

Notes:

- (i) The presentation of this subject should be supplemented by demonstrations wherever possible.
  - (ii) Care must be exercised to take the level of study for this grade into account, and consequently all calculations and problems should be of appropriate standard.
1. Direct current machines: Principles and general construction. Explanation and connection diagrams of simple lap and wave windings. Explanation of armature reaction and its effect. Simple treatment of commutation; methods to improve commutation.
  2. Direct current generators: Characteristic curves and uses of series, shunt and compound <sup>machines</sup> meters.
  3. Direct current motors: Back e.m.f. Torque and speed equations. Characteristic curves and the application of series, shunt and compound motors.  
  
Speed control by armature resistance and field control.  
Reversing the rotation of motors with and without interpoles.  
Simple direct current starters (Face-plate sliding contact).
  4. Efficiency and losses: Determination of efficiency and losses by means of direct, indirect and back-to-back tests.
  5. Alternating current circuits: Generation of an alternating e.m.f. (i.e.  $e = E_m \sin \omega t$ ). Illustration of an alternating quantity by a wave and phasors; instantaneous, maximum and average values; determination of average and effective values by using the mid-ordinate rule.

Determination of the form factor. The effect of resistance, inductance and capacitance in an alternating-current circuit.

The application of an alternating sinusoidal potential difference with regard to resistance, inductance and capacitance in series and parallel circuits including sketches of phasor diagrams.

6. Transformers: Principle of operation of single- and three-phase transformers. Connecting single-phase transformers in star and delta. Voltage, current and turns ratio including basic calculations.
7. Electronics: Comparisons between mechanical switching, series (mathematical) and the applicable logic symbols and truth tables for AND, OR, NOR and NAND gates. PNP and NPN characteristics. Forward and reverse bias. Concept of a diode; elementary concept of pulses and waveforms. Principles and application of the silicon controlled rectifier.

Introduction to the use of the calibrated oscilloscope so that pulses and waveforms may be recognised and compared.

The transistor as a simple current and voltage amplifier in the three basic configurations.

8. Measuring instruments: Shunts; series resistors; applicable calculations. Instrument transformers and their connections.