

SRM VALLIAMMAI ENGINEERING COLLEGE

(Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK



I SEMESTER

GE3131 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Regulation – 2023

Academic Year 2026-2027 ODD

**Common to
CSE, CYS, IT, AIDS, MDE, MECH, CIVIL & AGRI**

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SUBJECT & SUBJECT CODE: GE3131 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

SEM / YEAR: I / I

UNIT-I ELECTRICAL CIRCUITS

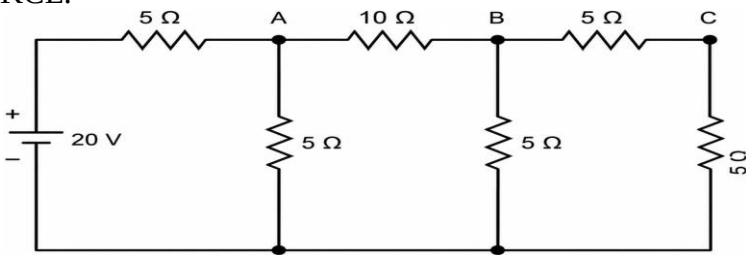
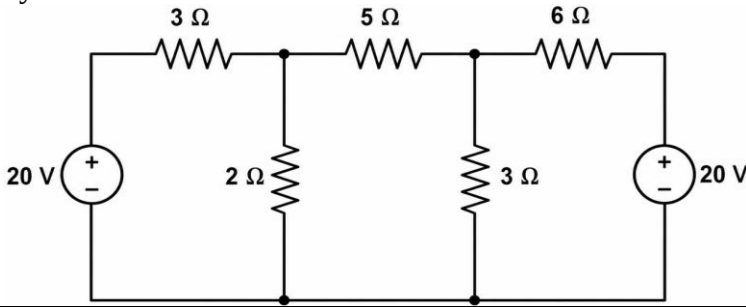
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with independent sources only (Steady state) Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only).

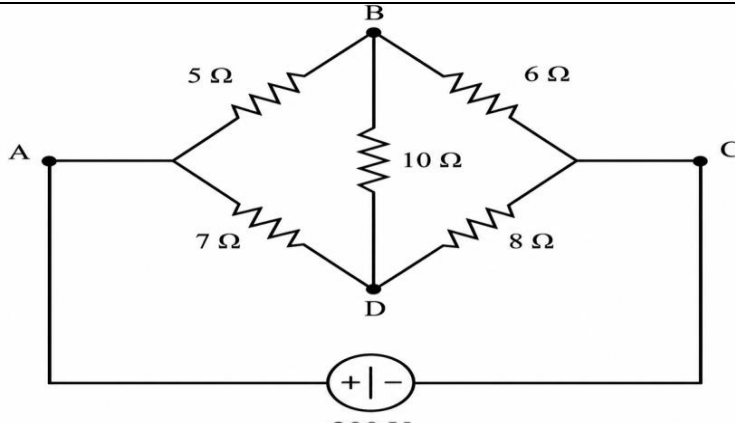
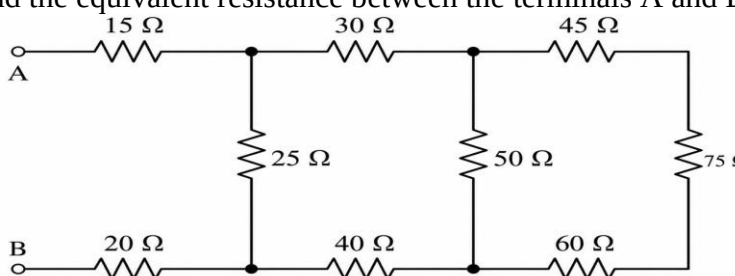
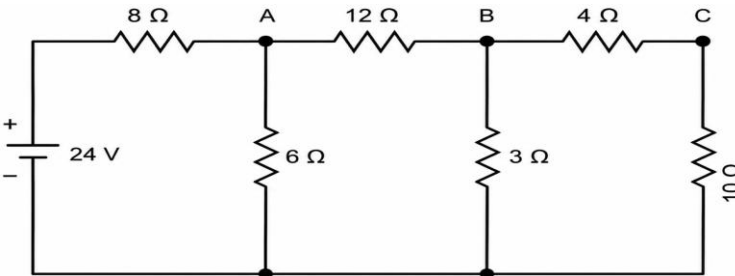
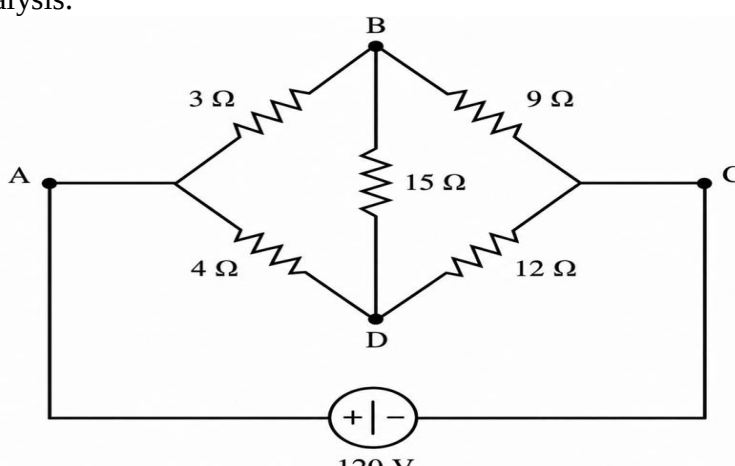
PART-A

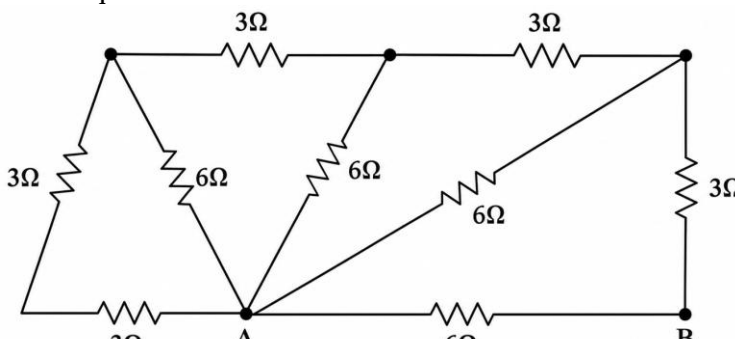
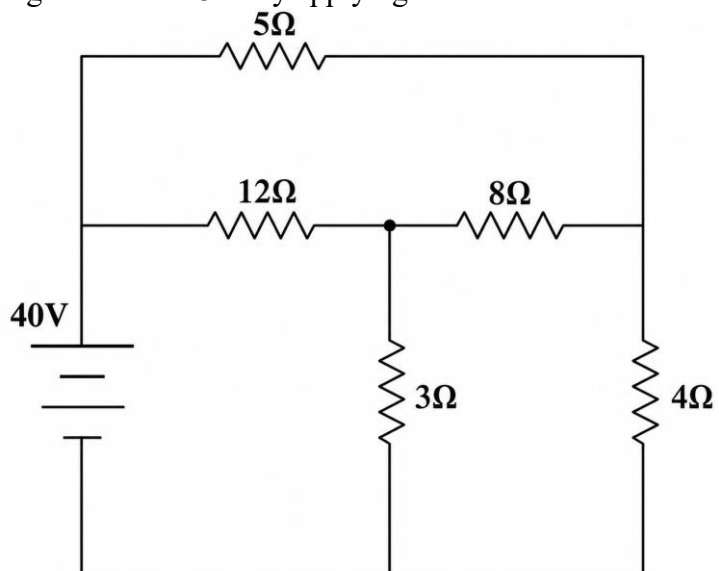
Q. No	Questions	BT Level	Competence	CO
1.	State Ohm's law and give its mathematical expression. Mention any two limitations.	BTL1	Remembering	CO1
2.	State Kirchhoff's Current Law (KCL) with its mathematical form.	BTL2	Understanding	CO1
3.	State Kirchhoff's Voltage Law (KVL) with its mathematical form.	BTL1	Remembering	CO1
4.	Define resistance of a conductor. List the four factors on which the resistance of a conductor depends.	BTL2	Understanding	CO1
5.	Define inductance and give its SI unit. Write the voltage-current relationship for an inductor.	BTL1	Remembering	CO1
6.	Define capacitance and give its SI unit. Write the voltage-current relationship for a capacitor.	BTL2	Understanding	CO1
7.	Differentiate between independent and dependent sources. Give one example of each.	BTL1	Remembering	CO1
8.	Define RMS value (effective value) of an alternating quantity. State its relationship with the peak value for a sinusoidal waveform.	BTL2	Understanding	CO1
9.	Define average value of an alternating quantity. What is the average value of a pure sinusoidal waveform over a full cycle?	BTL1	Remembering	CO1
10.	Define power factor. What is its significance in AC circuits?	BTL2	Understanding	CO1
11.	Define real power, reactive power, and apparent power in an AC circuit. Give their respective units.	BTL1	Remembering	CO1
12.	Define form factor and peak factor (crest factor) of an AC waveform. Give their values for a pure sinusoidal wave.	BTL2	Understanding	CO1
13.	A resistor of $10\ \Omega$ carries a current of 2 A. Calculate the voltage across the resistor and the power dissipated.	BTL1	Remembering	CO1
14.	A copper wire has a resistivity of $1.7 \times 10^{-8}\ \Omega\text{m}$, length 100 m, and cross-sectional area $2\ \text{mm}^2$. Calculate its resistance.	BTL2	Understanding	CO1
15.	Three resistors of values $2\ \Omega$, $3\ \Omega$, and $6\ \Omega$ are connected in series. Find the equivalent resistance.	BTL1	Remembering	CO1

16.	Three resistors of values $2\ \Omega$, $3\ \Omega$, and $6\ \Omega$ are connected in parallel. Find the equivalent resistance.	BTL2	Understanding	CO1
17.	In a series circuit, a 20 V source is connected to a $4\ \Omega$ and a $6\ \Omega$ resistor. Using KVL, determine the current and the voltage across each resistor.	BTL1	Remembering	CO1
18.	At a junction, three conductors meet carrying currents: $I_1 = 5\text{ A}$ (entering), $I_2 = 2\text{ A}$ (leaving), and I_3 (unknown). Determine the magnitude and direction of I_3 .	BTL2	Understanding	CO1
19.	A resistor of $100\ \Omega$ carries a current of 0.5 A . Calculate the power dissipated in watts.	BTL1	Remembering	CO1
20.	A 60 W electric bulb operates for 5 hours. Calculate the electrical energy consumed in watt-hours and kilowatt-hours.	BTL2	Understanding	CO1
21.	An inductor of 2 H has its current changing uniformly at the rate of 3 A/s . Find the magnitude of voltage induced across the inductor.	BTL1	Remembering	CO1
22.	A capacitor of $10\ \mu\text{F}$ is charged to a voltage of 100 V . Calculate the amount of charge stored in the capacitor.	BTL2	Understanding	CO1
23.	Find the RMS value of a sinusoidal voltage given by $v(t) = 311\sin(314t)$ volts.	BTL1	Remembering	CO1
24.	A sinusoidal alternating current has a peak value of 14.14 A . Determine its (i) RMS value and (ii) average value over a half cycle.	BTL2	Understanding	CO1

PART-B

1.	(i) State and explain Ohm's law with its mathematical expression. Discuss its limitations.	(10)	BTL3	Applying	CO1
	(ii) A resistor of 50 ohms carries a current of 3 A . Calculate the voltage across it and the power dissipated.	(6)			
2.	Find the current flowing through 10 ohms resistor using KVL or KCL. 	(16)	BTL4	Analyzing	CO1
3.	Find the current through 5-ohm resistance using mesh current analysis. 	(16)	BTL3	Applying	CO1
4.	Find the current through 10-ohm resistance using mesh current analysis.	(16)	BTL4	Analyzing	CO1

	 200 V				
5.	Find the equivalent resistance between the terminals A and B 	(16)	BTL3	Applying	CO1
6.	Find the current flowing through 12 ohms resistor using KVL or KCL. 	(16)	BTL4	Analyzing	CO1
7.	Find the current through 15-ohm resistance using mesh current analysis.  120 V	(16)	BTL3	Applying	CO1
8.	Explain Real Power, Reactive Power, Apparent Power, and Power Factor in AC circuits. Derive the relationships among	(16)	BTL4	Analyzing	CO1

	them and discuss the significance of power factor improvement in electrical power systems. Draw the power triangle and explain its components.				
9.	Define active power, reactive power, and apparent power. Derive the mathematical relationship between them and explain the importance of maintaining a high power factor in electrical systems	(16)	BTL3	Applying	CO1
10.	Find the equivalent resistance between the terminals A and B 	(16)	BTL4	Analyzing	CO1
11.	For the given network find the branch current in $8\ \Omega$ and voltage across the $3\ \Omega$ by applying KVL 	(16)	BTL3	Applying	CO1
12.	Describe the construction, symbols, operating principles, and characteristics of basic circuit components such as conductors, resistors, inductors, and capacitors. Compare their performance in DC circuits.	(16)	BTL4	Analyzing	CO1
13.	State and explain Ohm's Law, Kirchhoff's Current Law (KCL), and Kirchhoff's Voltage Law (KVL). Using Kirchhoff's laws, determine the current flowing through each branch of a simple DC circuit containing resistors and a voltage source.	(16)	BTL3	Applying	CO1
14.	Explain the principles of Nodal Analysis and Mesh Analysis with suitable examples. Determine the branch currents and	(16)	BTL4	Analyzing	CO1

	node voltages of a DC network containing independent sources using both methods and compare their advantages.				
15.	Explain AC waveforms and define cycle, time period, frequency, peak value, average value, and RMS value. Derive the expressions for the average value and RMS value of a sinusoidal waveform.	(16)	BTL3	Applying	CO1
16.	Discuss Ohm's Law, Kirchhoff's Current Law (KCL), and Kirchhoff's Voltage Law (KVL). Apply these laws to analyze a simple DC circuit and calculate the branch currents and voltages.	(16)	BTL4	Analyzing	CO1
17.	Explain the fundamental parameters of an AC waveform, including cycle, frequency, time period, peak value, average value, and RMS value. Derive the expressions for the average and RMS values of a sinusoidal waveform.	(16)	BTL3	Applying	CO1

UNIT-II ELECTRICAL MACHINES

Construction and Working principle- DC Separately and Self Excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, working principle and Applications of Transformer, three phase Alternator, Synchronous motor and Three Phase Induction Motor.

PART-A

Q. No	Questions	BT Level	Competence	CO
1.	State Faraday's law of electromagnetic induction. Give its mathematical form.	BTL1	Remembering	CO2
2.	What is the function of a commutator in a DC machine?	BTL2	Understanding	CO2
3.	Define back EMF (counter EMF) in a DC motor. State its significance.	BTL1	Remembering	CO2
4.	State the working principle of a DC generator.	BTL2	Understanding	CO2
5.	Write the EMF equation of a DC generator. Name each term.	BTL1	Remembering	CO2
6.	State Fleming's left-hand rule. For which machine is it used?	BTL2	Understanding	CO2
7.	State Fleming's right-hand rule. For which machine is it used?	BTL1	Remembering	CO2
8.	State the working principle of a single-phase transformer.	BTL2	Understanding	CO2
9.	Define transformation ratio of a transformer. Write its formula.	BTL1	Remembering	CO2
10.	Define slip in a three-phase induction motor. Write its formula.	BTL2	Understanding	CO2
11.	Define synchronous speed. Write the expression for it.	BTL1	Remembering	CO2
12.	Differentiate between lap winding and wave winding (any 2 points).	BTL2	Understanding	CO2
13.	List any four applications of DC shunt motors.	BTL1	Remembering	CO2
14.	A 4-pole DC generator has 500 armature conductors. Flux per pole = 0.05 Wb. The armature is lap-wound and runs at 1000 rpm. Calculate the generated EMF.	BTL2	Understanding	CO2
15.	A 4-pole DC generator has 500 armature conductors. Flux per pole = 0.05 Wb. The armature is wave-wound and runs at 1000 rpm. Calculate the generated EMF.	BTL1	Remembering	CO2
16.	A single-phase transformer has $N_1 = 500$ turns (primary) and $N_2 = 100$ turns (secondary). Primary voltage $V_1 = 220$ V. Calculate the secondary voltage V_2 .	BTL2	Understanding	CO2
17.	A single-phase transformer has primary voltage $V_1 = 230$ V and	BTL1	Remembering	CO2

	secondary voltage $V_2 = 115$ V. The primary has $N_1 = 400$ turns. Find the number of secondary turns N_2 .			
18.	A 4-pole, 3-phase induction motor operates on a 50 Hz supply. The rotor speed is 1440 rpm. Calculate the slip.	BTL2	Understanding	CO2
19.	A 6-pole, 50 Hz, 3-phase induction motor runs at a slip of 4%. Find the rotor speed in rpm.	BTL1	Remembering	CO2
20.	A DC shunt motor takes an armature current of 20A from a 220V supply. The armature resistance is 0.5Ω . Calculate the back EMF (E_b).	BTL2	Understanding	CO2
21.	A DC motor has a back EMF of 200 V and armature resistance of 0.4Ω . It is connected to a 220 V DC supply. Determine the armature current.	BTL1	Remembering	CO2
22.	A 6-pole, lap-wound DC generator has 600 conductors. Flux per pole = 0.03 Wb. Speed = 800 rpm. Calculate the generated EMF.	BTL2	Understanding	CO2
23.	A 4-pole, wave-wound DC generator has 400 conductors and runs at 1200 rpm. The generated EMF is 200 V. Determine the flux per pole.	BTL1	Remembering	CO2
24.	A single-phase transformer has 1000 primary turns and 250 secondary turns. If primary voltage is 400 V, calculate the secondary voltage. Is this a step-up or step-down transformer?	BTL2	Understanding	CO2

PART-B

1.	Explain the construction and working principle of a DC generator with a neat diagram. Also list any four applications of DC generators.	(16)	BTL3	Applying	CO2
2.	Classify the different types of DC generators with suitable circuit diagrams. Explain the voltage build-up process in a self-excited shunt generator.	(16)	BTL4	Analyzing	CO2
3.	Derive the EMF equation of a DC generator. Explain each term clearly. A 4-pole lap-wound generator has 720 conductors, flux per pole = 0.04 Wb, speed = 1500 rpm. Calculate the EMF.	(16)	BTL3	Applying	CO2
4.	Explain the working principle and construction of a DC motor with a neat labeled diagram. State the function of each main part.	(16)	BTL4	Analyzing	CO2
5.	Derive the torque equation of a DC motor. Explain the significance of each term. How does torque vary with armature current in series and shunt motors?	(16)	BTL3	Applying	CO2
6.	Classify the different types of DC motors with circuit diagrams. Compare their speed-torque characteristics and list their applications.	(16)	BTL4	Analyzing	CO2
7.	Explain the construction, working principle, and applications of a single-phase transformer with a neat diagram. Derive the EMF equation.	(16)	BTL3	Applying	CO2
8.	What is a three-phase alternator? Explain its construction and working principle. Write the EMF equation and explain how the rotating magnetic field is produced.	(16)	BTL4	Analyzing	CO2
9.	Explain the construction and working principle of a synchronous motor with a neat diagram. Why is it NOT self-starting? Explain the methods used to start it.	(16)	BTL3	Applying	CO2

10.	Explain the construction and working principle of a three-phase squirrel cage induction motor with a neat diagram. Derive the expression for synchronous speed and explain the concept of slip.	(16)	BTL4	Analyzing	CO2
11.	A 220V DC shunt motor: $R_a = 0.5 \text{ ohm}$, $R_{sh} = 110 \text{ ohm}$, line current $I_L = 52 \text{ A}$. Calculate:		BTL3	Applying	CO2
	(i) Shunt field current and armature current	(4)			
	(ii) Back EMF	(5)			
	(iii) Torque developed if speed $N = 1000 \text{ rpm}$.	(7)			
12.	A 240 V DC shunt motor has an armature resistance of 0.4Ω and a shunt field resistance of 120Ω . The motor draws a line current of 65 A from the supply and operates at a speed of 1200 rpm. Determine the shunt field current and armature current of the motor. Also calculate the back EMF developed in the armature and the torque produced by the motor.	(16)	BTL4	Analyzing	CO2
13.	A 50 Hz single-phase transformer: $N_1=600$, $N_2=150$, $V_1=440\text{V}$, secondary draws 8A at PF=0.8 lagging. Calculate the following:		BTL3	Applying	CO2
	(i) Secondary voltage V_2	(4)			
	(ii) Primary current I_1	(4)			
	(iii) Apparent, real, and reactive power on secondary.	(8)			
14.	A 60 Hz single-phase transformer has 800 turns on the primary winding and 200 turns on the secondary winding. The transformer is connected to a 480 V supply on the primary side. The secondary delivers a current of 10 A to a load operating at a power factor of 0.75 lagging. Determine the secondary voltage, the primary current, and the apparent power, active power, and reactive power supplied to the load on the secondary side.	(16)	BTL4	Analyzing	CO2
15.	A DC generator converts mechanical energy into electrical energy through electromagnetic induction. Derive the expression for the generated electromotive force (EMF) of a DC generator and clearly explain the significance of each parameter involved in the equation. Further, consider a 6-pole wave-wound DC generator having 900 armature conductors. The flux produced per pole is 0.03 Wb, and the armature rotates at a speed of 1200 rpm. Determine the generated EMF of the machine.	(16)	BTL3	Applying	CO2
16.	Explain the Applications of Various types of DC motor.	(16)	BTL4	Analyzing	CO2
17.	Explain the construction and working of 3 phase synchronous motor.	(16)	BTL3	Applying	CO2

UNIT-III ANALOG ELECTRONICS

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon & Germanium – PN Junction Diodes, Zener Diode – Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET, IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters.

PART-A				
Q. No	Questions	BT Level	Competence	CO
1.	Differentiate between intrinsic and extrinsic semiconductors.	BTL1	Remembering	CO3
2.	Compare pure semiconductors and doped semiconductors by highlighting their key characteristics and differences.	BTL2	Understanding	CO3
3.	What is a PN junction diode? Explain its formation in brief.	BTL1	Remembering	CO3
4.	What is meant by a PN junction diode? Briefly describe the process involved in creating the PN junction.	BTL2	Understanding	CO3
5.	Define knee voltage (cut-in voltage) for silicon and germanium diodes.	BTL1	Remembering	CO3
6.	Explain the term threshold voltage (barrier voltage) in a diode. State its typical values for silicon and germanium diodes.	BTL2	Understanding	CO3
7.	What is a Zener diode? How is it different from a regular PN diode?	BTL1	Remembering	CO3
8.	Define a Zener diode. In what ways does its operation differ from that of an ordinary PN junction diode?	BTL2	Understanding	CO3
9.	List any four applications of Zener diodes.	BTL1	Remembering	CO3
10.	In a Zener regulator, $V_{in} = 15V$, $V_z = 9V$, $R_s = 100 \Omega$. The load current is 40 mA. Find the Zener current and the power dissipated in the Zener diode.	BTL2	Understanding	CO3
11.	A Zener voltage regulator is connected to an 18 V supply. The Zener diode maintains a voltage of 10 V and is used with a series resistor of 160Ω . If the load current is 30 mA, calculate the Zener current and the power dissipated by the Zener diode.	BTL1	Remembering	CO3
12.	Bring out the differences between intrinsic and extrinsic semiconductors.	BTL2	Understanding	CO3
13.	State the relationship between alpha and beta of a BJT.	BTL1	Remembering	CO3
14.	A BJT has $\beta = 100$ and base current $I_B = 20 \mu A$. Calculate the collector current I_C and emitter current I_E .	BTL2	Understanding	CO3
15.	A bipolar junction transistor (BJT) has a common-emitter current gain (β) of 120. When the base current is $25 \mu A$, determine the collector current and emitter current.	BTL1	Remembering	CO3
16.	A BJT has a collector current $I_C = 2 \text{ mA}$ and base current $I_B = 25 \mu A$. Determine the value of beta and alpha for the transistor.	BTL2	Understanding	CO3
17.	In a transistor circuit, the collector current is measured as 4 mA while the base current is $40 \mu A$. Calculate the values of the common-emitter current gain (β) and the common-base current gain (α).	BTL1	Remembering	CO3
18.	Define pinch-off voltage in a JFET.	BTL2	Understanding	CO3
19.	What is an SCR? Draw its symbol and label the terminals.	BTL1	Remembering	CO3
20.	What is an inverter? Differentiate between voltage source and current source inverters.	BTL2	Understanding	CO3
21.	What is an IGBT? Mention one advantage of IGBT over MOSFET.	BTL1	Remembering	CO3
22.	Define ripple factor of a rectifier. Write its formula for a half-wave rectifier.	BTL2	Understanding	CO3
23.	A half-wave rectifier produces a DC output of 15V across a load. Find the PIV rating required for the diode. Assume ideal diode.	BTL1	Remembering	CO3

24.	A half-wave rectifier provides a DC output voltage of 20V across its load resistance. Assuming an ideal diode, determine the Peak Inverse Voltage (PIV) rating required for the diode.		BTL2	Understanding	CO3
PART-B					
1.	Explain the V-I characteristics of a PN junction diode with a neat diagram. Describe the forward bias and reverse bias behavior. Mention the effect of temperature on diode characteristics.	(16)	BTL3	Applying	CO3
2.	Explain the construction and operation of a PN junction diode with a neat diagram. Describe the formation of the depletion region and barrier potential. Discuss the diode behavior under forward and reverse bias conditions.	(16)	BTL4	Analyzing	CO3
3.	Explain the V-I characteristics of a PN junction diode with a neat graph. Discuss the cut-in voltage, reverse saturation current, breakdown region, and the effect of temperature on diode characteristics.	(16)	BTL3	Applying	CO3
4.	Compare intrinsic and extrinsic semiconductors in detail. Explain the process of doping and discuss the formation and characteristics of N-type and P-type semiconductors with suitable diagrams.	(16)	BTL4	Analyzing	CO3
5.	Describe the electrical behaviour of resistors, inductors, and capacitors in electronic circuits. Derive the voltage-current relationships for each component and explain their applications in practical electronic systems.	(16)	BTL3	Applying	CO3
6.	A silicon PN junction diode has a forward voltage drop of 0.7 V and is connected in series with a 1 k Ω resistor across a 12 V DC supply. Calculate the diode current, voltage across the resistor, power dissipated by the diode, and power dissipated by the resistor. Explain the significance of the results with the help of the diode's forward-bias characteristics.	(16)	BTL4	Analyzing	CO3
7.	A silicon PN junction diode with a forward voltage drop of 0.7 V is connected in series with a 2.2 k Ω resistor across a 15 V DC power supply. Determine the current flowing through the diode, the voltage drop across the resistor, the power dissipated by the diode, and the power dissipated by the resistor. Also explain the significance of the obtained results with reference to the forward-bias V-I characteristics of a silicon diode.	(16)	BTL3	Applying	CO3
8.	Explain the V-I characteristics of a Zener diode with a neat labeled diagram. Explain the principle of Zener breakdown and avalanche breakdown. List any four applications of Zener diodes.	(16)	BTL4	Analyzing	CO3
9.	For the Zener voltage regulator: $V_{in} = 12V$, $V_z = 6V$, $R_L = 500 \Omega$, $I_z(\min) = 5 \text{ mA}$. Calculate: (i) Load current I_L , (ii) Total current I_s through R_s , (iii) Required R_s , (iv) Maximum Zener power when load is disconnected, (v) Power in R_s .	(16)	BTL3	Applying	CO3
10.	Discuss the construction and V-I characteristics of a BJT with a	(16)	BTL4	Analyzing	CO3

	neat diagram.				
11.	Explain the construction, working, and V-I characteristics of an NPN Bipolar Junction Transistor (BJT) in Common Emitter (CE) configuration with a neat diagram. Define the three regions of operation.	(16)	BTL3	Applying	CO3
12.	Explain the construction, working principle, and V-I characteristics of a JFET with a neat diagram.	(16)	BTL4	Analyzing	CO3
13.	Explain the construction and V-I characteristics of an SCR with a neat diagram.	(16)	BTL3	Applying	CO3
14.	Explain the construction, working, and V-I characteristics of an enhancement-type MOSFET with a neat diagram.	(16)	BTL4	Analyzing	CO3
15.	Explain the working of a half-wave rectifier with a neat circuit diagram, input and output waveforms. Derive expressions for V_{dc} , V_{rms} , ripple factor, and efficiency.	(16)	BTL3	Applying	CO3
16.	For the half-wave rectifier circuit shown, the input is 230V RMS, 50 Hz through a 10:1 step-down transformer. The load resistance $R_L = 1\text{ k}\Omega$. Calculate: (i) Peak secondary voltage V_m , (ii) DC output voltage V_{dc} and DC load current I_{dc} , (iii) RMS output voltage V_{rms} and RMS load current, (iv) Ripple factor and rectification efficiency.	(16)	BTL4	Analyzing	CO3
17.	A half-wave rectifier is connected to a 240 V, 50 Hz AC supply through a 12:1 step-down transformer. The rectifier feeds a load resistance of $1.5\text{ k}\Omega$. Assuming an ideal diode and neglecting transformer losses, calculate the peak value of the secondary voltage, the DC output voltage and DC load current, the RMS output voltage and RMS load current, the ripple factor, the rectification efficiency, and the Peak Inverse Voltage (PIV) required for the diode.	(16)	BTL3	Applying	CO3

UNIT-IV DIGITAL ELECTRONICS

Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations – minimization using K maps (Simple Problems only).

PART-A

Q. No	Questions	BT Level	Competence	CO
1.	Label the different types of number system.	BTL1	Remembering	CO4
2.	Convert decimal to binary. i. 35 ii. 25	BTL2	Understanding	CO4
3.	Renovate decimal to octal. i. 45 ii. 65	BTL1	Remembering	CO4
4.	Infer the rules of successive multiplication method.	BTL2	Understanding	CO4
5.	Bring out the rules for binary to hexadecimal conversion with an example.	BTL1	Remembering	CO4
6.	Deduct the rules for octal to hexadecimal conversion with an example.	BTL2	Understanding	CO4

7.	Explore the different types of binary codes.	BTL1	Remembering	CO4
8.	Convert binary to gray code 1001.	BTL2	Understanding	CO4
9.	Switch the gray code 1101 to binary code.	BTL1	Remembering	CO4
10.	Identify error detection and correction code.	BTL2	Understanding	CO4
11.	Compose the meaning of literals.	BTL1	Remembering	CO4
12.	Compile about product term and sum term.	BTL2	Understanding	CO4
13.	Outline Excess-3 code.	BTL1	Remembering	CO4
14.	Criticize SOP form & POS form.	BTL2	Understanding	CO4
15.	Recollect canonical form.	BTL1	Remembering	CO4
16.	Infer about octet and quad in K-map.	BTL2	Understanding	CO4
17.	Infer about pair and isolated ones in K-map.	BTL1	Remembering	CO4
18.	Infer the basic logic gates.	BTL2	Understanding	CO4
19.	Convert the following numbers to their decimal equivalents $(BC2)_{16}$ and $(11011.011)_2$.	BTL1	Remembering	CO4
20.	Convert binary to gray code 1011.	BTL2	Understanding	CO4
21.	Switch the gray code 11001 to binary code.	BTL1	Remembering	CO4
22.	Deduct the rules for hexadecimal to octal conversion with an example.	BTL2	Understanding	CO4
23.	Convert decimal to binary. i. 34 ii. 24	BTL1	Remembering	CO4
24.	Renovate decimal to octal. iii. 75 iv. 96	BTL2	Understanding	CO4

PART-B

1.	Simply the Expression $Y = \sum m(3,4,6,7,8,9,10,13,14,15)$.	(16)	BTL3	Applying	CO4
2.	Draw the symbol and truth table of logic gates.	(16)	BTL4	Analyzing	CO4
3.	Briefly explain the binary, decimal, Octal and Hexadecimal number systems.	(16)	BTL3	Applying	CO4
4.	What is Half Adder? Draw the schematic circuit of half adder with Boolean functions.	(16)	BTL4	Analyzing	CO4
5.	Discuss in detail about Number system.	(16)	BTL3	Applying	CO4
6.	Simply using K-map. $F(A,B,C,D) = \sum m(7,8,9) + d(10,11,12,13,14,15)$.	(16)	BTL4	Analyzing	CO4
7.	Simply the Expression $Y = \sum m(0,1,2,3,8,9,12,13,15)$.	(16)	BTL3	Applying	CO4
8.	Sketch the standard symbols of logic gates and write the corresponding truth tables.	(16)	BTL4	Analyzing	CO4
9.	What are the different types of number system and give short note on conversion between number systems.		BTL3	Applying	CO4
	(i) Integer part	(8)			
	(ii) Fraction part	(8)			
10.	Convert the following.		BTL4	Analyzing	CO4
	(i) $(62.625)_{10} = (\text{_____})_2$	(6)			
	(ii) $(223)_{10} = (\text{_____})_{16}$	(5)			
	(iii) $(1100)_2 = (\text{_____})_{10}$	(5)			
11.	Obtain the truth table for the following function	(16)	BTL3	Applying	CO4

	$f(x,y,z)=xy+x'z$ and write it in M-notation and canonical form.				
12.	With use of K-map find the simplest form of SOP $F=f.g$ where $f=xy+z$; $g=yz+zx$	(16)	BTL4	Analyzing	CO4
13.	Make clear about the procedure to form hamming code and how to detect error and correct the message as well as determine hamming code for the binary word 1001 for even parity.	(16)	BTL3	Applying	CO4
14.	Determine which bit, if any, is in error in the even parity, Hamming coded information $(1100111)_2$. Decode the correct message.	(16)	BTL4	Analyzing	CO4
15.	What is Half Subtractor? Draw the schematic circuit of half subtractor with Boolean functions.	(16)	BTL3	Applying	CO4
16.	Minimize the following function $F(a,b,c,d)=\sum m(4,5,6,7,8,10,11,14)$.	(16)	BTL4	Analyzing	CO4
17.	Evaluate error detection and correction code with examples.	(16)	BTL3	Applying	CO4

UNIT-V MEASUREMENTS AND INSTRUMENTATION

Functional elements of an instrument, Standards and calibration, Operating Principle, types Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT, DSO- Block diagram- Data acquisition.

PART-A

Q. No	Questions	BT Level	Competence	CO
1.	Define the three primary functional elements of a generalized measurement system and sketch their sequence.	BTL1	Remembering	CO1
2.	What is 'calibration' of an instrument, and why is it considered an essential process in industrial instrumentation?	BTL2	Understanding	CO1
3.	Classify the standards of measurement in a hierarchical order (International, Primary, Secondary, Working Standards).	BTL1	Remembering	CO1
4.	Distinguish clearly between the roles of controlling torque and damping torque in indicating instruments.	BTL2	Understanding	CO1
5.	Why is the scale of a Moving Iron (MI) instrument non-linear (cramped at the beginning and open at the end)?	BTL1	Remembering	CO1
6.	State two major advantages of Permanent Magnet Moving Coil (PMMC) instruments over Moving Iron (MI) instruments.	BTL2	Understanding	CO1
7.	Briefly explain the operating principle of a repulsion-type Moving Iron instrument with a simple schematic concept.	BTL1	Remembering	CO1
8.	Why is a standard PMMC instrument incapable of measuring alternating current (AC) quantities directly?	BTL2	Understanding	CO1
9.	In the two-wattmeter method of measuring three-phase power, what will be the readings of the two wattmeters if the load power factor is (a) unity, and (b) 0.5 lagging?	BTL1	Remembering	CO1
10.	What is the function of the braking magnet (permanent magnet) in a single-phase induction-type energy meter?	BTL2	Understanding	CO1
11.	Why is the primary winding of a current transformer (CT) always connected in series with the power line under measurement?	BTL1	Remembering	CO1
12.	Explain why the secondary winding of a Current Transformer (CT)	BTL2	Understanding	CO1

	must NEVER be open-circuited while the primary is carrying current.			
13.	State the main components of the data acquisition system of a Digital Storage Oscilloscope (DSO).	BTL1	Remembering	CO1
14.	A permanent magnet moving coil (PMMC) instrument has a rectangular coil of dimensions 15 mm by 26.67 mm with 100 turns. The magnetic flux density in the air gap is 0.1 Tesla. If the current passing through the coil is 5 mA, calculate the deflecting torque acting on the coil.	BTL2	Understanding	CO1
15.	Find the deflecting torque acting on a 150-turn moving coil of a PMMC meter when it carries a steady current of 4 mA. The coil has an effective cross-sectional area of 5 cm ² and is placed in a uniform magnetic field of flux density 0.08 Wb/m ² .	BTL1	Remembering	CO1
16.	A PMMC ammeter has an internal coil resistance of 10 Ohms and gives a full-scale deflection at a current of 10 mA. Determine the required shunt resistance to extend its measurement range up to 100 mA.	BTL2	Understanding	CO1
17.	A moving-coil galvanometer with an internal resistance of 20 Ω is to be converted into an ammeter reading up to 0.5 A. If the meter shows full-scale deflection with a current of 0.02 A, find the value of the shunt resistor.	BTL1	Remembering	CO1
18.	In a balanced three-phase system, the active power is measured by the two-wattmeter method. If the readings of the two wattmeters are 2000 W and 1000 W respectively, calculate the operating power factor of the load.	BTL2	Understanding	CO1
19.	Two wattmeters are connected to measure the input power to a three-phase motor. One wattmeter reads 4 kW and the other reads 2 kW. Find the load power factor.	BTL1	Remembering	CO1
20.	An energy meter has a constant of 600 revolutions/kWh. It is connected to a residential load consuming 1000 W for a duration of exactly 2 hours. Calculate the total number of revolutions made by the aluminium disc.	BTL2	Understanding	CO1
21.	A 2 kW electric heater is operated continuously for a period of 90 minutes. If this energy is measured by an induction energy meter with a meter constant of 1200 rev/kWh, how many times will the aluminium disc rotate?	BTL1	Remembering	CO1
22.	A current transformer (CT) has a turns ratio of 4:80 (primary to secondary turns). If a primary current of 100 A flows through the line, calculate the current in the secondary winding.	BTL2	Understanding	CO1
23.	The primary winding of a current transformer has 5 turns and the secondary winding has 100 turns. When the primary line current is 120 A, determine the current reading on an ammeter connected across the secondary terminals.	BTL1	Remembering	CO1
24.	A Digital Storage Oscilloscope (DSO) has a sampling rate of 100 megasamples per second (MS/s). Determine the time interval between two consecutive samples in nanoseconds.	BTL2	Understanding	CO1
PART-B				

1.	Draw the block diagram of a generalized measurement system. Explain in detail the function and significance of each block with a suitable example like a pressure or temperature measurement system.	(16)	BTL3	Applying	CO1
2.	Explain what is meant by 'calibration' of measuring instruments. Detail the hierarchical classification of standards and discuss how traceability is maintained from working standards up to international standards.	(16)	BTL4	Analyzing	CO1
3.	Describe the three types of torques required for the satisfactory operation of an indicating instrument. Explain the methods used for producing controlling torque and damping torque with appropriate sketches and compare them.	(16)	BTL3	Applying	CO1
4.	Draw a neat, labeled cross-sectional diagram of a Permanent Magnet Moving Coil (PMMC) instrument. Explain its construction, working principle, and derive the expression for the deflecting torque. Discuss why the scale of a PMMC instrument is perfectly linear.	(16)	BTL4	Analyzing	CO1
5.	With neat structural diagrams, explain the construction, working principle, and torque equation of both attraction-type and repulsion-type Moving Iron (MI) instruments. Explain why these instruments can be used for both AC and DC measurements, and state their limitations.	(16)	BTL3	Applying	CO1
6.	Describe the Two-Wattmeter Method for measuring active power and power factor in a balanced three-phase star-connected load. Draw the schematic circuit diagram and the complete phasor diagram for a lagging power factor load. Derive the expression for the total active power and load power factor angle.	(16)	BTL4	Analyzing	CO1
7.	With a neat schematic diagram, explain the construction and working principle of a single-phase induction-type energy meter. Explain how the deflecting and braking torques are produced. Discuss any two common errors in energy meters and how they are compensated.	(16)	BTL3	Applying	CO1
8.	Define an instrument transformer. Explain the construction, working principle, and applications of Current Transformers (CT) and Potential Transformers (PT). Contrast their design features and explain why a CT secondary should never be open-circuited, whereas a PT secondary can be.	(16)	BTL4	Analyzing	CO1
9.	Draw the detailed block diagram of a Digital Storage Oscilloscope (DSO) and explain the working of each block. Compare the features, advantages, and limitations of a DSO over a conventional Analog Cathode Ray Oscilloscope (CRO).	(16)	BTL3	Applying	CO1
10.	Explain the process of data acquisition in a Digital Storage Oscilloscope (DSO). Discuss the concepts of sampling, quantization, and digitizing. Explain the significance of sampling rate, Nyquist criterion, vertical resolution, and the	(16)	BTL4	Analyzing	CO1

		different acquisition modes.				
11.		A moving coil instrument has an internal coil resistance of 50 Ohms and gives a full-scale deflection with a current of 15 mA. Calculate:		BTL3	Applying	CO1
	(i)	The shunt resistance required to enable it to read up to 15 A as a DC ammeter.	(8)			
	(ii)	The series multiplier resistance required to enable it to read up to 150 V as a DC voltmeter.	(8)			
12.		A Permanent Magnet Moving Coil (PMMC) instrument possesses an internal coil resistance of $80\ \Omega$ and requires a current of 10 mA to produce full-scale deflection. The instrument is to be modified so that it can be used for measuring larger currents and higher voltages. Determine the shunt resistance needed to convert the instrument into a DC ammeter capable of measuring currents up to 20 A. Also, calculate the series multiplier resistance required to convert the same instrument into a DC voltmeter capable of measuring voltages up to 300 V.	(16)	BTL4	Analyzing	CO1
13.	(i)	Explain how the deflection angle is related to inductance and current in a moving iron instrument, deriving the necessary relation.	(6)	BTL3	Applying	CO1
	(ii)	A moving iron ammeter has a control spring with a stiffness constant of 15×10^{-6} N-m/rad. The self-inductance of the coil is given by the relation: $L = (10 + 5\theta - \theta^2)\ \mu\text{H}$, where θ is the deflection in radians from the zero position. Find the deflection angle θ when a current of 5 A flows through the meter.	(10)			
14.	(i)	Establish the relation between deflecting torque, current, and the rate of change of inductance for an attraction-type moving iron meter.	(6)	BTL4	Analyzing	CO1
	(ii)	The control spring of a moving iron instrument exerts a torque of 10×10^{-6} N-m per radian. The inductance of the meter is expressed as: $L = (12 + 8\theta - 2\theta^2)\ \mu\text{H}$, where θ is the deflection in radians. Find the deflection produced by a steady current of 2 A.	(10)			
15.		A three-phase balanced star-connected load is connected across a 400 V, 50 Hz supply. Two wattmeters are connected to measure the active power. The wattmeter readings are 5 kW and 1.5 kW respectively. Calculate:		BTL3	Applying	CO1
	(i)	The total active power consumed by the load.	(4)			
	(ii)	The power factor of the load, showing all mathematical steps.	(6)			
	(iii)	The reactive power of the load.	(6)			
16.		During a laboratory test on a 3-phase, star-connected induction motor, the input power was measured using the two-wattmeter method. One wattmeter read 8 kW while the other read 2 kW.		BTL4	Analyzing	CO1

	Determine:				
	(i)	The total active power supplied to the motor.	(4)		
	(ii)	The phase angle and the operating power factor of the motor.	(6)		
	(iii)	The total reactive volt-amperes (reactive power) of the motor.	(6)		
17.	A single-phase, 230 V induction energy meter has a constant of 360 revolutions/kWh. During a test, a unity power factor load takes a current of 20 A at rated voltage for a duration of 1 hour. The disc of the meter makes 1620 revolutions during this test. Determine:			BTL3	Applying
	(i)	The actual active energy consumed by the load.	(4)		
	(ii)	The energy registered by the meter.	(6)		
	(iii)	The percentage error of the meter, and whether the meter is running fast or slow.	(6)		

Course Outcome:

compute the electric circuit parameters for simple problems.
explain the working principle and applications of electrical machines.
analyze the characteristics of analog electronic devices.
explain the basic concepts of digital electronics.
explain the operating principles of measuring instruments.