FEB 2023 EXAMINATION
I B.E./B.TECH. (4YDC) EXAM
EE 10015/10005: FUNDAMENTALS OF ELECTRICAL ENGINEERING

Time: 3 Hrs. **[Max. Marks: 70**
[Min. Pass Marks: 22

TOTAL NO. OF QUESTIONS IN THIS PAPER: 5

Note: Attempt all the FIVE questions. Internal choice is there, see carefully and attempt accordingly.

			Marks	COs	BL
Q.1	(a)	Write the statement of - Ohm's law, Kirchhoff's Voltage law and Kirchhoff's current law.	(03)	1	1
	(b)	Prepare the list of steps which are used in mesh analysis and nodal analysis for the solution of electrical circuit.	(04)	1	1
	(c)	Figure (1) shows a circuit containing two sources of emf, each with their internal resistance. Determine the current in each branch of the network by using the superposition theorem. Also write the statement of superposition theorem.	(07)	1	5
		OR			
	(d)	Find the value of the load resistor R_L shown in figure (2) that gives maximum power dissipation and determine the value of this power. Also write the statement of maximum power transfer theorem.	(07)	1	5

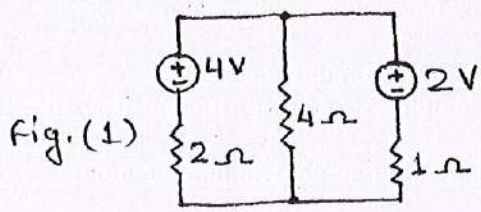

Fig. (1)

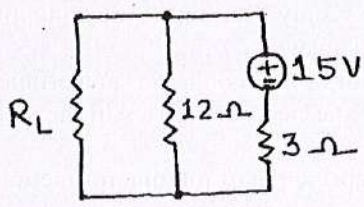

Fig. (2)

Q.2	(a)	For the periodic waveforms shown in figure (3), determine (i) frequency (ii) average value over half a cycle (iii) rms value (iv) form factor (v) peak factor.	(03)	2	5

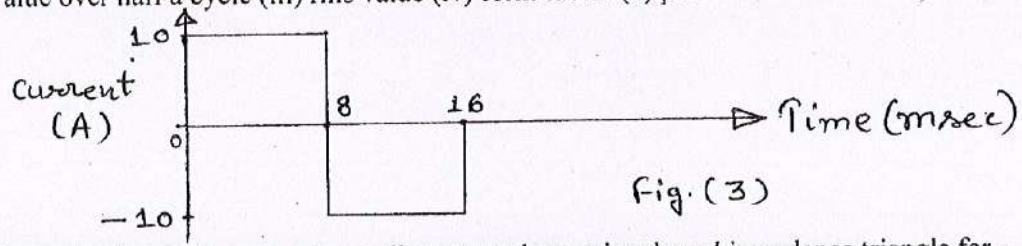

Fig. (3)

	(b)	Draw the circuit diagram, phasor diagram, voltage triangle and impedance triangle for – (i) RL series single phase AC circuit (ii) RC series single phase AC circuit.	(04)	2	1
	(c)	A coil of inductance 159.2mH and resistance 40 ohm is connected in parallel with a 30μF capacitor across a 230V, 50Hz supply. Determine – (i) the current in the coil and its phase angle (ii) the current in the capacitor and its pahse angle (iii) the supply current and its phase angle (iv) the circuit impedance (v) the power consumed (vi) the apparent power and (vii) the reactive power. Draw the phasor diagram.	(07)	2	5
		OR			
	(d)	A motor has an output of 4.8kW, an efficiency of 80% and a power factor of 0.625 lagging when operated from a 230V, 50Hz supply. It is required to improve the power factor to 0.95 lagging by connecting a capacitor in parallel with the motor. Determine – (i) the current taken by the motor (ii) the supply current after power factor correction (iii) the current taken by the capacitor (iv) the capacitance of the capacitor, and (v) the kVAR rating of the capacitor.	(07)	2	5

P.T.O.

Q.3	(a)	Prove that in the case of transformer $(V_1/V_2) = (N_1/N_2) = (I_2/I_1)$.	(03)	3	5
	(b)	Draw and explain hysteresis curve for ferromagnetic material with proper labelling.	(04)	3	2
	(c)	A closed magnetic circuit of cast steel contains a 6 cm long path of cross-sectional area 1 cm^2 and a 2 cm path of cross-sectional area 0.5 cm^2. A coil of 200 turns is wound around the 6 cm length of the circuit and a current of 0.4 A flows. Determine the flux density in the 2 cm path, if the relative permeability of the cast steel is 750. Also draw the magnetic circuit and electrical equivalent circuit for the given problem.	(07)	3	5
		OR			
	(d)	A 400kVA transformer has a primary winding resistance of 0.5 ohm and a secondary winding resistance of 0.001 ohm. The iron loss is 2.5kW and the primary and secondary voltages are 5kV and 320V respectively. If the power factor of the load is 0.85, determine the efficiency of the transformer (i) on full load, and (ii) on half load. Also draw the approximate equivalent circuit of the transformer.	(07)	3	5
Q.4	(a)	Define – Prime mover, Synchronous generator and Line voltage.	(03)	4	1
	(b)	Give the reason, why two-wattmeter method is more popular than three-wattmeter method. Also draw circuit diagram of both the methods.	(04)	4	1
	(c)	Three identical coils, each of resistance 10 ohm and inductance 50 mH are connected (i) in star and (ii) in delta to a 415V, 50Hz, 3-phase supply. Determine the total power dissipated in each case. Also comment on the obtained answers.	(07)	4	5
		OR			
	(d)	The three arms of a 3-phase load each comprise of resistance of 15 ohm and capacitor in series with a value of 150 μF are connected (i) in star and (ii) in delta to a 415V, 50Hz, 3-phase supply. Determine the total power dissipated in each case. Also comment on the obtained answers.	(07)	4	5
Q.5	(a)	Give your opinion on losses and efficiency of DC motor and Induction motor.	(03)	5	5
	(b)	Identify the need of starters in the starting of DC motor. Also enlist different types of starters.	(04)	5	3
	(c)	Explain principle of rotating magnetic field in the case of three-phase induction motor.	(07)	5	2
		OR			
	(d)	Illustrate the working principle of DC shunt motor.	(07)	5	2

JULY

JUNE 2022 EXAMINATION

I B.E./B.TECH (4YDC) EXAM

756

EE 10005: FUNDAMENTALS OF ELECTRICAL ENGINEERING

Time: 3 Hrs. **[Max. Marks: 70**

[Min. Pass Marks: 22

TOTAL NO. OF QUESTIONS IN THIS PAPER: 5

Note: Attempt all the FIVE questions. Internal choice is there, please see carefully and attempt accordingly. CO – Course Outcome, BL – Bloom's Taxonomy Level.

			Marks	CO	BL
Q.1	(a)	Determine the current i in the circuit of figure (1) by first combining the sources into a single equivalent voltage source.	(02)	1	3

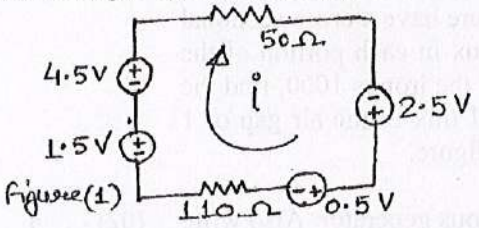

Figure (1)

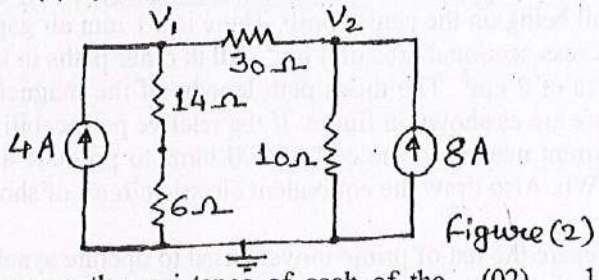

Figure (2)

	(b)	State the effect of an increase in temperature on the resistance of each of the following: aluminium, copper, tungsten, and carbon.	(02)	1	2
	(c)	Determine the current flowing left to right through the 30Ω resistor of figure (2), using nodal analysis.	(03)	1	3
	(d)	Determine the current through 4Ω resistor in the network shown in figure (3), by the use of Thevenin's theorem. Also write statement of the used theorem.	(07)	1	1,3
		OR			
	(e)	Determine the current through 4Ω resistor in the network shown in figure (3), by the use of Norton's theorem. Also write statement of the used theorem.	(07)	1	1,3

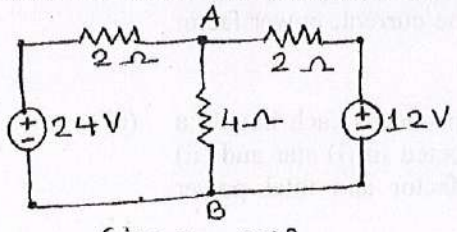

Figure (3)

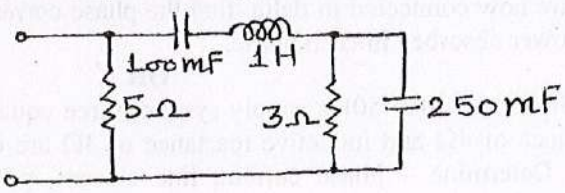

Figure (4)

Q.2	(a).	Write the specification of 1-ϕ AC supply used in the household applications. Also write at least two effects of poor power factor on the connected system.	(02)	2	1
	(b)	Define phasor diagram. Enlist limitations of phasor diagram.	(02)	2	1
	(c)	Determine the equivalent impedance of the network shown in figure (4), given an operating frequency of 5 rad/sec.	(03)	2	3
	(d)	A circuit consists of two coils in series connected to a 200V AC supply. The first coil has a resistor of 10Ω and inductive reactance of 20Ω. The second coil has a resistance of 12Ω and inductive reactance of 16Ω. Find – the total impedance of the circuit, the current in the circuit, the circuit phase angle, the voltage drop in each coil, total power consumed by the circuit, power consumed by the first coil as well as second coil.	(07)	2	3
		OR			
	(e)	Three impedances (6 + j 5) Ω, (8 - j 6) Ω, and (8 + j 10) Ω are connected in parallel. Calculate the current in each branch when the total current is 20A. Also calculate power consumed by the individual branch and total power consumed by the circuit.	(07)	2	3

P.T.O.

Q.3	(a)	What is meant by leakage flux and fringing in association with magnetic circuit?	(02)	3	1
	(b)	Derive the EMF equation of a transformer.	(02)	3	2
	(c)	Define the terms – Hysteresis loss and Eddy current loss. Also write their mathematical expression.	(03)	3	1
	(d)	A transformer is rated at 150kVA. At full load its copper loss is 1250W and its iron loss is 1000W. Find – (i) the efficiency at full load, unity power factor (ii) the efficiency at half load, 0.8 power factor (iii) the efficiency at 75% load, 0.7 power factor (iv) the load kVA at which maximum efficiency will occur (v) the maximum efficiency at 0.85 power factor.	(07)	3	3
		OR			
	(e)	An inductor has a core built up of stampings of the shape shown in figure (5), the coil being on the center limb. There is a 1 mm air gap in the center limb which has a cross-sectional area of 4 cm^2. All th other paths in the core have a cross-sectional area of 2 cm^2. The mean path lengths of the magnetic flux in each portion of the core are as shown in figure. If the relative permeability of the iron is 1000, find the current needed in the coil of 600 turns to produce a total flux in the air gap of 1 mWb. Also draw the equivalent electric circuit of shown figure.	(07)	3	3
Q.4	(a)	Prepare the list of prime movers used to operate synchronous generator. Also write function of diesel – generator set.	(02)	4	1
	(b)	Draw the connection diagram of a 3-phase, four wire supply system with proper labeling.	(02)	4	1
	(c)	Two wattmeter are used to measure the power in a 3-phase balanced system. What is the power factor when (i) both the meters read equal (ii) both the meters read equal but one is negative (iii) one reads twice the other?	(03)	4	2
	(d)	Three similar coils each having a resistance of 30Ω and an inductance of 0.05H are connected in star to a 3-phase, 50Hz supply, 230 volts between the lines. Find the phase current, line current, power factor and the power absorbed in each phase. If they are now connected in delta, find the phase current, line current, power factor and power absorbed in each phase.	(07)	4	3
		OR			
	(e)	In a 3-phase, 440V, 50Hz supply system, three equal impedances each having a resistance of 4Ω and inductive reactance of 3Ω are connected in (i) star and (ii) delta. Determine – phase current, line current, power factor and total power consumed.	(07)	4	3
Q.5	(a)	Write at least four applications of DC motor. Also write speed relation of DC motor.	(02)	5	1
	(b)	What are the different losses occur in an induction motor, show with the help of power flow diagram.	(02)	5	1
	(c)	Demonstrate the working of 1-phase fan motor.	(03)	5	2
	(d)	Prepare the technical note on 3-phase induction motor.	(07)	5	2
		OR			
	(e)	Prepare the technical note on DC motor.	(07)	5	2

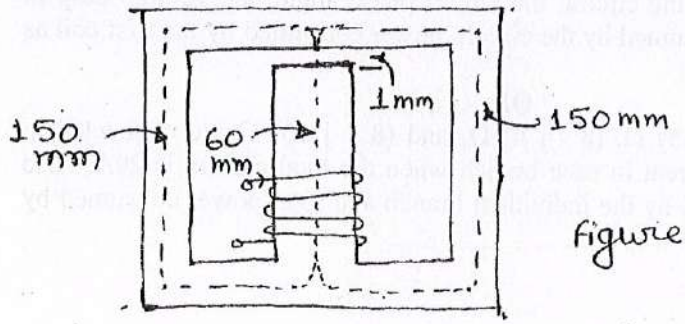

figure (5)

ONLINE FEBRUARY 2022 EXAMINATION
I B.E./B.TECH (4YDC) EXAM
EE 10005: FUNDAMENTALS OF ELECTRICAL ENGINEERING

Time: 90 Min. **[Max. Marks: 40**

TOTAL NO. OF QUESTIONS IN THIS PAPER: 5

Note: Attempt all the FIVE questions. Internal choice is there, please see carefully and attempt accordingly. CO – Course outcome, BL – Bloom's Taxonomy Level

			Marks	CO	BL
).1	(a)	A non-alternating periodic waveform has been shown in fig. (1). Calculate its form factor.	(02)	1	BL3

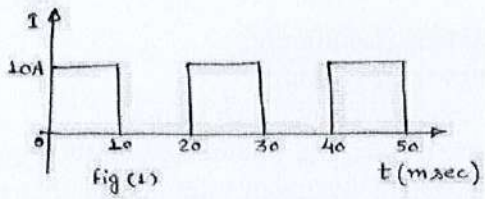

fig (1)

	(b)	Write the statement of superposition and Norton's theorem.	(02)	1	BL1
	(c)	Find the current through 50Ω resistor shown in fig. (2), using nodal analysis method.	(04)	1	BL3

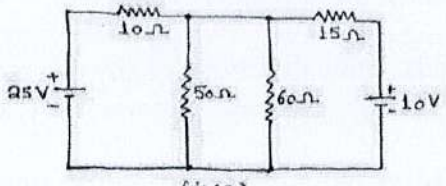

fig (2)

OR

	(d)	Find V by mesh analysis method such that the current through the 10 volt source is zero. Fig. (3)	(04)	1	BL3

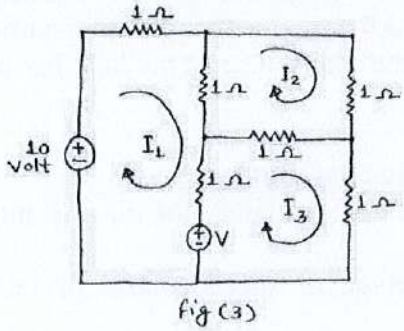

fig (3)

).2	(a)	Draw the sinusoidal waveforms of voltage and current for the following condition – (i) Current lags the voltage (ii) Current leads the voltage.	(02)	2	BL1
	(b)	Give the reason, why power factor should be maintained near to unity?	(02)	2	BL2

	(c)	In a series RLC circuit, the maximum inductor voltage is twice the capacitor voltage maximum. However, the circuit current lags the applied voltage by 30° and the instantaneous drop across the inductance is given by $v_L = 200sin377t$ volt. Assuming the resistance being 50Ω, find the values of the inductance and capacitance.	(04)	2	BL3
		OR			
	(d)	The applied voltage in a parallel RLC circuit is given by $v = 100\ sin\ (5000t + (\pi/4)$ volt If the values of R, L and C be given as 25Ω, 2mH and 25μF, find the total current supplied by the source.	(04)	2	BL3
Q.3	(a)	Draw the hysteresis curve for ferromagnetic material with proper labeling. Also mark coarcivity and retentivity on the curve.	(02)	3	BL1
	(b)	Derive EMF equation of a transformer.	(02)	3	BL2
	(c)	A magnetic circuit comprises three parts in series, each of uniform cross-sectional area. They are: (i) a length of 100mm and cross-sectional area 50mm^2, (ii) a length of 80mm and cross-sectional area 90mm^2, (iii) an airgap of length 0.5mm and cross-sectional area 150mm^2. A coil of 5000 turns is wound on part (ii), and the flux density in the airgap is 0.5T. Assuming that all the flux passes through the given circuit, and that the relative permeability is 1500, estimate the coil current to produce such a flux density.	(04)	3	BL3
		OR			
	(d)	The primary and secondary windings of a 100kVA transformer have resistance of 0.5Ω and 0.002Ω, respectively. The primary and secondary voltages are 11kV and 400V, respectively and the core loss is 3kW, assuming the power factor of the load to be 0.85. Calculate the efficiency on (i) full load and (ii) half load.	(04)	3	BL3
Q.4	(a)	Enlist 3-ϕ power measurement methods. Draw the circuit of any one method.	(02)	4	BL1
	(b)	Define the terms – prime mover and synchronous generator. Also write their applications.	(02)	4	BL1
	(c)	A balanced delta-connected 3-ϕ load is fed from a 3-ϕ, 400V supply. The line current is 25A and the total power absorbed by the load is 10kW. Calculate – the impedance in each branch, the power factor and total power consumed if the same impedances are star connected. Also draw circuit for given condition.	(04)	4	BL3
		OR			
	(d)	A balanced, 3-ϕ, star-connected load is fed from a 400V, 3-ϕ, 50Hz supply. The current per phase is 25A (lagging), and the total active power absorbed by the load is 15kW. Determine – the resistance and inductance of the load per phase, the total reactive power, the total apparent power.	(04)	4	BL3
Q.5	(a)	Enlist losses occur in the rotating machines and define them.	(02)	5	BL1
	(b)	Draw the schematic diagram of capacitor start capacitor run 1-ϕ induction motor. Also write application of it.	(02)	5	BL1
	(c)	Explain armature voltage control method of speed control of DC motor using suitable diagram. (Answer in brief)	(04)	5	BL2
		OR			
	(d)	Explain operation of 3-ϕ induction motor using suitable diagram. (Answer in brief)	(04)	5	BL2