

VOC 112: Electrical Systems

Learning Objectives:

1. To introduce students with basic concepts of single and three phase AC and electrical machines.

Learning Outcomes:

1. Students will be able to perform basic circuit analysis.
2. Students will be able to understand the operation of transformers and different variants of motors
3. Students will have basic knowledge of electricity generation through non-conventional sources.

Module -1: Basic Circuit Elements and D.C. Network Analysis

Basic Circuit Elements -Idea of Electric Potential and Current, Resistance -Unit, Law, Conductance and Conductivity, Effect Of Temperature on Resistance, Temperature Coefficient of Resistance, Ohms Law, Resistance and Parallel, Voltage Divider Rule, Short and Open Circuits, Equivalent Resistance. Inductance- Self inductance, mutually induced EMF, Capacitance – Charging & Discharging, Time Constant

D.C. Network Analysis- Introduction (Circuit, Parameters, Types of Circuits, Types of Networks, Node, Branch, loops, Mesh), Kirchoff's Volatage and Current Law, Thevenin Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Delta /Star and Star /Delta Transformation.

Module -2: Electrical Fundamentals and Transformer

Single Phase AC - Generation of Alternating Voltage and Current, Equation of Alternating Voltage & Current, Simple Waveform, Complex waveform, Cycle, Time Period, Frequency, Amplitude Different form of EMF Equations, Phase, Phase Difference, Root mean Square Value(RMS) , Representation of Alternating Quantities.

Three Phase AC - Generation of Three phase voltage, Phase Sequence, Phase sequence at load, Numbering of phases, Interconnection of phases (Star and delta Connection), Concept of balance and unbalanced Load

Single Phase Transformers- Construction, Working Principle, EMF Equations, Transformation Ratio, Working of Transformer On no load and with load, losses, efficiency

Three Phase Transformers- Construction, Working Principle, Three phase transformer connections; Instrument transformers (Current and Potential transformer)

Module -3: Electric Motors

AC motors – Principle, Stator construction and operation (two and three phase), Single Phase Induction motors, Motor characteristics, Resistance-start-induction-run motor,

capacitor start- induction run motor, Three phase motors, Induction motor, Synchronous motor, parameters on motor nameplate

DC motors - Principle, Basic motor Construction, Motor classifications, Significance of back e.m.f., Rotary Motion, control of field flux, Counterelectromotive force, Armature reaction, Armature torque and shaft torque, Torque and speed of a DC motor, DC motor characteristics
Speed control of DC motor

Module -4: Energy Sources

Energy Sources – Renewable and non-renewable, Thermal & Nuclear Power Plant - Working principle, application, advantages & limitations, Solar & Wind Power plant – Working principle, application, advantages & limitations

Module – 5:

Tutorials, assignments, demonstrations and presentation based on Module I to IV

References:

1. Electrical Technology (Vol 1 and 2)- B.L.Thereja, A. K. Thereja; S. Chand Publishers; First multicolour edition, 2005; New Delhi
2. Network Analysis and Synthesis- Ravish R. Singh; Mc. Graw Hill Education (India) Pvt. Ltd. First Edition, 2013, New Delhi
3. Grob's Basic Electronics- M.E. Schultz; Mc.Graw Hill Pvt. Ltd., Special Indian Edition (Tenth) 2007, New Delhi
4. Industrial Electronics – Terry Bartlet; Cengage Learning India Edition, Second Indian Reprint, 2006, New Delhi
5. Non Conventional Energy Resources- B.H. Khan; Mc. Graw Hill Education, Second Edition, 2009, New Delhi