JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), PULIVENDULA
ELECTRICAL AND ELECTRONICS ENGINEERING

II B.TECH I SEM

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Performance of DC Machines

Course Objectives:
- To understand the basic principles of electromechanical energy conversion
- To understand the working and performance of DC generators
- To understand the working and performance of DC motors
- To understand the design of DC machines

UNIT-I
Magnetic circuit and core loss
Basic laws for calculating magnetic field – Biot-savart law – Ampere's circuital law – Reluctance and permeance – Different zones of BH characteristics – Review of series and parallel magnetic circuits – Eddy current loss – Its derivation – Hysteresis loop with alternating exciting current – hysteresis loss – separation of core loss– Numerical Problems

Principles of Electromechanical Energy conversion
Energy in magnetic system - field energy, co-energy, mechanical force, torque in single and multiply-excited magnetic field systems with permanent magnets – dynamic equations of electromechanical systems– Numerical Problems

Learning outcomes:
- Learn about basics of magnetic circuits and their loss
- Learn about basics of electromechanical energy conversions

UNIT-II
DC Generators – Construction, Armature Reaction and Commutation
Working principle – Constructional details and Applications – Armature windings: Lap and Wave windings, Simplex and multiplex winding, dummy coils – Types of Generators – EMF equation – Total Losses and condition for maximum efficiency – Armature reaction : Demagnetizing and Cross magnetizing MMF – Compensating windings requirement – Commutation – methods to improve commutation– Numerical Problems

Learning outcomes:
- Learn about working and construction of DC generators
- Learn about armature reaction and commutation process

UNIT-III
DC Generators – Characteristics
Internal and External Characteristics of separately and self excited (series, shunt and compound) DC generators – OCC curve – Voltage build up process and precautionary measures – Load sharing – parallel operation of DC generators (series, shunt and compound) – Numerical Problems

DC Motors – Principle

Principle of working , Applications , Back EMF – Torque production and equation– Numerical Problems.

Learning outcomes:
- Learn about characteristics of DC generators
- Learn about the working of DC motors

UNIT-IV

DC Motors – Speed control

Types of DC motors – Characteristics of DC motors (series, shunt and compound) – Speed control methods of DC motors (series, shunt and compound) – Armature and field control methods – Ward leonard system – Braking of DC shunt and series motors – 3 point and 4 point starters for DC motors – Calculations of step resistance– Numerical Problems

Learning outcomes:
- Learn about speed control of DC motors
- Learn about the starting methods of DC motors

UNIT-V

DC Motors – Testing

Direct and Indirect testing – Brake test – Swinburne's Test – Hopkinson's Test – Field's Test – Retardation Test – Numerical Problems

DC Machines – Design

Output equation and main dimensions - choice of flux density - choice of ampere-conductors - Selection of number of poles - Length of air gap - Design of field winding – Numerical Problems

Learning outcomes:
- Learn about testing of DC motors
- Learn about the design of DC machines

Text Books:
1. Electrical Machines by I.J. Nagrath & D.P. Kothari, Tata Mc Graw – Hill Publishers, 3rd Edition, 2004.
2. Electrical Machines – P.S. Bimbra., Khanna Publishers, 2011.
3. A course on Electrical Machine Design, 6th edition, Dhanpat Rai & Co Pvt. Ltd., 2014.

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

Course Outcomes: After completion of the course, the student will be able to:
- Understand the basic principles of electromechanical energy conversion
- Understand the working and performance of DC generators
- Understand the working and performance of DC motors
- Understand the design of DC machines

(BOS-Chairman)