Total No. of Questions – [4]

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MAY 2022 (INSEM+ ENDSEM) EXAM
F.Y. B. TECH. (SEMESTER - II)
COURSE NAME: BASIC ELECTRICAL ENGINEERING
COURSE CODE: ET10203A
(PATTERN 2020)

Time: [2Hr] [Max. Marks: 60]

(*) Instructions to candidates:

1) **Figures to the right indicate full marks.**
2) **Use of scientific calculator is allowed**
3) **Use suitable data wherever required**

Q.1 **Solve the following**

i) For the circuit shown in fig.1 below with 4Ω as a load branch resistance, the open circuit voltage across it after removing the load branch from the circuit will be [2]

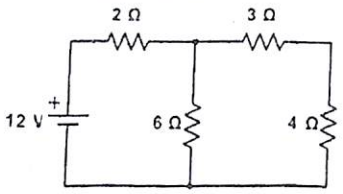

Fig. 1

a) 4.5 V b) 18 V c) 9 V d) 12 V

ii) For a circuit shown in fig.1 with 3Ω as a load branch resistance, the equivalent resistance seen by the open terminals after removing the load branch and shorting the voltage source will be [2]

a) 4.5 Ω b) 5.5 Ω c) 12 Ω d) 1.0909 Ω

iii) For a circuit shown in fig.1 the current flowing through 3Ω resistance in Amperes will be [2]

a) 0.9333 b) 0.9411 c) 1.0588 d) 2.0597

iv) For a circuit shown in fig.1, the voltage across 3Ω resistance is [2]

a) 4.235 V b) 3.176 V c) 12 V d) 8.4704 V

v) For the circuit shown in fig.2 below, the current in 4Ω resistance with only 20V voltage source acting alone and the other source as inactive will be [2]

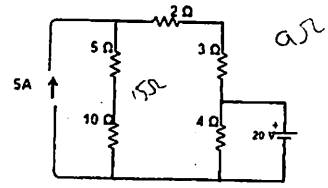

Fig. 2

a) 5 A b) 1.25 A c) 3.75 A d) 0 A

vi) For the circuit shown in fig.2, the current in 4Ω resistance with only 5A current source acting alone and the other source inactive will be [2]

a) 3.75 A b) 5 A c)1.25 A d) 0 A

vii) A series R-C circuit with R=1MΩ and C=0.02μF is connected across the DC voltage source of 100V. Determine the charging current after 0.06sec. [2]

a) 1.25 μA b) 100 μA c) 4.98 μA d) 6.33 μA

viii) A 6μF capacitor in series with 2.4MΩ resistor is connected across a 200V dc supply. Find the voltage across the capacitor 4 sec after switching on the dc supply in Volts will be. [2]

a) 12.13 b) 50.11 c) 24.25 d) 48.5

ix) A resistance of 100Ω and capacitance of 50μF are connected in series across a 230V, 50Hz ac supply. The voltage in Volts across the resistance. [2]

a) 123.51 b) 133.5 c) 194.02 d) 230

x) A 20Ω resistance and a 30mH inductance are connected in series across 230V, 50Hz ac supply. The reactive power of the circuit in VAR will be [2]

a) 2392 b) 2164.7 c) 1019.8 d) 1082.35

xi) A series circuit consisting of a resistance of 120Ω, a capacitor of 16.88μF and an inductor of variable inductance are connected across a 230V, 50Hz single phase ac supply. The value of the inductance connected in the circuit so that the current will be maximum is [2]

a) 0.06 mH b) 0.6 H c) 0.6 mH d) 6 mH

xii) A sinusoidal current is given by the expression $i = 20\sqrt{2}\sin(\omega t + \theta)$Amp. At t=0, the instantaneous value of current is found to be $10\sqrt{2}$Amp. The time at which the current will reach its positive maximum will be _____ msec if the frequency of the ac supply is 50Hz. [2]

a) 6.66 b) 1.67 c) 3.33 d) 5

xiii) If an active power consumed by a series R-L circuit is 300 W while the reactive power is 400VAR when connected across a 200V, 50Hz single phase ac supply. The inductive reactance in Ω connected in the circuit will be [2]

a) 64 b) 32 c) 48 d) 80

xiv) The expression for current when a pure capacitor of 50μF is connected across 200V, 50Hz, ac supply is [2]

a) $i = 3.141 \sin(314t - 90^0)$ A b) $i = 3.141 \sin(314t + 90^0)$ A
c) $i = 4.443 \sin(314t - 90^0)$ A d) $i = 4.443 \sin(314t + 90^0)$ A

xv) A resistance of 100Ω and capacitance of 50μF are connected in series across a 230V, 50Hz single phase ac supply. The active power consumed by the circuit in Watts will be [2]

a) 376.46 b) 446.26 c) 239.65 d) 479.3

Q2 **Solve any three out of four**

a) Derive an expression for emf induced in primary and secondary winding of a single phase transformer with usual notations. [5]

b) A 40kVA, 2200V/220V, 50Hz, single phase transformer has an iron loss of 250W. The resistances of low and high voltage windings are 0.005Ω and 0.5Ω respectively. Calculate the % efficiency at full load and load power factor of 0.8 lagging. [5]

c) A single phase 90kVA, 3.2kV/220V, 50Hz transformer has an efficiency of 89% both at full load and at half load with unity power factor. Determine the efficiency at half load and 0.8 power factor leading. [5]

d) The resistance and leakage reactance of a single phase 10 KVA, 2200/220 V distribution transformer are as given below. [5]

High voltage (HV winding):- $r_1 = 4\Omega$, $x_1 = 5\Omega$
Low voltage (LV winding):- $r_2 = 0.04\Omega$, $x_2 = 0.05\Omega$
The transformer is supplying rated KVA at 0.8 power factor lagging to a load at rated voltage. Determine the % voltage regulation. At what power factor will the % voltage regulation be zero?

Q.3 **Solve any three out of four**

a) In a three phase star connected balanced load connected across a symmetrical three phase, 440V, 50Hz ac supply, it is observed that each phase of the load carries a current of 4A and the total active power is equal to the total reactive power. Calculate the value of resistance and inductance in each phase of the load. [5]

b) Draw a neat phasor diagram for a three phase balanced delta connected inductive load in each phase across a symmetrical three phase ac supply and hence derive the relationship between the line current and phase current. [5]

c) The daily usage pattern of various electrical appliances in a typical house is as given below. [5]

Sr. No.	Electrical Appliance	Power rating	Quantity	Usage Time
1	Ceiling Fan	70W	5	6Hrs.
2	Fluorescent Tube	36W	5	5Hrs.
3	Oven	800W	1	30min
4	Washing Machine	600W	1	20min
5	Refrigerator	65W	1	24Hrs.
6	Television set	85W	1	4Hrs.
7	Electric Iron	1kW	1	15min
8	Miscellaneous	50W	1	5Hrs.

Calculate the monthly electricity consumption in kWh for a month of 30 days. If two supply companies X and Y are supplying power at the following rate (tariff).

Company X:- Rs.5.50/-per unit plus Rs.350/- as fixed charges

Company Y:- Rs.4.50/-per unit plus Rs.550/- as fixed charges

Which tariff is cheaper for a monthly electricity bill for a month of 30 days and by what amount?

d) A dc electric motor drives a locomotive that takes a current of 5A when connected to 11kV supply while moving up on an incline plane of 1 in 100. The mass of the locomotive is 10000 kg while frictional force offered by the track is 50.6×9.81N per tonne mass of the locomotive. If the overall efficiency of the system is 90%, calculate the steady speed at which the locomotive is moving. Take g as 9.81m/sec^2. [5]