

**Unit - I****Chapter 1 : Electric and Magnetic Circuits 1-1 to 1-32**

Syllabus : EMF, Current, Potential difference, Power and Energy, MMF, Magnetic force, Permeability, Hysteresis loop, Reluctance, Leakage factor and BH curve, Analogy between electric and magnetic circuits. Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law, Dynamically induced emf, Statically induced emf : (a) Self induced emf (b) Mutually induced emf, Equations of self and mutual inductance.

1.1	Introduction to Electricity	1-2	1.7.1	Magnetic Field	1-9
1.1.1	Electrical Quantities	1-2	1.7.2	Magnetic Flux ϕ	1-9
1.2	Concept of EMF and Current	1-2	1.7.3	Magnetic Flux Density (B)	1-9
1.2.1	Concept of EMF	1-2	1.7.4	Magnetic Field Strength (H)	1-9
1.2.2	Concept of Current	1-2	1.8	Permeability	1-9
1.3	Concept of Electric Potential and Potential Difference	1-3	1.8.1	Absolute Permeability (μ)	1-9
1.3.1	Definition of Electric Potential	1-3	1.8.2	Permeability of Free Space or Vacuum (μ_0)	1-9
1.3.2	Potential Difference (P.D.)	1-3	1.8.3	Relative Permeability (μ_r)	1-9
1.4	Concept of Resistance (R)	1-3	1.9	Definitions Concerning Magnetic Circuits	1-10
1.4.1	Factors Affecting the Resistance Value	1-3	1.9.1	Magnetomotive Force (MMF)	1-10
1.4.2	Series Circuit (Resistors in Series)	1-4	1.9.2	Reluctance (S)	1-10
1.4.3	Parallel Circuit (Resistors in Parallel)	1-4	1.9.3	Permeance	1-10
1.4.4	Power	1-5	1.10	Magnetic Circuit	1-12
1.4.5	Electrical Energy	1-5	1.10.1	Analogy between Magnetic and Electrical Circuits	1-13
1.4.6	Relation between Voltage, Current, Resistance : Ohm's Law	1-5	1.11	Composite Magnetic Circuits	1-14
1.5	Concept of Electrical Work, Power and Energy	1-5	1.11.1	Series Magnetic Circuit	1-14
1.6	Magnetism	1-8	1.11.2	A Series Magnetic Circuit with Air Gap	1-15
1.6.1	Magnet	1-8	1.11.3	Solved Examples	1-15
1.6.2	Electromagnets	1-8	1.12	Parallel Magnetic Circuit	1-17
1.7	Important Definitions Related to Magnetism	1-9	1.12.1	Expression for the Total MMF (Ampere-Turns)	1-18
			1.12.2	Expression for the Reluctance of a Parallel Magnetic Circuit	1-18
			1.12.3	Parallel Magnetic Circuit with Air Gap	1-19
			1.13	B-H Curve or Magnetization Curve	1-19
			1.13.1	Magnetic Hysteresis and Hysteresis Loop	1-20
			1.13.2	Hysteresis Loss	1-20
			1.13.3	Magnetization Curves for Magnetic and Non-magnetic Materials	1-21



1.13.4	Factors Affecting the Hysteresis	
	Loss	1-22
1.14	Electromagnetic Induction	1-22
1.14.1	Faraday's Laws of Electromagnetic Induction	1-22
1.14.2	Direction of Induced E.M.F.	1-23
1.14.2.1	Fleming's Right Hand Rule	1-23
1.14.2.2	Lenz's Law	1-23
1.15	Nature of the Induced E.M.F.	1-23
1.16	Dynamically Induced E.M.F.	1-23
1.16.1	Magnitude of Dynamically Induced E.M.F.	1-24
1.16.2	Direction of Dynamically Induced EMF	1-24
1.16.3	Applications	1-24
1.17	Statically Induced E.M.F.	1-24
1.17.1	Self Induced E.M.F.	1-25
1.17.2	Self Inductance	1-26
1.17.3	Expression for the Coefficient of Self Inductance (L)	1-26
1.17.4	Mutually Induced E.M.F.	1-26
1.17.5	Mutual Inductance (M)	1-27
1.17.6	Alternate Way of Defining the Mutual Inductance	1-27
1.17.7	Expression for Mutual Inductance	1-27
1.17.8	Coefficient of Coupling (K)	1-27
1.17.9	Comparison of Statically and Dynamically Induced E.M.F.	1-28
1.18	I-Scheme Questions and Answers	1-32
	• Review Questions	1-31

Unit - II**Chapter 2 : Single Phase AC Circuits 2-1 to 2-55**

Syllabus : Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form factor, Peak factor, Impedance, Phase angle, and Power factor, Mathematical and phasor representation of alternating emf and current, AC in resistors, Inductors and capacitors, AC in RL series, RC series, RLC series and parallel circuits, Power in AC circuits, power triangle.

2.1	Difference between AC and DC Quantities.....	2-2
2.2	AC Waveforms	2-2
2.2.1	Definition of Waveform	2-2
2.2.2	Types of AC Waveforms	2-2
2.2.3	Waveform of Sinusoidal AC	2-2
2.2.4	Graphical and Mathematical Representation of Sinusoidal AC Quantities	2-3
2.3	Definitions	2-4
2.3.1	Waveform	2-4
2.3.2	Instantaneous Value	2-4
2.3.3	Cycle	2-4
2.3.4	Time Period or Periodic Time (T)	2-4
2.3.5	Frequency	2-5
2.3.6	Amplitude	2-5
2.3.7	Angular Velocity (ω)	2-5
2.4	Peak and Peak to Peak Voltage	2-6
2.5	Effective or R.M.S. Value	2-6
2.6	Average Value	2-6
2.7	Form Factor	2-7
2.8	Crest Factor or Peak Factor (K_p)	2-7
2.9	Solved Examples	2-7
2.10	Phasor Representation of an Alternative Quantity	2-11
2.11	Phase of an Alternating Quantity	2-12
2.11.1	Phase Angle	2-12



2.11.2	Phase Difference	2-12	2.17.2	Waveforms and Phasor Diagram	2-21
2.11.3	Leading and Lagging Phase Difference	2-12	2.17.3	Power in a Purely Inductive Circuit	2-21
2.12	Mathematical Representation of Phasor	2-14	2.17.4	Impedance of a Purely Inductive Circuit	2-21
2.12.1	Polar Representation	2-14	2.18	AC Circuit Containing Capacitance Only	2-22
2.12.2	Rectangular Representation	2-14	2.18.1	Equation for Voltage and Current	2-22
2.13	Single Phase AC Circuits	2-15	2.18.2	Current and Voltage Waveforms and Phasor Diagram	2-22
2.13.1	Reactance and Impedance	2-15	2.18.3	Power in Purely a Capacitive AC Circuit	2-23
2.13.2	Reactance	2-15	2.18.4	Impedance of a Purely Capacitive Circuit	2-23
2.13.3	Inductive Reactance (X_L)	2-15	2.19	AC Circuits with Series Elements	2-24
2.13.4	Capacitive Reactance (X_C)	2-15	2.20	The Series R-L Circuit	2-24
2.13.5	Impedance (Z)	2-15	2.20.1	Phasor Diagram	2-24
2.14	Concept of Impedance Triangle	2-15	2.20.2	Impedance of L-R Series Circuit	2-24
2.15	Important Terms Related to Power	2-16	2.20.3	Impedance Triangle	2-24
2.15.1	Apparent Power (S)	2-16	2.20.4	Voltage and Current Waveforms	2-25
2.15.2	Real Power or True Power or Active Power (P)	2-16	2.20.5	Average Power in Series L-R Circuit	2-25
2.15.3	Reactive Power or Imaginary Power (Q)	2-16	2.20.6	Power Triangle for L-R Series Circuit ...	2-25
2.15.4	Power Factor	2-17	2.20.7	Apparent Power (S)	2-25
2.15.5	Importance (Significance) of Power Factor	2-17	2.20.8	Real Power or True Power or Active Power (P)	2-26
2.15.6	Causes of Low Power Factor	2-18	2.20.9	Reactive Power or Imaginary Power (Q)	2-26
2.15.7	Power Triangle	2-18	2.20.10	Power Factor	2-26
2.16	Purely Resistive AC Circuit	2-18	2.20.11	Q-Factor	2-26
2.16.1	Voltage and Current Waveforms and Equations	2-19	2.21	The Series R-C Circuit	2-29
2.16.2	Phasor Diagram	2-19	2.21.1	Phasor Diagram	2-30
2.16.3	Impedance of the Purely Resistive Circuit	2-19	2.21.2	Impedance of RC Series Circuit	2-30
2.16.4	Average Power (P_{av})	2-19	2.21.3	Impedance Triangle (Series R-C Circuit)	2-30
2.16.5	Energy in Purely Resistive Circuit	2-19	2.21.4	Phase Relationship between Voltage and Current (Series R-C Circuit)	2-31
2.17	AC Circuit Containing Inductance Only	2-20			
2.17.1	Equations for Current i and Voltage v ...	2-20			



2.21.5	Average Power in Series R-C Circuit	2-31
2.21.6	Power Triangle for R-C Series Circuit	2-31
2.21.7	Various Powers and Power Factor	2-32
2.21.8	Q-Factor	2-32
2.22	An R-L-C Series Circuit	2-34
2.22.1	Importance of the Values of Reactances	2-34
2.22.2	Phasor Diagrams	2-34
2.22.3	Phasor Diagram for : $X_L > X_C$	2-34
2.22.4	Phasor Diagram for : $X_L < X_C$	2-35
2.22.5	Phasor Diagram for : $X_L = X_C$	2-35
2.22.6	Impedance of Series LCR Circuit	2-36
2.22.7	Impedance Triangle for an LCR Circuit	2-36
2.22.8	Power Supplied to the R.L.C. Circuit	2-36
2.22.9	Power Triangle	2-36
2.22.10	Various Powers and Power Factors of RLC Series Circuit	2-37
2.22.11	Figure of Merit or Q-factor	2-37
2.23	A.C. Parallel Circuit	2-40
2.23.1	Two Impedances in Parallel	2-41
2.24	Multiplication and Division of Impedances	2-41
2.24.1	Multiplication of Impedances	2-41
2.24.2	Division of Impedances	2-41
2.25	Parallel AC Circuits	2-42
2.26	Resistance in Parallel with Pure Inductance	2-42
2.27	Resistance in Parallel with Pure Capacitance	2-43
2.28	Series Combination of R and L in Parallel with Capacitor	2-44
2.29	The Concept of Admittance	2-48
2.29.1	Conductance and Susceptance	2-48
2.29.2	Admittance Triangle	2-49
2.30	MSBTE Questions and Answers	2-51
2.31	I-Scheme Solved Examples	2-53
2.32	I-Scheme Questions and Answers	2-54
	• Review Questions	2-50

Unit - II**Chapter 3 : Three Phase AC Circuits****3-1 to 3-17**

Syllabus : Voltage and current relationship in star and delta connections.

3.1	Introduction to Polyphase AC Circuits	3-2
3.1.1	Why to use a Polyphase System ?	3-2
3.1.2	How Many Phases ?	3-2
3.1.3	Three Phase Supply Waveforms	3-2
3.2	Advantages of Three Phase Systems over Single Phase System	3-2
3.2.1	Comparison of Single Phase and Three Phase Systems	3-3
3.3	Principle of Three Phase Emf Generation and Its Waveforms	3-3
3.3.1	Mathematical Representation of the Three Phase Voltages	3-3
3.3.2	Concept of Symmetrical or Balanced System	3-4
3.3.3	Concept of Phase Sequence	3-4
3.4	Three Phase Supply Connections	3-4
3.4.1	Star Connection (Wye Connection)	3-4
3.4.2	Delta Connection	3-5
3.5	Types of Loads	3-5
3.5.1	Balanced or Unbalanced Load	3-5
3.6	Relation between Voltages and Current for a Balanced Star Load	3-6
3.6.1	Line Voltages and Phase Voltages	3-6
3.6.2	Relation between Line and Phase Voltages for Star Connected Supply	3-7
3.6.3	Relation between Phase and Line Current	3-7
3.6.4	Equations for Three Phase Power	3-8
3.6.5	Power Factor for a Star Load	3-8
3.6.6	The Complete Phasor Diagram	3-8



3.7	Voltage, Current and Power Relation in a Balanced Delta Load3-9	4.2.3	Windings of the Transformer 4-4
3.7.1	Line Voltages and Phase Voltages for Delta Connected Supply3-9	4.2.4	Transformer Tank 4-4
3.7.2	Phase and Line Voltages in Delta Connections3-9	4.2.5	Conservator 4-4
3.7.3	Line Current and Phase Current for Delta Connection3-10	4.2.6	Breather 4-5
3.7.4	Power Relations3-10	4.3	Transformer Types on the Basis of Construction 4-5
3.7.5	Power Factor3-11	4.3.1	Core Type Transformer 4-5
3.7.6	The Complete Phasor Diagram for Delta Load3-11	4.3.2	Shell Type Transformer 4-5
3.8	Different Types of Power and their Relations3-11	4.4	EMF Equation of a Transformer 4-6
3.8.1	Power Triangle3-11	4.4.1	Expressions for the Induced Voltages 4-6
3.8.2	Power Factor 3-12	4.5	Voltage and Current Ratios of a Transformer 4-8
3.9	Comparison of Star Connection and Delta Connection3-12	4.5.1	Voltage Ratios of the Transformer with Load 4-8
3.10	Applications of 3 Phase AC Circuits 3-12	4.5.2	Voltage Ratios for the Transformer Without Load 4-8
3.11	Solved Examples3-12	4.5.3	Transformation Ratio (K) 4-8
3.12	MSBTE Questions and Answers3-16	4.5.4	Turns Ratio of the Transformer 4-9
3.13	I-Scheme Questions and Answers3-17	4.5.5	Types of Transformers Based on the Value of K 4-9
	• Review Questions 3-16	4.5.6	Current Ratios 4-9
	Unit - III	4.6	Ratings of Transformer 4-10
		4.6.1	Specifications of Transformer 4-10
Chapter 4 : Transformer	4-1 to 4-24	4.7	Losses in a Transformer 4-14
Syllabus : General construction and principle of different types of transformers, EMF equation and transformation ratio of transformers. Auto transformers.			
4.1	Introduction4-2	4.7.1	Copper Loss (P_{cu}) 4-14
4.1.1	Types of Transformer4-2	4.7.2	Iron Loss (P_i) 4-14
4.1.2	Principle of Operation4-2	4.7.3	Hysteresis Losses 4-14
4.2	Construction of a Transformer4-3	4.7.4	Eddy Current Losses 4-15
4.2.1	Laminated Steel Core4-3	4.8	An Ideal Transformer 4-15
4.2.2	Different Cross-Sections for Transformer Limbs4-3	4.9	Definitions of Efficiency and Regulation 4-15
		4.9.1	Efficiency (η) 4-15
		4.9.2	Condition for Maximum Efficiency 4-16
		4.9.3	Load at Maximum Efficiency 4-16
		4.9.4	Voltage Regulation of a Transformer ... 4-16
		4.10	Autotransformer 4-18



4.10.1	Autotransformer as Step Down Transformer	4-18
4.10.2	Autotransformer as a Step Up Transformer	4-19
4.10.3	Copper Saving in Autotransformer	4-19
4.10.4	Advantages of Autotransformer	4-20
4.10.5	Disadvantages of an Autotransformer ..	4-20
4.10.6	Applications of an Autotransformer	4-20
4.10.7	Comparison of Two Winding and Autotransformer	4-20
4.11	MSBTE Questions and Answers	4-22
4.12	I-Scheme Questions and Answers	4-24
	• Review Questions	4-21

Unit - III

Chapter 5 : Special Motors 5-1 to 5-16

Syllabus : Construction and working principle of single phase AC motor. Types of single phase motors, Applications of single phase motors.

5.1	Introduction	5-2
5.2	Single Phase Induction Motors	5-2
5.2.1	Construction of Single Phase Induction Motors	5-2
5.2.2	Double Revolving Field Theory	5-2
5.2.3	Torque Speed Characteristics of Single Phase Induction Motor	5-3
5.2.4	Split Phasing Principle of Starting	5-3
5.2.5	Types of Single Phase Induction Motors	5-4
5.3	Split Phase Induction Motor (Resistive Split Phase I.M.)	5-4
5.4	Capacitor Start Induction Motors	5-5
5.4.1	Capacitor Start Capacitor Run Motor	5-6
5.4.2	Applications	5-6
5.5	Shaded Pole Induction Motors	5-7

5.5.1	Specifications of a 1 Phase Induction Motor	5-8
5.6	Single Phase Commutator Motors	5-8
5.6.1	Single Phase A.C. Series Motors	5-8
5.7	Universal Motor	5-10
5.7.1	Uncompensated Universal Motor	5-10
5.7.2	Compensated Universal Motor	5-10
5.7.3	Advantages of Universal Motors	5-11
5.7.4	Disadvantages of Universal Motors	5-11
5.7.5	Speed Range and Direction Reversal ..	5-11
5.7.6	Applications of Universal Motors	5-11
5.7.7	Specifications / Ratings of a Universal Motor	5-12
5.8	Servomotors	5-12
5.8.1	A.C. Servomotor	5-12
5.8.2	Torque Speed Characteristics	5-13
5.8.3	Advantages of AC Servomotors	5-13
5.8.4	Applications of AC Servomotors	5-13
5.9	MSBTE Questions and Answers	5-14
5.10	I-Scheme Questions and Answers	5-16
	• Review Questions	5-13

Unit - IV

Chapter 6 : Electronic Components and Signals 6-1 to 6-31

Syllabus : Active and passive components, Resistor, Capacitor, Inductor - Symbols, Working principles, Applications, Colour codes, Specifications. Voltage and current source, Signal waveform, Time and frequency domain representation, Amplitude, Frequency, Phase, Wavelength, Types of signals Sinusoidal, Triangular and square. Integrated circuits - analog and digital.

6.1	Introduction.....	6-2
6.2	Classification of the Materials	6-2
6.2.1	Conductors	6-2



6.2.2	Insulating Materials	6-2	6.11.3	Colour Coding with Three Bands	6-9
6.2.3	Semiconductor Materials	6-2	6.11.4	Colour Coding for Five Band Colour Code	6-9
6.2.4	Magnetic Materials	6-2	6.12	Variable Resistors	6-10
6.3	Need of Electronics	6-2	6.12.1	Circuit Symbols and Types of Variable Resistors	6-10
6.3.1	Definition of Electronics	6-3	6.12.2	Applications of Variable Resistors	6-11
6.4	Applications of Electronics	6-3	6.12.3	General Construction and Operation of a Potentiometer	6-11
6.4.1	Industrial Applications	6-3	6.13	Capacitors	6-11
6.4.2	Defence Applications	6-3	6.13.1	Capacitance	6-12
6.4.3	Medical Sciences	6-3	6.13.2	Classification of Capacitors	6-12
6.4.4	Instrumentation	6-3	6.13.3	Dielectric Materials used for Capacitors	6-13
6.4.5	Communication and Entertainment	6-3	6.14	Capacitors Specification	6-13
6.5	Types of Electronic Components	6-4	6.15	Types of Fixed Capacitors and their Applications	6-14
6.5.1	Active Components	6-4	6.16	Colour Coding of Capacitors	6-15
6.5.2	Passive Components	6-4	6.16.1	Using Numerals	6-15
6.5.3	Comparison of Active and Passive Components	6-4	6.16.2	Using Colour Band System	6-16
6.6	Resistor	6-4	6.16.3	By Means of Characters	6-16
6.6.1	Resistance (R)	6-4	6.16.4	Directly Printed	6-16
6.7	Classification of Resistors	6-5	6.17	Variable Capacitors	6-17
6.7.1	Linear Resistors	6-5	6.17.1	Symbol and Units	6-17
6.7.2	Nonlinear Resistors	6-5	6.17.2	Applications of Variable Capacitors	6-17
6.8	General Specifications of Resistors	6-5	6.18	Inductors	6-17
6.9	Working Principles and Applications of Resistors	6-6	6.18.1	Construction and Symbol	6-18
6.9.1	Carbon Composition Resistor	6-6	6.18.2	Types of Inductor	6-18
6.9.2	Wire-wound Resistors	6-7	6.18.3	Types of Fixed Inductor	6-18
6.9.3	Film Type Resistors	6-7	6.18.4	Materials used for Inductor	6-18
6.9.4	General Applications of Fixed Resistors	6-8	6.18.5	Applications of Fixed Inductors	6-18
6.10	Preferred Values	6-8	6.18.6	Choke	6-18
6.11	Colour Coding of Resistors	6-8	6.19	Classification of Inductors	6-19
6.11.1	Types of Resistor Colour Codes	6-8	6.20	Colour Code of Inductors	6-19
6.11.2	Colour Coding with Four Bands	6-8			



6.20.1	Four Band Colour Code	6-19
6.20.2	Five Band Colour Code	6-20
6.21	Variable Inductors	6-21
6.21.1	Application of Variable Inductors	6-21
6.22	Voltage and Current Sources	6-21
6.22.1	Independent Voltage Sources	6-21
6.22.2	Current Sources	6-22
6.23	Signal Waveform	6-23
6.23.1	Definition of Waveform	6-23
6.23.2	Types of AC Waveforms	6-23
6.23.3	Waveform of Sinusoidal AC	6-24
6.23.4	Cycle	6-25
6.23.5	Time Period or Periodic Time (T)	6-25
6.23.6	Frequency	6-25
6.23.7	Amplitude	6-26
6.23.8	Phase	6-26
6.23.9	Wavelength	6-26
6.24	Types of Signals : Sinusoidal, Triangular and Square	6-26
6.24.1	Time and Frequency Domain Representation of Signals	6-27
6.25	Introduction to Integrated Circuits	6-27
6.25.1	Disadvantages of Discrete Circuits	6-28
6.26	Integrated Circuits	6-28
6.26.1	Classification of Integrated Circuits	6-28
6.26.2	Classification Based on the Applications (Linear and Digital)	6-28
6.27	Scale of Integration or Level of Integration	6-28
6.28	Advantages of Integrated Circuits	6-29
6.29	Disadvantages of Integrated Circuits	6-29
6.30	Uses of ICs	6-29
6.31	Difference between Linear and Non-linear ICs	6-29
6.32	I-Scheme Solved Examples	6-30

6.33	I-Scheme Questions and Answers	6-30
	• Review Questions	6-29

Unit - V

Chapter 7 : Semiconductor Diode	7-1 to 7-18
--	--------------------

Syllabus : P-N junction diode Symbol, Construction, Working and applications. Light emitting diodes Symbol, Construction, Working principle and applications.

7.1	Introduction to p-n Junction	7-2
7.1.1	Formation of P-N Junction	7-2
7.1.2	Formation of the Depletion Region	7-2
7.1.3	Barrier Potential or Junction Potential (V_j)	7-3
7.2	p-n Junction Diode	7-3
7.3	Biasing the p-n Junction	7-4
7.3.1	Forward Bias	7-4
7.3.2	Voltage Drop Across the Forward Biased Diode (V_F)	7-5
7.3.3	Reverse Bias	7-5
7.3.4	Breakdown in the Reverse Biased Diode (Breakdown Voltage)	7-7
7.4	The Volt-ampere (V-I) Characteristics of a Diode	7-7
7.4.1	Forward Characteristics of p-n Junction Diode	7-8
7.4.2	Reverse Characteristics of a Diode (Breakdown Voltage)	7-8
7.4.3	Complete V-I Characteristics of a Diode	7-9
7.4.4	Complete V-I Characteristics of Silicon and Germanium Diodes	7-9
7.4.5	Comparison of Silicon and Germanium Diodes	7-9
7.4.6	Mathematical Expression for the Diode Current (V-I Characteristics)	7-10



7.4.7	Effect of Temperature on the V-I Characteristics	7-10
7.4.8	Circuit Diagram for Characteristics	7-10
7.4.9	Ideal Characteristics	7-11
7.4.10	Comparison of Ideal Diode and Real Diode	7-11
7.5	Applications of p-n Junction Diode	7-11
7.6	Zener Diode	7-11
7.6.1	Operating Principle	7-12
7.6.2	Circuit Symbol and Biasing of a Zener Diode	7-12
7.6.3	V-I Characteristics of a Zener Diode	7-12
7.6.4	Circuit Diagram for the V-I Characteristics	7-13
7.7	Breakdown Mechanisms in Zener Diode	7-14
7.7.1	Zener Breakdown	7-14
7.7.2	Avalanche Breakdown in Zener Diodes	7-14
7.7.3	Comparison of Zener Diode and p-n Junction Diode	7-15
7.8	Applications of Zener Diode	7-15
7.9	Light Emitting Diodes (LED)	7-15
7.9.1	Construction of LED	7-16
7.9.2	Principle of LED Operation	7-16
7.9.3	Applications of LEDs	7-17
7.9.4	Infra Red Light Emitting Diode (IR-LED)	7-17
7.9.5	Comparison of Conventional Diode and LED	7-17
7.10	MSBTE Questions and Answers	7-18
7.11	I-Scheme Questions and Answers	7-18
	• Review Questions	7-17

Unit - V

Chapter 8 : Diode Circuits & Regulated Power Supply**8-1 to 8-28**

Syllabus : Rectifiers : Half wave, Full wave and Bridge rectifier, Performance parameters. PIV, Ripple factor, Efficiency, Filters C, Circuit diagram and working of L, C and π filters. Zener diode voltage regulator.

8.1	Introduction.....	8-2
8.1.1	Polarities of Transformer Voltages	8-2
8.1.2	Types of Rectifiers	8-2
8.2	Half Wave Rectifier (HWR)	8-3
8.2.1	Operation of the HWR	8-3
8.2.2	Important Terms Related to Rectifiers (Performance Parameters)	8-4
8.2.3	Values of Performance Parameters	8-5
8.3	Full Wave Rectifier with Center Tapped Transformer	8-5
8.3.1	Operation of FWR	8-6
8.3.2	Values of Performance Parameters	8-7
8.3.3	Applications of FWR	8-7
8.4	Full Wave Bridge Rectifier	8-7
8.4.1	Operation of the Bridge Rectifier	8-8
8.4.2	The Values of Performance Parameters	8-9
8.4.3	Applications of Bridge Rectifier	8-9
8.4.4	Comparison of Rectifiers	8-9
8.5	Necessity of Filter Circuits	8-10
8.5.1	Types of Filters (Classification of Filters)	8-10
8.6	Capacitor Filter (C Type Filter)	8-10
8.6.1	Operation of FWR with a Capacitor Filter	8-11
8.6.2	HWR with Capacitor Filter	8-12
8.6.3	Bridge Rectifier with Capacitor Filter	8-13



8.7	Series Inductor Filter (L Type Filter).....	8-14
8.7.1	Operation of the Circuit	8-15
8.7.2	Comparison of Capacitor and Inductor Filters.....	8-15
8.7.3	HWR with Series Inductor Filter	8-15
8.7.4	Bridge Rectifier with Series Inductor Filter	8-15
8.8	Inverted L Filter (LC Filter)	8-15
8.8.1	LC Filter with Half Wave Rectifier	8-15
8.8.2	LC Filter with Bridge Rectifier	8-15
8.9	π Type (CLC Filter)	8-15
8.9.1	CLC Filter with Half Wave Rectifier	8-16
8.9.2	CLC Filter with Bridge Rectifier	8-17
8.9.3	Comparison of C, L, LC and π Filters	8-17
8.10	Introduction to Voltage Regulators	8-18
8.10.1	Unregulated Power Supply	8-18
8.10.2	Need of Regulator	8-18
8.11	Basic Block Diagram of Regulated Power Supply	8-18
8.11.1	Load Regulation	8-19
8.11.2	Line Regulation or Source Regulation	8-20
8.12	Zener Diode as a Voltage Regulator	8-20
8.12.1	Regulating Action with a Varying Input Voltage (Constant I_L)	8-21
8.12.2	Regulating Action with a Varying Load (V_{in} Constant)	8-22
8.12.3	Limitations of Zener Regulators	8-22
8.12.4	Merits of Zener Regulator	8-22
8.12.5	Applications of Zener Regulator	8-22
8.12.6	Applications of Regulated Power Supplies	8-26
8.13	MSBTE Questions and Answers	8-26
8.14	I-Scheme Questions and Answers	8-28
	• Review Questions	8-26

Unit - VI**Chapter 9 : Bipolar Junction Transistor 9-1 to 9-26**

Syllabus : BJT : Symbol, Construction and working principle, Transistor as switch and amplifier, Input and output characteristics CE, CB and CC configurations, Operating regions – Cut-off, Saturation and Active, Transistor parameters CB gain α , CE gain β , Input resistance, Output resistance, Relation between α and β .

9.1	Introduction to Bipolar Junction Transistors.....	9-2
9.1.1	Advantages of a Transistor	9-2
9.1.2	Transistor Definition	9-2
9.1.3	Why is it Called a “Bipolar” Transistor ? ..	9-2
9.1.4	Types and Symbols of Transistors	9-2
9.2	Construction of a BJT	9-3
9.2.1	An Unbiased Transistor	9-3
9.3	Transistor Biasing in the Active Region	9-3
9.4	Operation of NPN Transistor	9-4
9.4.1	Operation of PNP Transistor	9-5
9.5	Transistor Currents	9-5
9.5.1	Circuit Symbols and Conventions	9-5
9.6	Transistor Configurations	9-6
9.7	Common Base (CB) Configuration	9-6
9.7.1	Current Relations in CB Configuration ..	9-6
9.7.2	Characteristics of a Transistor in Common Base Configuration	9-7
9.7.3	Input Characteristics	9-7
9.7.4	Output Characteristics of Transistor in CB Configuration	9-8
9.7.5	Features of CB Configuration	9-9
9.8	Common Emitter (CE) Configuration	9-10
9.8.1	Current Relations in CE Configuration ..	9-10
9.8.2	Current Gain (β)	9-11
9.8.3	Relation between α_{dc} and β_{dc}	9-11
9.8.4	Input Characteristics	9-11



9.8.5	Output Characteristics	9-12	9.15.1	Amplifier Characteristics	9-19
9.8.6	Features of CE Configuration	9-13	9.16	Classification Depending on the Type of Coupling	9-20
9.8.7	Typical Junction Voltages	9-13	9.17	Transistor as an Amplifier	9-20
9.9	Common Collector (CC) Configuration	9-14	9.17.1	Transistor as a Current Amplifier	9-20
9.9.1	Practical Way to Draw Common Collector Configuration	9-14	9.17.2	Transistor as a Voltage Amplifier	9-20
9.9.2	Input Characteristics of n-p-n Transistor in CC Configuration	9-15	9.18	Single Stage RC Coupled CE Amplifier	9-21
9.9.3	Output Characteristics of a n-p-n Transistor in CC Configuration	9-15	9.18.1	Circuit Components their Functions and Selection Criteria	9-21
9.9.4	Features of CC Configuration	9-16	9.18.2	Operation of the RC Coupled Amplifier	9-22
9.10	Comparison of Configurations	9-16	9.19	Transistor as a Switch	9-23
9.11	Solved Examples	9-17	9.19.1	Applications of Transistor as a Switch ..	9-24
9.12	Specifications of a Transistor	9-18	9.20	MSBTE Questions and Answers	9-25
9.13	Transistor Applications	9-18	9.21	I-Scheme Questions and Answers	9-26
9.14	Concept of Amplification and Definition of Amplifier	9-18		• Review Questions	9-24
9.15	Block Diagram of an Amplifier	9-19		• Appendix-A : Star to Delta and Delta to Star.....	A-1 to A-5

□□□