (c) voltage across R, L and C (d) power in watts and VA (e) power factor and power factor angle.