

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech. in Electrical Engineering
Semester:	IV
Course Code:	2EE101CC26
Course Title:	Transformers and DC Machines
Course Type:	Core
Year of Introduction:	2023 – 24

L	T	Practical component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. infer the construction and operating principles of transformers and DC machines **(BL2)**
2. determine the performance parameters of transformers and DC machines **(BL3)**
3. relate the use of Permanent Magnet materials in DC machines **(BL4)**
4. select transformers and DC machines for specific applications **(BL3)**

Content:

Teaching Hours: 30

Unit-1 Single-Phase Transformers

10

Construction and operating principle of single-phase transformer, operation at no load and on load, inrush current, phasor diagram, equivalent circuit, various losses, efficiency, voltage regulation and its calculation for different power factor, direct testing and indirect testing of transformer, all-day efficiency, the concept of power and distribution transformer, Sumpner's test, auto-transformer and its applications, concept of welding transformer, furnace transformer, traction transformer etc.

Unit-2 Three-Phase Transformers

08

Construction and operating principle of a three-phase transformer, different types of connections, phasor diagrams (vector groups), open delta connection, parallel operation of three-phase transformers, load sharing between transformers in parallel, Scott connection, selection of three-phase transformers for various applications

Unit-3 DC Machines

12

Construction and operating principle of DC machines, types of dc machines, the concept of DC generators, emf equation of generator, armature reaction, back emf and factors affecting it, dc motor starters, motor torque equation, characteristics, speed control, types of permanent magnet materials - B-H loop and demagnetization characteristics, temperature dependence and effects, construction and working of Permanent Magnet DC motor, characteristics and applications of Permanent Magnet DC motor

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

This shall consist of at least 10 practical / simulations based on the above syllabus.

Suggested Reading:

1. E. Fitzgerald, Electric Machinery, TMH Publications.
2. M. G. Say, Alternating Current Machines, CBS publishers.
3. Nagrath and Kothari, Electrical Machines, TMH Publications.
4. P. S. Bhimbra, Electrical Machinery, Dhanpat Rai Publishers.
5. B. L. Theraja, Electrical Technology, Vol. – II, S. Chand & Co.
6. Venkatratnam K., Special Electric Machines, CRC Press.
7. Janardanan E. G, Special Electrical Machines, Prentice Hall India Learning Pvt. Ltd.
8. Miller T. J. E., Brushless Permanent Magnet and Reluctance Motor Drives, Clarendon Press.

Suggested List of Experiments :

Title of Experiment	Hrs.
1. To understand the different components of DC machine.	2
2. To perform & analyse the external and internal characteristics of a DC shunt generator.	2
3. To perform & analyse the external and internal characteristics of a DC series generator.	2
4. To investigate the characteristic of DC series motor based on the load test.	2
5. To investigate the characteristic of DC shunt motor based on the load test.	2
6. To perform & identify the proper speed control technique for a particular application of a DC shunt motor by: (i) Armature voltage (rheostatic) control & (ii) Field control.	2
7. To analyse the performance of a 1- ϕ transformer (efficiency and regulation) by direct load test.	2
8. To evaluate the performance of a 1- ϕ transformer (efficiency and regulation) by indirect load test i.e., using S.C & O.C test.	2
9. To understand & verify the voltage relationship in different types of connections in 3- ϕ transformer and classify them based on the phase displacement.	2
10. To perform & analyse the parallel operation of two 3- ϕ transformers.	2
11. To perform & obtain 2- ϕ supply from the 3- ϕ supply using Scott connection.	2
12. To analyse characteristics of Permanent Magnet DC Motor.	2

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2023 - 24 and onwards