

2/4 B.Tech. FIRST SEMESTER

EE3T1

ELECTRICAL MACHINES – I

Credits: 4

Lecture: 4 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.

Learning outcomes:

Upon completing of the course student

1. Should be 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 explain the principle of DC motor, electrical characteristics and industrial application, purpose of starter and its design.
5. Able to analyse the purpose of parallel operation of DC generator
6. Able to understand features and their industrial applications.

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 – Methods of Excitation-Types of DC generator: separately excited and self excited generators

UNIT – II Armature Reaction in D.C. Generator:

Armature reaction – Cross magnetizing and de-magnetizing AT/pole –commutation Process – reactance voltage – methods of improving commutation – Compensating windings – Interpoles.

UNIT – III Characteristics of D.C Generators:

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, Losses and Efficiency, Condition for maximum efficiency - Name plate details available rating in market approximate cost.

UNIT – IV Parallel Operation:

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 – V: 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, Losses and Efficiency, Application of DC Motors - Name plate details available rating in market approximate cost.

UNIT – VI: Speed Control of D.C. Motors:

Speed control of D.C Motors: Armature voltage and field flux control methods, Ward-Leonard system, Principle of 2 point, 3 point and 4 point starters – protective devices – Design of starter elements. Introduction to solid state control of D.C motors

UNIT – VII Testing of D.C. Machines:

Testing of D.C machines: Methods of testing - 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-VIII Special Type of DC Generators :

Cross Field dynamos Principle, operation and applications of Rosenberg generator, Amplidyne and Metadyne – areas of specific application - name plate details – expected efficiency levels.

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, 4th edition
2. Electrical Machines by S.K. Bhattacharya
3. Electro mechanics – I (D.C Machines) S. Kamakshaiah Hi-Tech Publishers