

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech. in Electrical Engineering
Semester:	IV
Course Code:	2EE101
Course Title:	Transformers and DC Machines
Course Type:	Core
Year of Introduction:	2023 – 24

L	T	Practical component				C
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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)

Syllabus:

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, 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, Dhanpatrai 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 (not restricted to the following):**(Only for Information)**

1. To understand the different components of DC machine.
2. To perform & analyze the external and internal characteristics of a DC shunt generator.
3. To perform & analyze the external and internal characteristics of a DC series generator.
4. To investigate the characteristic of DC series motor based on the load test.
5. To investigate the characteristic of DC shunt motor based on the load test.
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.
7. To analyze the performance of a 1- \emptyset transformer (efficiency and regulation) by direct load test.
8. To evaluate the performance of a 1- \emptyset transformer (efficiency and regulation) by indirect load test i.e. using S.C & O.C test.
9. To understand & verify the voltage relationship in different types of connections in 3- \emptyset transformer and classify them based on the phase displacement.
10. To perform & analyze the parallel operation of two 3- \emptyset transformers.
11. To perform & obtain 2- \emptyset supply from the 3- \emptyset supply using Scott connection.
12. To analyze characteristics of Permanent Magnet DC Motor.

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

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