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II B.Tech I Sem

15AEE05-ELECTRICAL MACHINES – I

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Objectives: To make the students learn about:

- The constructional features of DC machines and different types of winding employed in DC machines
- The phenomena of armature reaction and commutation
- Characteristics of generators and parallel operation of generators
- Methods for speed control of DC motors and applications of DC motors
- Various types of losses that occur in DC machines and how to calculate efficiency
- Testing of DC motors

UNIT – I Principles Of Electromechanical Energy Conversion

Electromechanical Energy Conversion – Forces and Torque In Magnetic Field Systems – Energy Balance – Energy and Force in A Singly Excited Magnetic Field System, Determination of Magnetic Force - Co-Energy – Multi Excited Magnetic Field Systems.

UNIT – II D.C. Generators -I

D.C. Generators – Principle of Operation – Constructional Features – Armature Windings – Lap and Wave Windings – Simplex and Multiplex Windings – Use of Laminated Armature – E. M.F Equation– Numerical Problems – Parallel Paths-Armature Reaction – Cross Magnetizing and De-Magnetizing AT/Pole – Compensating Winding – Commutation – Reactance Voltage – Methods of Improving Commutation.

UNIT–III D.C Generators – II

Methods of Excitation – Separately Excited and Self Excited Generators – Build-Up of E.M.F - Critical Field Resistance and Critical Speed - Causes for Failure to Self Excite and Remedial Measures-Load Characteristics of Shunt, Series and Compound Generators – Parallel Operation of D.C Series Generators – Use of Equalizer Bar and Cross Connection of Field Windings – Load Sharing.

UNIT – IV D.C. Motors

D.C Motors – Principle of Operation – Back E.M.F. – Circuit Model – Torque Equation – Characteristics and Application of Shunt, Series and Compound Motors – Armature Reaction and Commutation.

V. Sarada
BOS Chairman

Speed Control of D.C. Motors: Armature Voltage and Field Flux Control Methods. Ward-Leonard System–Braking of D.C Motors – Permanent Magnet D.C Motor (PMDC).

Motor Starters (3 Point and 4 Point Starters) – Protective Devices-Calculation of Starter Steps for D.C Shunt Motors.

UNIT – V Testing Of Dc Machines

Losses – Constant & Variable Losses – Calculation of Efficiency – Condition for Maximum Efficiency.

Methods of Testing – Direct, Indirect – Brake Test – Swinburne's Test – Hopkinson's Test – Field's Test – Retardation Test

Outcomes:

After completing the course, the student should be able to do the following:

- Calculate the e.m.f. generated on open circuit and find terminal voltage on load
- Diagonise the failure of DC generator to build up voltage
- Compute the load shared by each generator when several generators operate in parallel
- Determine the gross torque and useful torque developed by DC motor
- Identify suitable method and conditions for obtaining the required speed of DC motor
- Calculate the losses and efficiency of DC generators and motors

Text Books:

1. Electric Machines by I.J. Nagrath & D.P. Kothari, Tata Mc Graw – Hill Publishers, 3rd Edition, 2004.
2. Electrical Machines – P.S. Bimbhra., Khanna Publishers, 2011.

References:

1. Performance and Design of D.C Machines – by Clayton & Hancock, BPB Publishers, 2004.
2. Electrical Machines -S.K. Battacharya, TMH Edn Pvt. Ltd., 3rd Edition, 2009.
3. Electric Machinary – A. E. Fitzgerald, C. Kingsley and S. Umans, Mc Graw-Hill Companies, 5th Editon, 2003.
4. Electrical Machines – M.V Deshpande, Wheeler Publishing, 2004.
5. Electromechanics – I - Kamakshaiah S., Overseas Publishers Pvt. Ltd, 3rd Edition, 2004.

BOS - Chairman