



SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

**Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE
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Department of Electrical and Electronics

Number of programmes where syllabus revision was carried out

SL. NO.	COURSE CODE	COURSE OFFERED
1	SEE1204	DC MACHINES AND TRANSFORMERS
2	SEE4053	DC MACHINES AND TRANSFORMERS LAB

SEE1204	DC MACHINES AND TRANSFORMERS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To study the fundamental principles of Electrical machines using the concepts of electro-mechanical energy conversion.
- To acquaint the constructional details, the principle of operation and prediction of performance characteristics of D.C Machines and Transformers.
- To study about the various losses and different testing methods to determine the performance of D.C Machines and Transformers.

UNIT 1 ELECTRO-MECHANICAL CONVERSION

9 Hrs.

Introduction - Principles of Energy Conversion - Field Energy and Co-energy in Linear Systems - Energy Flow - Losses and Efficiency - Singly and Multiply Excited Magnetic Field Systems - Torque Production in Rotating Machines - General Analysis of Electromechanical system

UNIT 2 D.C. GENERATORS

9 Hrs.

Constructional Details - Principle of Operation - E.M.F Equation - Methods of Excitation - Types - No load & Load characteristics of Series, Shunt & Compound generators - Armature Reaction, Effects, Methods of Compensation - Commutation: Methods of Improving Commutation - Applications.

UNIT 3 D.C. MOTORS AND TESTING OF D.C. MACHINES

9 Hrs.

Principle of Operation - Back E.M.F & Torque Equation - Characteristics of Series, Shunt & Compound Motors - Starters - Speed Control of DC Series & Shunt Motors - Electrical Braking - Testing of DC Machines - Brake Test, Swinburne's Test & Hopkinson's Test.

UNIT 4 TRANSFORMERS

9 Hrs.

Principle of Operation - Constructional Details - E.M.F. Equation - Transformation Ratio - Transformer on No Load - Parameters Referred to HV / LV Windings - Equivalent Circuit - Transformer On Load - Phasor diagram - Regulation - Testing of Transformer - Open Circuit and Short Circuit Test - All day Efficiency - Sumpner's Test.

UNIT 5 SPECIAL TRANSFORMERS AND THEIR APPLICATIONS

9 Hrs.

Auto Transformer - Saving of copper in comparison with Two winding Transformer - Parallel Operation of Single Phase Transformers - Construction of Three Phase Transformer - Transformer Connections – Scott connection - Three Phase to Single Phase Transformer conversion - Elementary Ideas on Instrument Transformers and Toroidal Transformer.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Apply the energy conversion concept to electrical machines.
- CO2 - Examine the performance of DC generator.
- CO3 - Determine the winding resistance required to control the speed of DC motor.
- CO4 - Evaluate the performance of a single phase transformer..
- CO5 - Evaluate the amount of copper saved in auto transformer
- CO6 - Justify the transformer connection for various applications.

TEXT / REFERENCE BOOKS

1. A K Theraja & B L Thereja, "A Text book of Electrical Technology (Vol II)", S Chand & Co- 23 rd Edition 2008.
2. I J Nagrath and D P Kothari , "Electrical Machines", Tata McGraw Hill Publishing Company Limited New Delhi, 3rd Edition, 2007.
3. R.K.Rajput, "Electrical Machine", Laxmi Publications, 5th Edition 2008.
4. J.B. Gupta, "Theory and Performance of Electrical Machines", S.K.Kataria and Sons, Reprint 2010.
5. S K Sen, "Electrical Machinery", Khanna Publishers, New Delhi, Reprint 2002.
6. Theodore Wildi, Electrical Machines, Drives and Power Systems, Pearson, 6th Ed, 2007.
7. Irving Kosow, Electric Machinery and Transformers, Pearson, 2nd Ed, 2007.
8. Albert E. Clayton and NN Hancock, "The performance and Design of Direct Current Machines", Oxford and IBH.Publishing Co. Pvt.Ltd., New Delhi, 1990.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEE4053	DC MACHINES AND TRANSFORMERS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. OCC and load characteristics of self excited dc shunt generator
2. OCC and load characteristics of separately excited dc shunt generator
3. Load characteristics of DC series generator
4. Load characteristics of DC compound generator (Differential and Cumulative)
5. Load characteristics of DC shunt motor
6. Load characteristics of DC series motor
7. Load characteristics of DC compound motor (Differential and Cumulative)
8. Speed control of DC shunt motor
9. Swinburne's test on DC shunt motor
10. Hopkinson's test.
11. OC and SC test on single phase transformer
12. Load test on single phase transformer
13. Parallel Operation of Single Phase Transformer
14. Sumpner's Test on Single Phase Transformer

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Analyze the no load and load characteristics of DC Generators
- CO2 - Examine the electrical and mechanical characteristics of various motors.
- CO3 - Evaluate the performance characteristics on constant flux machine and adapt various speed control techniques on DC shunt motor.
- CO4 - Determine the performance characteristics of a DC machine when operating as motor and as generator.
- CO5 - Investigate the performance, regulation and losses on single phase transformer.
- CO6 - Investigate performance indices of transformer using standard analytical as well as graphical methods.