First Semester 2016-17

Part - II

Date: Jul 30, 2016

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: **DHEERENDRA SINGH**

Room No: 2210-L, (e-mail: dhs@pilani.bits-pilani.ac.in)

Instructors: **Tutorial**: Dheerendra Singh, Hari Om Bansal, Hitesh Dutt Mathur, Rajneesh Kumar, Ashish Patel.

Practical: Dheerendra Singh, Rajneesh Kumar Tulsi Ram Sharma, Prashant Upadhyaya Fani Mani, Heema Dave, Ravinder Kumar, 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, 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 (EDD Notes), 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, 3.2- 3.6
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	3.1-3.87
		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	3.13, 3.15, 3.16,
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	9.2 - 9.6, 9.13,
26-28	Fractional Kilowatt Motors(Single-phase Ind. Motor)	Principle of development of rotating two fields. Types of single phase Induction Motor,	10.1,10.2,10.5
29-33	Synchronous Machine	Constructional details, Circuit Model, Operating Characteristics, Power flow, Capability Curve,	8.1,8.2, 8.9-8.14
34-35		Synchronizing Power (Torque), Slip Test, Hunting, Starting, Parallel Operation of Synchronous Generators	8.15, 8.16, 8.17, 8.18, 8.19,
36-40	DC Machine	Constructional details, EMF & Torque relationship, Armature reaction , Compensating winding	7.1-7.13
		Speed Control of DC Motors, Speed Regulation, Efficiency, Swinburne's Test and Hopkinson's Test on DC Motors	7.17, 7.19,7.20
41	Special Electric Machines	Overview of Stepper Motors, Switched Reluctance Motors, Linear Electric Motors, Induction Generators	7.22, 8.22, 9.17, 10.6, 10.7

5. Evaluation Scheme:

Evaluation Component	Duration	Marks (300)	Date & Time	Evaluation Type
Mid-Semester Test	**90 Min**	**75**	To be Announced	**CB**
Assignments + Quizes	**10 Min**	60	During Tutorial Hours	**OB+CB**
Comprehensive Examination	**180 Min**	**105**	**12/12, FN**	**CB**
Practical: Punctuality, Lab Report & Viva	-------	30	Regular Lab Sessions	**OB**
Lab Test	-------	30	To be Announced	**CB**

6. List of Experiments: (Reference 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 Ttransformers.
   (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: **Thursdays, 4:00 PM to 06:00 PM.**

8. Notices: EEE Notice Board (FD-II) & Nalanda.

9. Make-Up Examination: Make-up of Comprehensive Exam will be permitted, ONLY in case of Sickness Resulting in Hospitalization or extremely genuine reason. No make-up will be permitted for other evaluation components.

Dr. Dheerendra Singh
Instructor I/C
Electrical Machines (EEE/INSTR F211)