

Transformer & Alternators

Lecture (KnowledgeCriteria)	
1	1. Magnetic circuit, MMF, reluctance and mention their units, Absolute permeability and Relative permeability and mention their units, relationship between Flux, MMF and Reluctance. simple problems on magnetic circuit
	2. AC fundamentals Concept of capacitive reactance, inductive reactance, and impedance. Current and Power in a pure resistive, inductive and capacitive circuit.
	3. Current, Power and Power factor of R-L, R-C, R-L-C series and parallel circuits. Concept and Applications of resonance.
2	TRANSFORMERS 1. Basics: a. Working Principle of Transformer. b. Construction. c. Operation.
	2. Classification of Transformers: a. Based on Construction b. Based on No. of phases c. Based on application Shell and Core type: Construction and application.
	3. Main Parts of Transformer: a. Tank b. Core c. Winding d. Insulation: i. Oil ii. Paper e. Bushings (HT/LT/NT) f. Conservator g. OLTC (ON Load/OFF Load Tap Changers) h. Breather i. Safety Devices: i. Pressure Relief Device ii. Buchholz Relay j. Instruments: i. Oil Temperature Indicator (OTI)/Transmitter ii. Winding Temperature Indicator (WTI)/Transmitter iii. Conservator Oil level Indicator/Transmitter
3	1. Derive emf equation, and explain transformation ratio (K). Explain Operation of a transformer on No-load with a vector diagram.
	2. Operation of a transformer On-load with vector diagrams. Draw equivalent Circuit of transformer.

	3. Problems on emf equation, transformer on NO-load and ON-load conditions.
4	1. Losses in Transformer -List Various losses in a transformer. - Voltage regulation and efficiency in the transformer. - Write an equation for voltage regulation and efficiency. -Condition for maximum efficiency. - All day efficiency. -Problem on all-day efficiency.
	2. Pre-determine the Regulation and Efficiency of 1-ph transformer by conducting O.C. and S.C. tests.
	3.Necessity and conditions for parallel operation. - Parallel operation of single phase transformers with their load sharing.
5	1.Generation of 3-ph voltage, phase sequence, Star and Delta Connection in 3-ph system, Relation between line voltage and phase voltage in 3-ph Star, Relation between line voltage and phase voltage in 3-ph Delta system. Equation for a 3-ph power
	2. Working principle & construction of three-phase transformers. Connection type: i. Star-Delta ii. Delta-Star iii. star-star iv. Delta-Delta v. Open delta vi. Scott.
	3. Vector Group i. Brief introduction of Vector Grouping ii. Type of Vector group: a. Yy0, Dd0 b. Yd1, Dy1 c. Yd6, Dy6 d. Yd11, Dy11. Problems on 3 phase star and delta circuits.
6	1. Special purpose transformers Construction and working of current transformer (CT). Ref.7.2(9)

	2. Construction, working of potential transformer (PT)
	3. Construction, working of Pulse, Toroidal, Isolation transformer and Auto transformer
7	1. Study Code of practice for selection, installation and maintenance of transformers. IS 10028
	2. Study IS 1180 and IS 2026 standards: a. scope of IS 1180 and IS 2026 b. List transformers covered and not covered by IS 1180 c. List manufacturer of IS 1180 transformers.
	3. IEC 60071-1 to IEC 60071-12 standards for power transformers
8	1. Testing and Troubleshooting of given transformer-1
	2. Testing and Troubleshooting of given transformer -2
	3. Installation and Commissioning of transformer
9	1a. Working principle and construction of DC generator. 1b. Alternator: working principle, Construction of salient pole and non-salient pole alternator.
	2. Full pitch Armature windings and Fractional pitch Armature windings. Advantages and disadvantages of Full pitch and Fractional pitch Armature windings.
	3. Relationship between P, N, f and Derivation of emf equation, Simple problems on E.M.F equation.
10	1. Armature reaction in an alternator with sketches, Effects of p.f of load on armature reaction and Effects of

	armature reaction on terminal voltage.
	2. Procedure for conducting O.C & S.C. tests on an alternator with circuit arrangements.
	3. Effective resistance, leakage reactance & synchronous reactance. Calculate the synchronous impedance by O.C. & S.C test results. Equation for the no-load terminal voltage at different power factors. Voltage regulation definition and methods.
11	1. Vector diagram of alternator on Load at different power factors.
	2. Necessity and Conditions for parallel operation of three-phase alternators.
	3. Parallel operation of three-phase alternators using synchroscope.
12	1. Meaning and types of excitations. Static excitation system Ref.7(14)
	2. Effect of unequal voltage on load sharing. Effect of change in excitation and prime mover input power on distribution of load.
	3. Hunting and its prevention in alternators. Necessity of cooling in alternators. Cooling agents. – Hydrogen cooling.
13	1. Maintenance of the transformer.
	2. Installation and Maintenance of alternator. Ref.7(15)
	3. Construction of an Energy efficient transformer. -Star rating of a transformer. -Benefits Of Higher Efficiency in Transformers. -Calculate Cost saving by buying an energy efficient transformer.