2/4 B.Tech. FIRST SEMESTER

EE3T2 ELECTRICAL MACHINES – I Credits: 3
Lecture: 3 periods/week Internal assessment: 30 marks
Tutorial: 1 period /week Semester end examination: 70 marks

Objective:
Electrical machines course is one of the important courses of the Electrical discipline. In this course the different types of DC generators and motors which are widely used in industry are covered and their performance aspects will be studied.

Course outcomes:
Upon completing of the course student should be

1. Able to understand the construction of D.C machine, different windings, their merits and demerits
2. Able to analyze different types of DC generators their characteristics, industrial applications, effect of armature reaction and its assessment
3. Able to interpret the various losses in DC machines and their efficiency
4. Able to explain the principle of DC motor, electrical characteristics and industrial application, purpose of starter and its design.
5. Able to understand special type of DC Generators

UNIT – I D.C. Generators – Construction & Operation:
D.C. Generators – Principle of operation – Constructional Features-E.M.F Equation- Action of commutator – armature windings – lap and wave windings – simplex and multiplex windings –Types of DC generator: separately excited and self excited generators
Armature reaction – Cross magnetizing and de-magnetizing AT/pole –commutation Process – reactance voltage – methods of improving commutation – Compensating windings – Interpoles.

UNIT – II Characteristics of D.C Generators:
Methods of Excitation - O.C.C– build-up of E.M.F - critical field resistance and critical speed - causes for failure to self excite and remedial measures—Internal & External characteristics of shunt, series and Compound generator-Applications - Name plate details available rating in market approximate cost.
Need for parallel operation - Parallel operation of DC Shunt, Series and Compound generators – use of equalizer bar and cross connection of field windings – load sharing – specific areas of applications

UNIT – III: D.C. Motors:
D.C Motors – Principle of operation – Back E.M.F - Torque equation –characteristics of shunt, series and compound motors – Armature reaction and commutation - Application of DC Motors - Principle of 2 point, 3 point and 4 point starters – protective devices – Design of starter elements - Name plate details available rating in market approximate cost

UNIT – IV Speed Control of D.C. Motors:
Speed control of D.C Motors: Armature voltage and field flux control methods, Ward-Leonard system, Introduction to solid state control of D.C motors

Testing of D.C. Machines:
Losses in DC machines – Efficiency as generator and motor – condition for maximum efficiency Methods of testing D.C machines: - Brake test, Indirect testing: Swinburne's test, Hopkinson's test - Field's test for series machines - Retardation test-- separation of losses – expected efficiency levels

UNIT-V Special Type of DC Machines :
Cross Field dynamos Principle, operation and applications of Rosenberg generator, Amplidyne and Metadyne – areas of specific application - name plate details – expected efficiency levels.
Three brush DC generators: construction, principle of operation and its application .
Commutator motors, A.C series motor-modifications in construction -characteristics
Universal motors applications.

TEXT BOOKS:
1. Electrical Machines – P.S.Bhimbra, Khanna publishers.
2. Performance and Design of DC Machines by Clayton & Hancock, BPB Publishers
3. Electrical Machines (DC) - J.B. Gupta, Kataria Publications

REFERENCE BOOKS:
1. Electrical Machines by D P.Kothari, I .J .Nagarth, Mc GrawHill Publications, 4^{th} edition
2. Electrical Machines by S.K. Bhattacharya
3. Electro mechanics – I (D.C Machines) S. Kamakshaiah Hi-Tech Publishers