TED (15/19) 3033
(Revision – 2015/19)

A22-06347

Reg. No……………………
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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE, APRIL – 2022

FUNDAMENTALS OF AC SYSTEMS

[Maximum Marks: **100**] [Time: **3.00** Hours]

(PART-A)

(Maximum Marks: **10**)

I. (Answer ***all*** questions in one or two sentences. Each question carries ***2*** marks)

1. List any two factors affecting the magnitude of generated voltage in a generator.
2. A 4 pole alternator produces alternating voltage at 50 Hz. Calculate the speed of alternator motor in r.p.m
3. A coil of resistance 5Ω and inductance of 0.015 H is connected across 240 V, 50 Hz AC supply. If 35 A current is passing through the coil, calculate the power consumed by the coil.
4. Three similar coils, each having a resistance of 15 Ω and inductance of 0.02H are connected in delta to a 440V, three phase, 50 Hz supply. Calculate the voltage across each coil.
5. The power consumption of a three phase induction motor is measured using two wattmeter method. It is found that one wattmeter reading is zero and other wattmeter reading is 438 watts. What will be the power factor of the 3 phase induction motor.

(5 x 2 = 10)

(PART – B)

(Maximum Marks: **30**)

II. (Answer ***any five*** of the following questions. Each question carries ***6*** marks)

1. List advantages of AC supply over DC supply.
2. The e.m.f of each of the two coils, as read by a voltmeter, is 200 V. When the coils are connected is series at random, the resulting e.m.f is 346.4 V. What is the phase angle of the e.m.f s of the two coils?
3. A capacitor of 8 μF takes a current of 1A when alternating voltage applied across it is 250V.Calculate (i) frequency of the applied voltage (ii) the resistance to be connected in series with the capacitor to reduce the current in the circuit to 0.5A at the same frequency.

4. Derive relationship between line current and phase current of three phase balanced delta connected system.
5. The power input to a three phase motor is measured by two wattmeters, which indicate 300 kW and 100kW respectively, the latter reading being obtained after the reversal of its current coil. Find the power factor of the motor.
6. Define resonance in series AC circuit and derive equation for resonance frequency.
7. List and explain any three power factor correction equipment.

(5 x 6 = 30)

(PART – C)

(Maximum Marks: **60**)

(Answer ***one*** full question from each Unit. Each full question carries **15** marks)

UNIT – I

III.(a) Calculate the resultant e.m.f in rectangular form of a series arrangement of four coils A,B,C and D generating e.m.f of 25 V, 30V, 30V and 20V respectively. The e.m.f of coil B leads that of A by 30^0, e.m.f of coil C leads B by 60^0 and e.m.f of coil D lags 45^0 behind that of A. (8)

(b) Derive the equation for R.M.S value of sinusoidal alternating current. (7)

OR

IV. (a) Define the terms:

(a) Frequency (b) Form factor

(c) Average value (d) R.M.S value (8)

(b) The equation of current though a 2.2 kΩ resistor is i=5 sin ($100\pi t + 45^0$) mA.

(i) Write the mathematical representation of the voltage across the resistor.

(ii) Calculate the R.M.S value of the voltage across the resistor.

(iii) Calculate the instantaneous value of the voltage across the resistor at t=5 mS. (7)

UNIT - II

V. (a) A choke coil is connected in series with a 20µF capacitor. A constant alternating voltage of 200V is applied to the circuit. It is found that the circuit takes its maximum current of 50 A when the supply frequency is 100 Hz. Calculate.

(i) inductance of the choke coil and

(ii) resistance of the choke coil. (8)

(b) Explain alternating current through R.L series circuit with relevant vector diagram and waveforms. (7)

OR

VI. (a) An alternating voltage of 100+j150 volt is applied to a circuit and the current flowing is 4.5+j12 A. Find

(i) Impedance of the circuit

(ii) Power consumed by the circuit

(iii) The phase angle. (8)

(b) Derive the equation for current, power and impedance of RLC series circuit with the help of phasor diagram. (7)

UNIT - III

VII. (a) Three similar coils, connected in star, take a total power of 1.5 kW at a power factor of 0.2 lagging from a three phase 400V, 50Hz supply. Calculate the resistance and inductance of each coil. (8)

(b) List and explain advantage of three phase system over single phase system. (7)

OR

VIII. (a) A balanced delta-connected load of impedance (6+j8) Ω per phase is connected to a three phase, 230V, 50Hz supply. Find the line current and power absorbed by each phase. (8)

(b) Differentiate balanced star and delta systems. (7)

UNIT- IV

IX. (a) Using phasor diagram, explain how three phase power can be measured using two wattmeters. (8)

(b) Compare balanced and unbalanced three phase load. (7)

OR

X. (a) Each of the two wattmeters connected to measure the input to a three phase induction motor reads 10kW. If the power factor of the motor be changed to 0.866 lagging, determine the readings of the two wattmeters, the total input power remaining unchanged. (8)

(b) List effects of low power factor on AC power system. (7)
