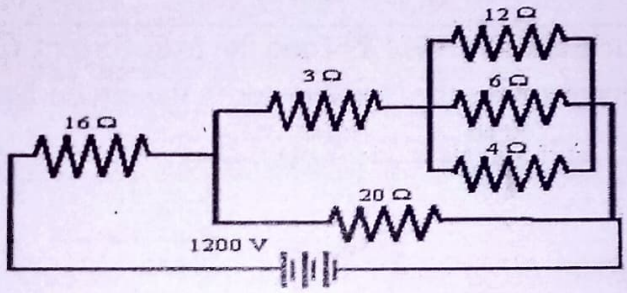
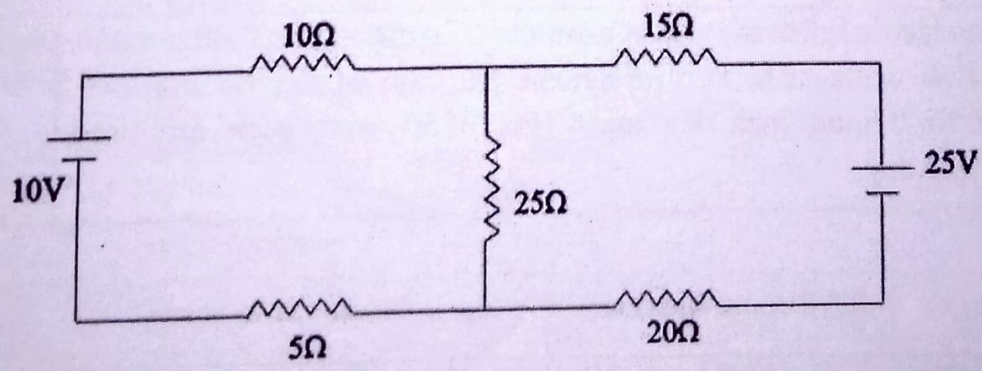
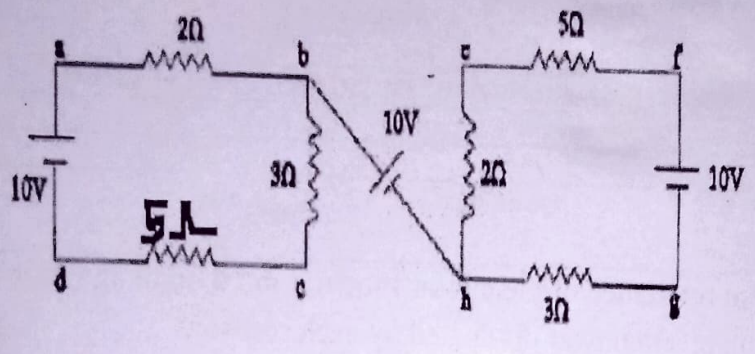
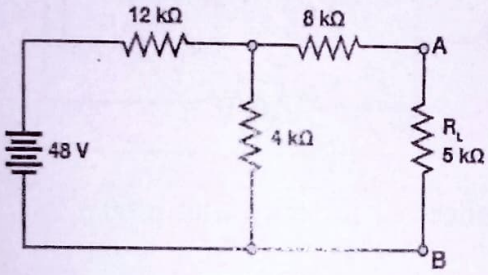
Academic year 2023-2024 (EVEN Sem)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Date	14/05/24	Maximum Marks	50
Course Code	EE123AT	Duration	90 Min
Sem	2nd sem	Test-1	
COURSE NAME: BASICS OF ELECTRICAL ENGINEERING			

SI. No	Questions	Marks	CO	BT
1a)	Find the equivalent resistance of the circuit shown. Find the voltage drop over, current through, and power dissipated by each resistor. 	5	2	2
b)	A 100W, 200V bulb is connected in series with a 60W bulb across a supply. Determine the following (i) Find the current drawn (ii) What will be the voltage across the 60W bulb (iii) Find the supply voltage	5	2	1
2a)	Calculate the branch current in 15 Ω resistor by applying Kirchhoff's law 	5	2	2

b)	For the Circuit shown below determine voltages V_{df} . 	5	2	2
3a)	Using Thevenin's Theorem find V_{TH}, R_{TH} and the load current I_L flowing through and load voltage across the load resistor in the circuit below. 	5	3	3
b)	State and prove the Maximum Power Transfer theorem.	5	2	2
4a)	Mention any four precautions against Electric Shock.	4	3	1
b)	What is the necessity of earthing the electrical appliances? Explain with diagram plate earthing.	6	3	2
5a)	Illustrate how the power is transmitted and distributed through block diagrams.	4	2	2
b)	Calculate the electric bill at the end of a month of 30 days at Rs.2.00 per unit if 6 lamps of 40 watts each burn for 8 hours per day, an electric iron of 1 kW is used for 2 hours per day and 4 fans of 50 watts each are used for 10 hours per day.	6	4	3

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	BT1	BT2	BT3
	Test	Max Marks	00	29	15	06	09	30	11

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Department of Electrical & Electronics Engineering

Basics of Electrical Engineering

Date	19th June 2024	Maximum Marks	50
Course Code	22ES24D	Duration	90 Mins
Sem	II Semester	CIE -2	

Basics of Electrical Engineering

Q.No	CIE - 2	Marks	COs	BT
1. a)	Derive expressions for Effective and Average value of an alternating quantity.	4	2	2
b)	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?	6	2	3
2. a)	Prove that in a series RL Circuit, Power consumed is $P = VI\cos\phi$ with all relevant equations, phasor diagram and Graphical representation.	5	2	3
b)	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.	5	3	3
3. a)	A three-phase delta connected motor operating on a 400 V supply is delivering 25 HP at an efficiency of 0.87 and power factor of 0.42. Calculate the line current, phase current and the readings of two-watt meters connected to measure the input. Assume, 1hp=746 w.	6	3	3
b)	Explain the advantages of 3 phase circuits over single phase circuits.	4	1	2
4. a)	Arrive at the Voltage and Current expressions for 2 types of connections of a 3-phase circuit.	5	1	2
b)	A balanced, three phase, star connected load is fed from a 400V, three phase, 50Hz supply. The current per phase is 25 A(lagging) and the total active power absorbed by the load is 13.856 kW.	5	3	3

Department of Electrical & Electronics Engineering

	Determine the resistance and inductance of the load per phase, the total reactive power and total apparent power.			
5. a)	Prove that, the readings of the wattmeter's are in terms of cos(30+ϕ) and cos (30 - ϕ) while measuring the power of a three-phase circuit. Mention the status of two wattmeter's at power factors: 1, 0.5 and 0 respectively.	6	2	3
b)	Input power to a three-phase circuit was measured by two wattmeter method. The readings were 3kW and 1.5kW. Determine the total power consumed and the power factor of the balanced three phase circuit.	4	3	2

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Test	Max Marks	9	21	20	-	-	17	33	-	-	-

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Department of Electrical & Electronics Engineering

Basics of Electrical Engineering

Date	**2nd July 2024**	**Maximum Marks**	**60**
Course Code	**EE123ATD**	**Duration**	**110 Mins**
Sem	**II Semester**	**Improvement Test**	
Basics of Electrical Engineering			

PART - A

Q.No	Questions	Marks	COs	BT
1.	Define voltage regulation of a transformer.	2	CO2	L1
2.	A 11000 / 220V , 50Hz, 1-phase transformer takes a current of 20A,if the number of turns on the primary side is 1000. The primary and secondary currents are I_1 =--------- and I_2=--------- .	2	CO2	L2
3.	Mention the constant and variable losses in transformers, and also write the equation for the same.	2	CO1	L1
4.	The current in a circuit is $(8 - j10)$A, when the applied voltage is $(50 + j25)$V . determine the impedance and power factor of the circuit.	2	CO1	L2
5.	The equation for an alternating current is given by $i = 28.28 \sin(314t + 30°)$ A. Find its r.m.s , frequency and phase angle	2	CO2	L1

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PART - B

Q.No	Questions	Marks	COs	BT
1. a)	Derive the E.M.F equation of a transformer.	04	02	02
b)	A 600 kVA transformer has an efficiency of 92% at full-load, unity power factor and at half-load, 0.9 power factor. Determine its efficiency at 75% of full-load and 0.9 power factor	06	03	03
2. a)	Explain the constructional details of core and shell type transformer.	05	02	01
b)	A single phase, 20 kVA transformer has 1000 primary turns and 2500 secondary turns. The net cross-sectional area of the core is 100 cm^2. When the primary winding is connected to 500V, 50 Hz supply. Calculate i) The maximum value of the flux density in the core ii) The voltage induced in the secondary winding iii) The primary and secondary full load currents	05	02	02
3. a)	A coil of power factor 0.6 is in series with 100μF. When connected to a 50Hz supply, the potential difference (p.d) across the coil is equal to the p.d cross the capacitor. Find the resistance and inductance of the coil.	05	02	02
b)	Show that a pure inductance does not consume any power. Draw the waveforms of voltage, current and power, when a sinusoidal voltage is applied to a pure inductance.	05	02	02
4. a)	Define the following terms: i)Instantaneous value ii) Amplitude iii) form factor and iv) Peak factor	04	01	01
b)	A current i = 10 sin(314t -10°) A produces a potential drop v=220 sin(314t+20°)V in a circuit. Find the values of the passive elements, assuming a series combination of only two passive elements is supplied from a source.	06	02	02
5. a)	Derive an equation for the power consumed by an R-C series circuit. Draw the waveforms of voltage, current, and power.	05	02	01
b)	An inductive coil takes a current of 33.24 A from 230V,50Hz supply. If the resistance of the coil is 6Ω. Calculate the inductance of the coil and the power taken by the coil.	05	02	02

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Test	Max Marks	08	46	06	-	20	34	06	-	-	-

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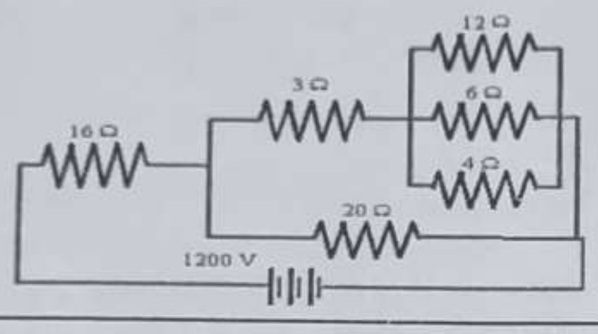
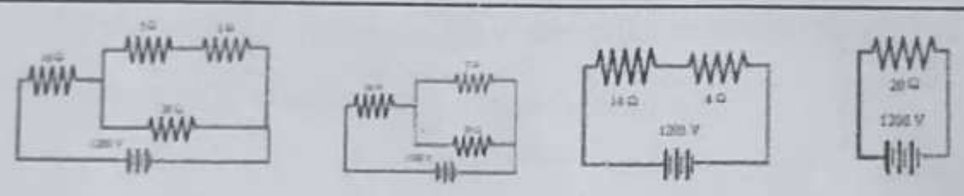
Academic year 2023-2024 (EVEN Sem)

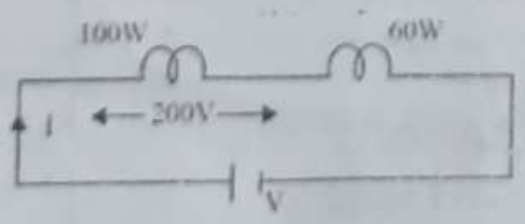
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Date	13/05/24	Maximum Marks	50
Course Code	EE123AT	Duration	90 Min
Sem	2nd sem	Test-1	
COURSE NAME: BASICS OF ELECTRICAL ENGINEERING			

Sl. No	Questions	Marks	CO
1a)	Find the equivalent resistance of the circuit shown . Find the voltage drop over, current through, and power dissipated by each resistor. 	5	2
sol			

Resistor (Ω)	*V* (Volts)	*I* (Amps)	*P* (Watts)
16	960	60	57600
20	240	12	2880
3	144	48	6912
12	96	8	768
6	96	16	1536
4	96	24	2304
20	1200	60	72000

b)	A 100W, 200V bulb is put in series with a 60W bulb across a supply. What will be the current drawn? What will be the voltage across the 60W bulb? What will be the supply voltage?	5	2



Power dissipated in the first bulb, $P_1 = V_1 I$

Current, $I = P_1 / V_1 = 100/200 = 0.5$ A

Power dissipated in the second bulb, $P_2 = V_2 I$

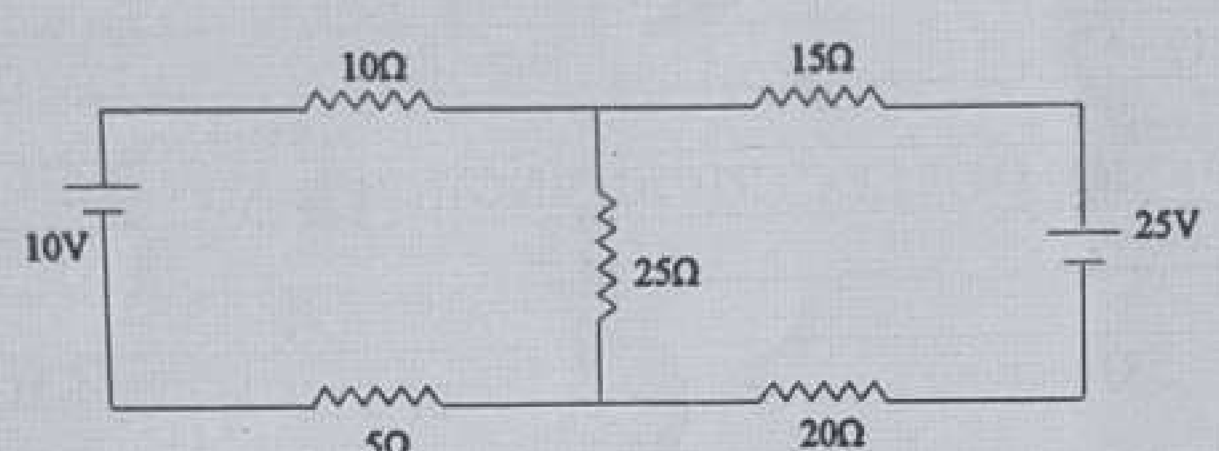
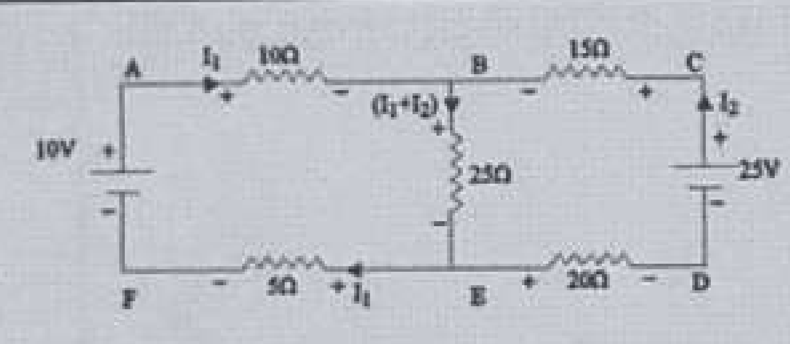
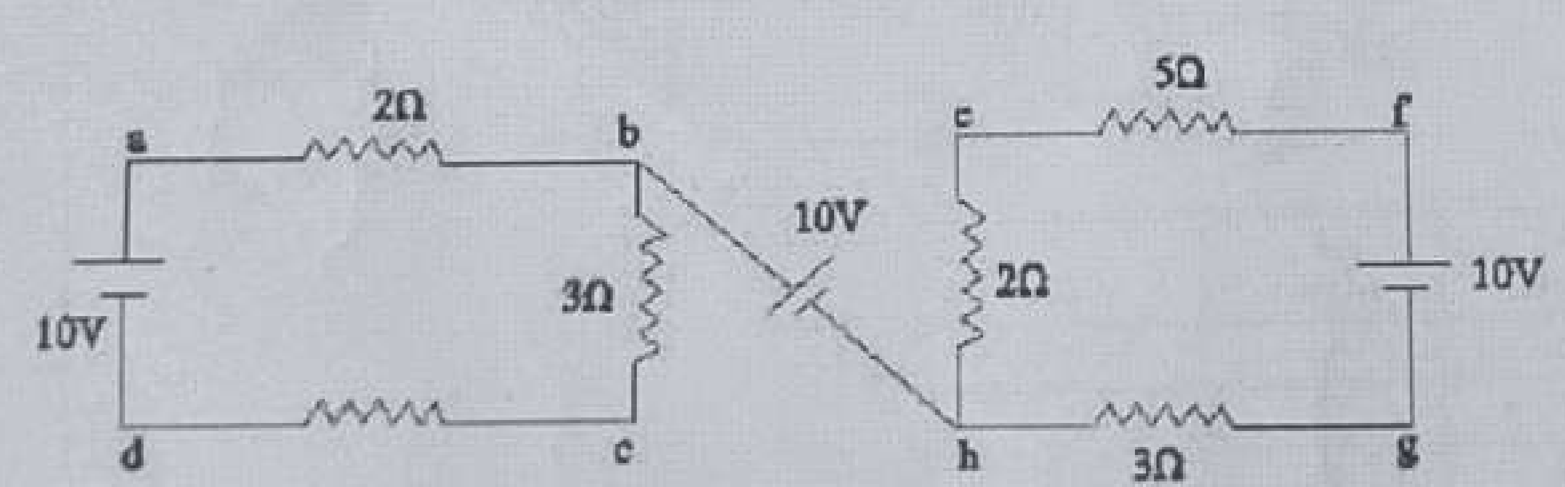
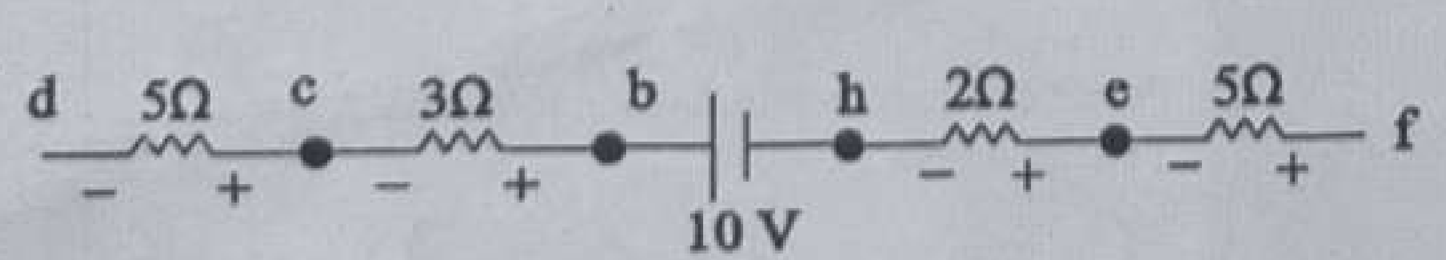
Voltage across the 60 W bulb,

$$V_2 = \frac{P_2}{I} = \frac{60}{0.5} = 120V$$

The supply voltage, $V = V_1 + V_2 = 200 + 120$

$V = 320V$

The supply voltage, V = 320 V.

2a)	Calculate the branch current in 15 Ω resistor by applying Kirchhoff's law 	5	2
	 Consider the loop ABEFA & apply KVL in CLK wise $10 - 10I_1 - 25(I_1 + I_2) - 5I_1 = 0$ $10 - 10I_1 - 25I_1 - 25I_2 - 5I_1 = 0$ $-40I_1 - 25I_2 + 10 = 0$ $40I_1 + 25I_2 = 10$ (1) Consider the loop BCDEB and Apply KVL in CLK wise direction $15I_2 - 25 + 20I_2 + 25(I_1 + I_2) = 0$ $15I_2 - 25 + 20I_2 + 25(I_1 + I_2) = 0$ $15I_2 - 25 + 20I_2 + 25I_1 + 25I_2 = 0$ $25I_1 + 60I_2 - 25 = 0$ $25I_1 + 60I_2 = 25$ ....(2) $I_2 = 0.42$ Amps. Current in 15 Ω resistor is 0.42Amps.		
b)	For the Circuit shown below determine voltages Vdf .  Apply KVL to loop abcda $10 - 2I_1 - 3I_1 - 5I_1 = 0$ $-10I_1 = -10$ $I_1 = 1$ Amps Apply KVL to loop efghe $5I_2 - 10 + 3I_2 + 2I_2 = 0$ $10I_2 = 10$ $I_2 = 1$ Amps  $V_{df} = -5(I_1 - 3I_1 + 10 + 2I_2 + 5I_2)$ $V_{df} = -5 - 3 + 10 + 2 + 5$ $V_{df} = 9$ Volts. $V_{df} = -9$ Volts [∵ because - sign on d side + on f side]	5	2

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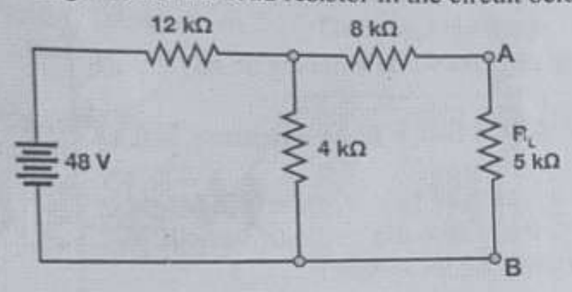
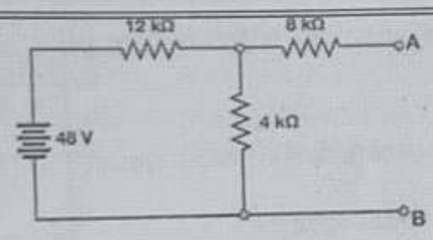
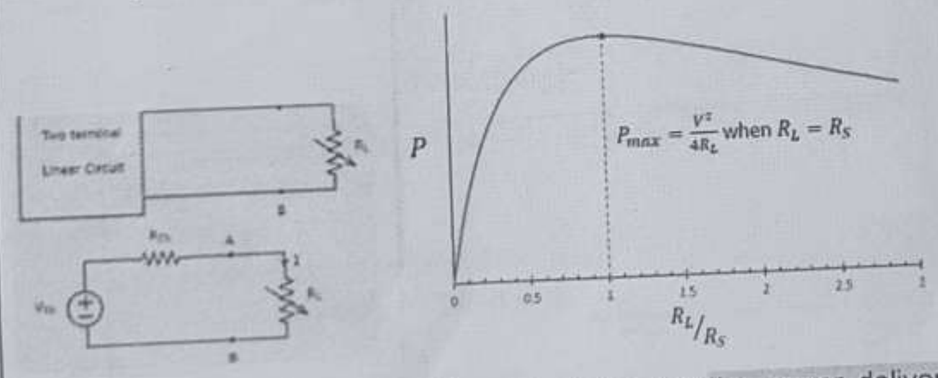
3a)	Using Thevenin's Theorem find V_{TH}, R_{TH} and the load current I_L flowing through and load voltage across the load resistor in the circuit below. 	5	3
	 Remove the 5 kΩ from the circuit.Measure the open-circuit voltage. This will give you the Thevenin's voltage (V_{TH}). 0.75 MA **I = 48 V /(12 kΩ + 4 kΩ) = 3 mA** 12 Thevenin's Resistance Rth calculated as follows: 8kΩ + (4k Ω ‖ 12kΩ) R_{TH} = 8 kΩ + [(4 kΩ x 12 kΩ) / (4 kΩ + 12 kΩ)] R_{TH} = 8 kΩ + 3 kΩ R_{TH} = 11 kΩ		
b)	State and prove Maximum power transfer theorem.  The maximum power transfer theorem states that the power delivered to the load resistor is maximized when the load resistance is equal to the series resistance. This can be calculated by taking the derivative of the power equation with respect to the load resistance and calculating the critical point.	5	2
4a)	Mention any eight precautions against Electric Shock. 1. The first step of electrical safety, avoid water at all times when working with electricity. Never touch or try repairing any electrical equipment or circuits with wet hands. It increases the conductivity of the electric current. 2. Never use equipment with frayed cords, damaged insulation, or broken plugs. 3. If you are working on any receptacle at your home then always turn off the mains. It is also a good idea to put up a sign on the service panel so that nobody turns the main switch ON by accident. 4. Always use insulated tools while working.	4	3

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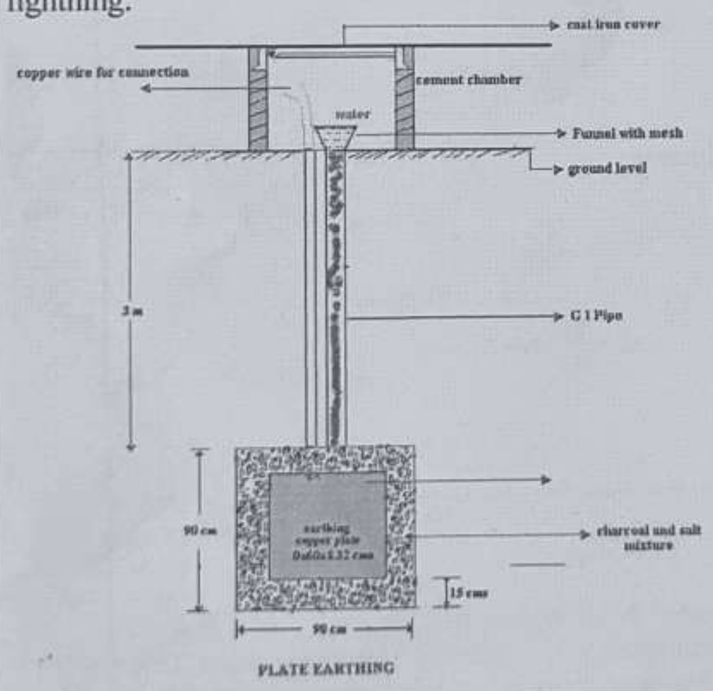
	5. Electrical hazards include exposed energized parts and unguarded electrical equipment which may become energized unexpectedly. Such equipment always carries warning signs like "Shock Risk". 6. Always use appropriate insulated rubber gloves and goggles while working on any branch circuit or any other electrical circuit. 7. Never try repairing energized equipment. Always check that it is de-energized first by using a tester. 8. Never use an aluminum or steel ladder if you are working on any receptacle at height in your home. An electrical surge will ground you and the whole electric current will pass through your body. Use a bamboo, wooden or a fiberglass ladder instead.		
b)	What is the necessity of earthing the electrical appliances? Explain with diagram pl earthing. **Necessity of Earthing:** 1. To protect the operating personnel from danger of shock in case they come in contact with the charged frame due to defective insulation. 2. To maintain the line voltage constant under unbalanced load condition. 3. Protection of the equipments 4. Protection of large buildings and all machines fed from overhead lines against lightning.  PLATE EARTHING	6	3
5a)	Explain the concept of power transmission and distribution through block diagrams.	4	2

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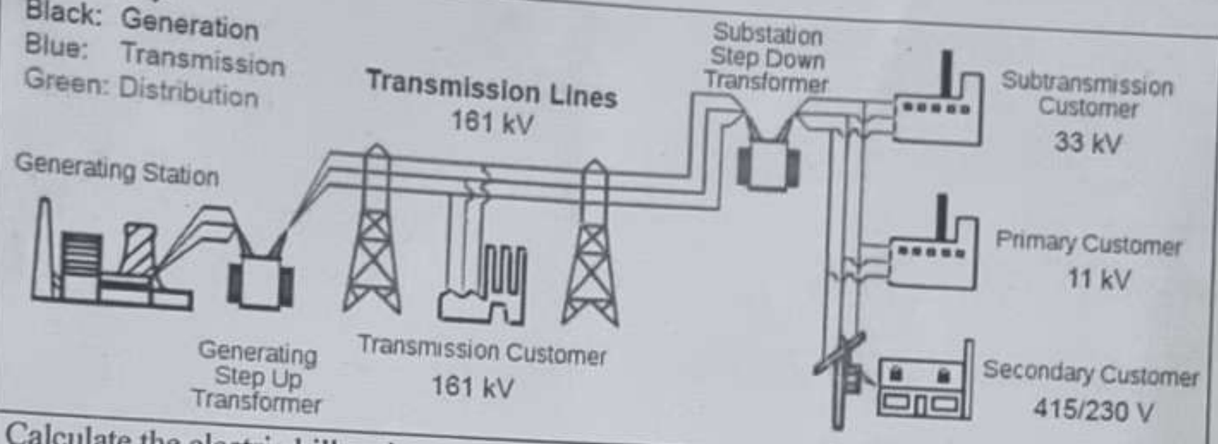


b) Calculate the electric bill at the end of a month of 30 days at Rs.2.00 per unit if 6 lamps of 40 watt each burn for 8 hours per day, an electric iron of 1 kW is used for 2 hours per day and 4 fans of 50 watt each are used for 10 hours per day. — 6 — 4

Name of the Appliance	Power Rating (W)	Avg. Daily Usage Hrs	No. of Appliances	Daily Energy Required (Wh)
lamps	40	8	6	1920
electric	1kw	2	1	2000
fan	50	10	4	2000
Total Energy				5920Wh

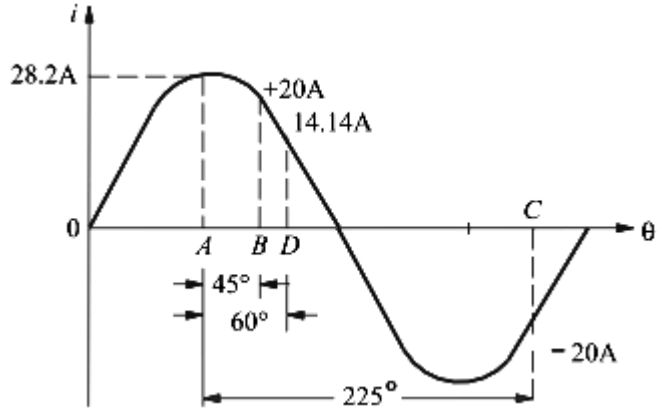
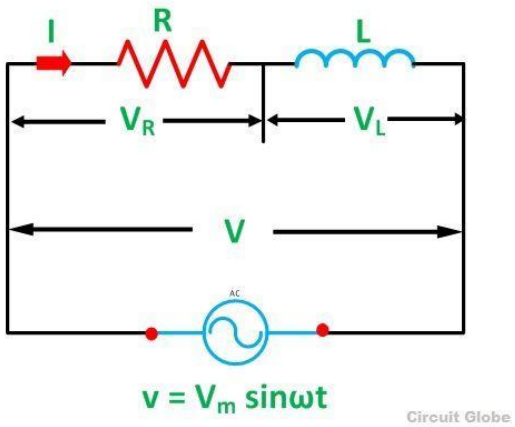
Total energy consumed per day Etotal=E1+E2+E3
=1920+2000+2000=5920 Wh
5.920 kWh or units
Total energy consumed per month =30×Etotal
=30×5.92 = =177.60 kWh or 177.60 units

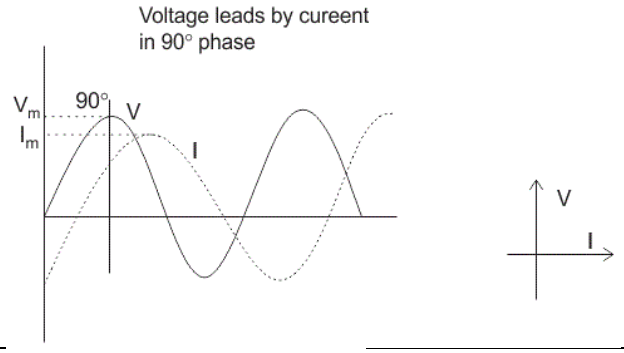
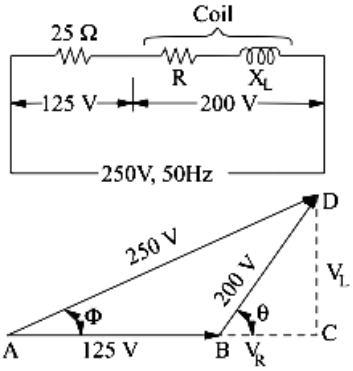
Bill for one month =Rate/unit×units=(Rs.2.00/unit)×(177.60 units)
=Rs.355.20
So the electric bill at the end of a month will be **Rs.355.20**

SCHEME AND SOLUTION

CIE-2

BASICS OF ELECTICAL ENGINEERING(EE123ATD)

Q.NO	SOLUTION	Marks
1.a	$I_{RMS} = 0.707\ I_M$, $I_{AV}=0.637I_M$ ----------04M	**04**
b	 ----------**06M** Im = 20√2 = 28.2 A, ω = 2π × 50 = 100 π rad/s. i = 28.2 sin 100 πt ampere (i) When t = 0.0025 second i = 28.2 cos 100π × 0.0025 ...angle in radian = 28.2 cos 100 × 180 × 0.0025 ...angle in degrees = 28.2 cos 45º = 20 A ...point (ii) (ii) When t = 0.0125 second i = 28.2 cos 100 × 180 × 0.0125 = 28.2 cos 225º = 28.2 × (1/ √2) − = −20 A ...point **(iii)** (iii) Here i = 14.14 A ∴ 14.14 = 28.2 cos 100 × 180 t ∴ cos 100 × 180 t = 1/2 or 100 × 180 t = cos−1 (0.5) = 60º, t = 1/300 second ...point D	**06**
2.a	 $V_R = IR$ and $V_L = I_{XL}$ where $X_L = 2\pi fL$ $V = \sqrt{(V_R)^2 + (V_L)^2} = \sqrt{(IR)^2 + (IX_L)^2}$ $V = I\sqrt{R^2 + X_L^2}$ or $I = L = \frac{V}{Z}$	**05**

	Where, $Z = \sqrt{R^2 + X_L^2}$ $P = \text{average of } \frac{V_m}{\sqrt{2}}\frac{V_m}{\sqrt{2}}\cos\varphi - \text{average of } \frac{V_m}{\sqrt{2}}\frac{V_m}{\sqrt{2}}\cos(2\omega t - \varphi)$ or $P = \frac{V_m}{\sqrt{2}}\frac{I_m}{\sqrt{2}}\cos\varphi - \text{Zero}$ or $P = V_{r.m.s} I_{r.m.s} \cos\varphi = V I \cos\varphi$  	
b.	 $BC^2 + CD^2 = 200^2$ ...(i) $(125 + BC)2 + CD2 = 250^2$ ...(ii) Subtracting Eq. (i) from (ii), we get, $(125 + BC)2 - BC2 = 250^2 - 200^2$ ∴ BC = 27.5V; CD = √(2002 - 27.52) = 198.1V (i) Coil impedance = 200/5 = 40 Ω $V_R = IR = BC$ or 5 R = 27.5 ∴ P = 27.5/5 = 5.5 Ω Also $V_L = I \cdot X_L = CD = 198.1$ ∴ X_L = 198.1/5 = 39.62 Ω or X_L = (402 - 5.52) = 39.62Ω (ii) Power absorbed by the coil is = $I^2R = 52 \times 5.5 = 137.5$ W Also P = 200 × 5 × 27.5/200 = 137.5 W (iii) Total power = VI cos φ = 250 × 5 × AC/AD = 250 × 5 × 152.5/250 = 762.5 W	**05**
3.a	I_L = 73.64A, I_{PH} = 42.53A, W_1 = - 2.65 KW, W_2 = 24.08 KW	**06**
b	Any 4 advantages	**04**
4.a	Star : $E_L = \sqrt{3}\, E_{ph}$, $I_L = I_{ph}$, Delta: $I_L = \sqrt{3}\, I_{ph}$, $E_L = E_{ph}$	**05**
b	Z_{ph} = 9.23 ohm, R = 7.384 ohm, X_L= 5.538 ohm, L= 0.0176H Q = 10392.30, S = 17320.5	**05**
5.a	i) Unity pf = $W_1 = W_2$ ii) 0.5 pf = W_1= 0, W_2=0.866 iii) zero pf = W_1=-0.5, W_2= +0.5	**06**
b	P = 4.5 KW, Pf = 0.866	**04**

USN | 1 | R | V | 2 | 3 | C | D | 0 | 0 | 3 |

RV COLLEGE OF ENGINEERING®

(An Autonomous Institution Affiliated to VTU)

I / II Semester B. E. Regular / Supplementary Examinations Aug-2024

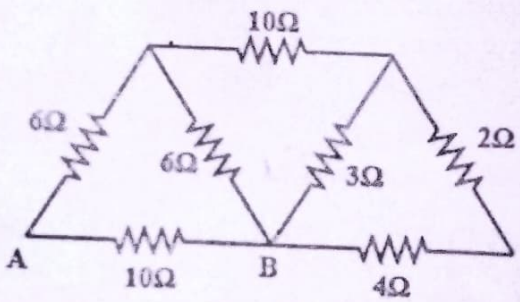
BASICS OF ELECTRICAL ENGINEERING

Time: 03 Hours ***Maximum Marks: 100***

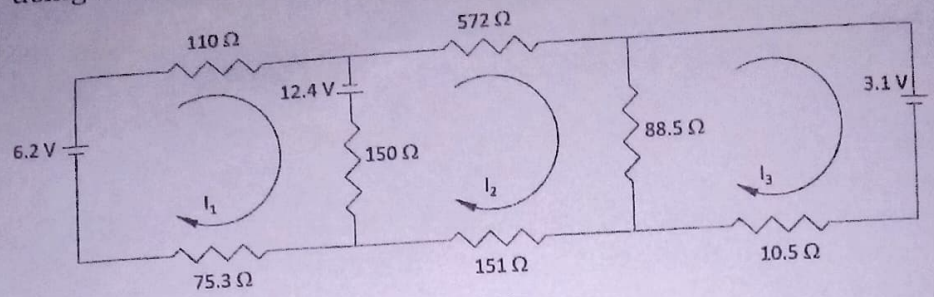
Instructions to candidates:

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, 9 and 10.

PART-A

			M	BT	CO
1	1.1	Define Ohm's Law?	01	1	1
	1.2	What is the resistance of a good insulator?	01	3	2
	1.3	Determine the equivalent resistance between AB of the following circuit shown in Fig. 1.3.  Fig. 1.3	02	3	2
	1.4	List out any two advantages of AC system over DC system.	01	2	1
	1.5	Define Form Factor.	01	1	1
	1.6	The complex Volt Amperes in a series circuit are $(4330 - j2500)$, and the current is $(25 + j43.3)$ A. Find the applied voltage.	02	3	2
	1.7	The power flowing in a 3 –phase, 3 –wire balanced load system is measured by two wattmeter method. The reading in a wattmeter A is 750 W and wattmeter B is 1500 W. What is the system's power factor?	02	3	2
	1.8	What are the different types of losses in transformer and which tests are conducted to calculate the losses?	02	1	1
	1.9	A 3-Phase, 4 pole, 440 V, 50 Hz induction motor runs with a slip of 5%. Find the rotor speed and frequency of the rotor current.	02	3	2
	1.10	Draw the Torque-slip curve for three-phase induction motor.	02	3	1
	1.11	Write down the advantages and disadvantages of Fuse.	02	2	1
	1.12	A geyser is rated at 2 kW, 230 V, 50 Hz. If it is switched ON for one hour daily, what would be the energy cost saving, at the rate of $Rs.$ 2.50 per unit if it is replaced by a solar water heater?	02	3	4

PART-B

2	a	State Maximum Power Transfer Theorem and prove that maximum power transfer when $R_L = R_{TH}$.	08	4	1
	b	Find the currents I_1, I_2 and I_3 in the circuit shown in Fig. 2b using *KVL/KCL*.  Fig. 2b	08	3	2
3	a	With neat sketch, phasor diagram and necessary waveforms, prove that average power in a pure inductive circuit is zero.	06	1	1
	b	A series *RLC* circuit containing a resistance of 12 Ω, an inductance of 0.15 *H* and a capacitor of 100 μ*F* are connected in series across a 100 *V*, 50 *Hz* supply. Calculate the total circuit impedance, voltage across each element, the circuit current, power factor, actual power consumed, reactive power and draw the voltage phasor diagram.	07	3	2
	c	i) What is resonance condition? ii) What is the power factor at resonance? iii) What is the reactive power at resonance?	03	1	2
		OR			
4	a	With a neat circuit, phasor diagram and waveforms deduce the equations for voltage, current, phase angle and average power for a series *RLC* circuit in different cases: i) $X_L > X_C$; ii) $X_L < X_C$; iii) $X_L = X_C$.	08	1	2
	b	Define: i) Average value ii) *RMS* value iii) Form Factor iv) Peak factor	04	1	1
	c	Derive Average value, *RMS* value, Form factor and Peak factor for sinusoidal current.	04	3	1
5	a	In a three-phase balanced circuit using two-wattmeter method, derive power factor, active power, reactive power and apparent power for the following connections: i) Balanced star-connected load ii) Balanced delta-connected load	10	1	2
	b	A balanced three-phase delta-connected load has per-phase impedance of $(25 + j40)\Omega$. If 400 *V*, 3-phase supply is connected to this load, find: i) phase current ii) line current iii) power supplied to the load.	06	3	1
		OR			

6	a	Prove that the efficiency of the transformer will be maximum when copper losses equal to constant losses.	06	3	1
	b	A 600 kVA transformer has an efficiency of 92% at full load, unity p.f. and half full load, 0.9 $p.f$. Determine its efficiency at 75% of full load and 0.9 $p.f$.	08	3	2
	c	Compare core type and shell type transformers.	02	1	2
7	a	With a neat sketch and vector diagram, mathematically explain how the rotating magnetic field is produced in the three-phase induction motor.	08	2	2
	b	A 4 pole, 50 Hz induction motor has a slip of 1% at NO load. When operated at full load, the slip is 2.5%. Find the change in speed from no load to full load.	04	3	3
	c	Distinguish between Squirrel cage and Slip ring induction motor.	04	2	2
		OR			
8	a	Explain the concept of double-revolving field theory.	08	1	2
	b	Name the different types of single-phase induction motors and applications.	05	1	2
	c	A 10-pole induction motor is supplied by a 6-pole alternator, which is driven at 1200 rpm. What is the speed if the induction motor runs with a slip of 3%?	03	3	3
9	a	With the help of a block diagram, explain the concept of power transmission and power distribution.	08	1	3
	b	Estimate the total daily energy requirement for the loads shown in the table below. Also, calculate monthly electricity bill if the electricity cost is $Rs.2$/unit for the first 40 units, $Rs.4$/unit for next 50 units and $Rs.6$/unit for rest of the units.	08	5	4
		OR			
10	a	Define Earthing, what is the necessity of earthing and types. Explain in detail the plate earthing with neat sketch.	08	1	4
	b	What are the safety precautions to be taken to avoid electric shock?	04	5	4
	c	Differentiate between Fuse and MCB.	04	3	1

Name of the appliance	*Power Rating (W)*	*Average daily usage hrs.*	*Number of appliances*
Fan	50	10	4
CFL	12	6	8
LED TV	100	5	2
Refrigerator	300	24	1
Laptop	60	5	1