

EE-401: DC and Synchronous Machine

Credit	L	T	P
3	2	1	-

UNIT I

DC Machine: Basic parts, induced e.m.f., developed torque, lap winding, wave winding, equalizer connection. Armature flux distribution and its effects, brush shift, demagnetizing and cross magnetizing m.m.f., commutation, interpoles and compensating winding. Determination of compensating winding m.m.f. Determination of interpoles m.m.f. for compensated and uncompensated DC machines.

UNIT II

DC Generator: Types, magnetization characteristics, self-excitation principles. External and internal characteristics of separately excited and self excited DC generators. Applications. Parallel operation of DC generators.

DC Motor: Types, load characteristics of separately excited, shunt, series and compound motors. Applications. Starting, speed control and braking.

UNIT III

DC Machine: Power balance, losses and efficiency, condition for maximum power output and maximum efficiency. Testing- Swinburne's, Hopkinson's, Field's and retardation tests; separation of losses.

Synchronous Machine: General constructional features, principle of operation, types of rotor, e.m.f. equation, short pitch winding and pitch factor, distributed winding and distribution factor. Cylindrical rotor machine- interaction between excitation flux and armature m.m.f., steady state equivalent circuit and phasor diagram, transition from generator action to motor action.

UNIT IV

Synchronous Machine: Steady state power flow and power angle characteristics. Effect of variation in excitation at constant load, V-curves, inverted V-curves and generator compounding curves. Open-circuit, short-circuit and zero power factor (lagging) tests. Short Circuit Ratio (SCR). Voltage regulation of alternator and its determination by synchronous impedance, m.m.f., Potier's triangle and American Standards Association methods.

UNIT V

Synchronous Generator: Synchronization and parallel operation of synchronous generators (Alternators). Governor characteristics and load sharing. Synchronizing current, synchronizing power and synchronizing torque.

Synchronous Motor: Starting methods of synchronous motor. Operation as synchronous condenser.

Salient-pole machine: Two reaction theory. Operation under balanced steady-state conditions in generator and motor modes. Power angle equations and characteristics. Determination of X_d and X_q by slip test.

TEXT/REFERENCE BOOKS.

1. I.J. Nagrath and D.P. Kothari, "Electrical Machines", Tata McGraw Hill, New Delhi.
2. Ashfaq Husain, "Electric Machines", Dhanpat Rai & Co.
3. George McPherson, "An Introduction to Electric Machine and Transformers", John Wiley, New York.
4. A.E. Fitzgerald, C. Kingsley and S.D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi