



First Semester 2018-19

Part - II

Date: Aug 2, 2018

In addition to Part-I (General Handout for all courses appended to the time table), this portion gives further specific details regarding the course.

Course No: **EEE F211 /INSTR F211**

Course Title: **Electrical Machines**

Instructor-in-charge: **HARI OM BANSAL (e-mail: hbansal@pilani.bits-pilani.ac.in)**

Instructors: **Lecture:** Hari Om Bansal and Rajneesh Kumar

Tutorial: Dheerendra Singh, Hari Om Bansal, Hitesh Dutt Mathur, Rajneesh Kumar, Jahagirdar Ankush

Practical: Tulsi Ram Sharma, Prashant Upadhyay, Heema Dave, Ravinder Kumar, Krishna Veer Singh, Dhananjay Kumar

1. Scope and Objective of the Course:

Electrical Machines are the work horse in almost all industries ranging from few watts' power to several mega watt power applications. The scope of this course is to study of working principle & operating characteristics of Electrical Machines for the mode of Generation, and Utilization of Electrical Power. The specific objective of this course is to gain better understanding of various conventional electrical-magnetic devices such as Transformer, DC Machines and AC Machines.

The course covers theory as well as detailed experimental component for better understanding of the concepts.

2. Text Book:

T1 I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill, 4th Edition, 2010.

T2 Electrical Machines Laboratory Manual by Nagrath I.J & M.R. Poonkuzhali, 1998.

3. Reference Books:

R1 Bhag S. Guru and Huseyin R. Hiziroglu, "Electric Machinery and Transformers", Oxford.

R2 P.S. Bimbhra, "Electrical Machinery", Khanna Publishers.





4. Course Plan:

Lecture No.	Topic to be Covered	Learning Objectives	Reference to Text Book (T1)
1-2	Introduction to Poly-phase system.	Review of Single /Three-phase system, Concepts of various power & their measurement.	Appendix-I & II
3 -6	Introduction to Magnetic Ckt.	Review of elementary concepts of Magnetic circuit, their electrical analogy, AC-operation of magnetic circuit, energy stored & losses.	2.1-2.6
7-11	Transformer: Single-Phase	Construction, Principle of Operation, Ideal Transformer, Equivalent Circuit. Practical Transformer, Transformer on No-load and on Load, Equivalent Circuit, per unit system	3.1-3.8
		Transformer Losses, Testing, Efficiency, Voltage Regulation, Harmonics in Transformer	3.9, 3.10
		Parallel Operation of Transformers	3.14
12-13	Transformer: Three-Phase	Three Winding Transformers, different 3-phase transformer connections, Phase Conversion (Scott Connection), Equivalent Circuits, Tap changing transformers	3.13, 3.15, 3.16, 3.17
14	Autotransformer	Single Phase Autotransformer	3.11
15-20	Basic Concepts of Rotating Machine	Generated EMF, Rotating Mag. Field-Concepts,	5.1-5.7 & 5.10
21-25	Three-Phase Induction Motors	Constructional features, Principle of operation, Rotating Magnetic Field, Circuit Model, Phasor diagram, Induction Generator, starting and speed control	9.1 - 9.6, 9.8-9.10
26-28	Fractional Kilowatt Motors(Single-phase Ind. Motor)	Principle of development of rotating two fields. Types of single phase Induction Motor,	10.1-10.3
29-33	Synchronous Machine	Constructional details, Circuit Model, Operating Characteristics, V –curves, Efficiency	8.1,8.4, 8.9-8.11
34-40	DC Machine	Constructional details, EMF & Torque relationship, Armature reaction , Compensating winding	7.1-7.11
		Speed Control of DC Motors, Speed Regulation, Efficiency, Swinburne's Test and Hopkinson's Test on DC Motors	7.15-7.17, 7.19





5. Evaluation Scheme:

Evaluation Component	Duration	Marks (300)	Date & Time	Evaluation Type
Mid-Semester Test	90 Min	70	9/10 2:00 - 3:30 PM	OB
Quizzes	10 Min	60	Surprise, During Tutorial Hours	CB
Comprehensive Examination	180 Min	110	3/12 FN	CB
Practical: Punctuality, Lab Report & Viva	-----	33	Regular Lab Sessions	OB
Lab Test	-----	27	To be Announced	CB

6. List of Experiments: (Text Book –T2)

- 1) (a) Open circuit & Short circuit tests on a single phase Transformer.
(b) Sumpner's test on a single phase Transformer.
- 2) No load tests on a DC Shunt motor.
- 3) No load tests on a DC Shunt generator.
- 4) Load test on a DC Shunt Generator.
- 5) Design of Single-Phase Transformer.
- 6) (a) Parallel operation of two single phase Transformers.
(b) Scott connection of single phase Transformers.
- 7) Hopkinson's test on DC machines.
- 8) Open circuit and Short circuit tests on a Synchronous machine
- 9) Load test on a Synchronous motor.
- 10) Load test on a three phase Induction motor.
- 11) No-load and blocked rotor tests on a three phase induction motor.

7. **Chamber Consultation Hours:** To be Announce in the class

8. **Notices:** All notices will be displayed on EE Notice Board and Nalanda only.

9. **Make-Up Examination:** Makeup will be granted to extremely genuine cases only.

Instructor in Charge
Electrical Machines (EEE/INSTR F211)

