EE 206: ELECTRICAL MACHINES-I (3-1-2 : 5)

DC Machines:
Review of constructional features, armature winding, Lap and Wave winding. Review of EMF equation for a generator and Torque equation for a motor. Armature reaction, Distribution of Flux density in the air gap, commutation, Methods for improving commutation. DC Generator: Methods of excitation, shunt, series and compound generators, open circuit characteristics, Load characteristics and voltage regulation. DC motor: Speed torque characteristics of motors, Regions of normal operations, Methods of speed control. Losses and Efficiency of DC machines: Swinburne's test & Hopkinson's test.

Transformers:
Review of e.m.f equation and equivalent circuit, voltage regulation and efficiency, Determination of parameter from OC & SC tests, Back to Back test, parallel operation and load sharing, per-unit representation of transformer parameters & problem solving. Auto Transformer: Principle of operation, Phasor diagram, Equivalent circuit and comparison with two winding transformer. Three Phase Transformer: Construction of various types, operating characteristics of Star–Star, Star–Delta, Delta – star, Delta – Delta, Open – Delta and Zigzag connections, Vector Groups, Phase transformation, Three phase to Two phase, Three phase to Six phase, Three phase to Twelve phase transformation, Scott connection, parallel operation of Three phase transformer, Time harmonies in transformers – their cause and remedy, Three winding transformers equivalent circuit and applications.

Suggested list of Laboratory Experiments:

1. OC and SC Tests on single phase transformer
2. Sumpner's Test on single phase transformer
3. Parallel operation of single phase transformer
4. OCC test on DC shunt generator
5. Speed control of DC shunt motor
6. Brake test on DC shunt motor
7. Brake test on DC series motor
8. Swinburne's Test
9. Hopkinson's Test
10. Tests on compound DC machines

Text Books:

1) A. Fitzgerald, C. Kingsley, S. Umans, Electric Machinery, TMH, New Delhi.
2) I. J. Nagrath, D.P. Kothari, Electric Machines, TMH, New Delhi.

References:

1) Say M. G., The performance and design of alternating current machines, CBS Publishers, Delhi.
2) Bimbhra P. S., Electrical Machinery, Khanna Pub., Delhi.
3) Clayton A. E., The performance and design of direct current machines, Pitman and sons, London.
4) Bhag S. Guru, H. R. Hiziroglu, Electric Machinery and Transformers, Oxford.
5) Mukherjee, Chakravorty, Electrical Machines, Dhanpat Rai Pub., New Delhi.