First Semester 2015-16

Part - II

Date03/08/2015

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: **Dr. PRADYUMN CHATURVEDI**

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

Instructors: **Tutorial**: Hitesh Dutt Mathur, Dheerendra Singh, Rajneesh Kumar, A. Anand Kumar**.**

Practical: Hitesh Dutt Mathur, Rajneesh Kumar, A. Anand Kumar, Tulsi Ram Sharma, Fani Mani, Aishwarya Pandey, Yogesh Krishnan, Ravinder Kumar, Dhananjay Kumar.

1. Scope and Objective of the Course:

Electrical Machines are the prime driving force in almost all industries ranging from few micro watts power to several mega watt power applications. The scope of this course is to study Electrical Machines for Generation, Transmission, Distribution and Utilization of Electrical Power. The specific objective of this course is to gain better understanding of various conventional electrical machines (such as Transformer, DC Machines, AC Machines i.e. Induction Machines & Synchronous Machines) as well as special electrical machines (such as Stepper Motors, Switched Reluctance Motors, Linear Electric Motors, Induction Generators etc.). 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 M. G. Say, "The Performance and Design of Alternating Current Machines", CBS Publisher.
R2 Bhag S. Guru and Huseyin R. Hiziroglu, "Electric Machinery and Transformers", Oxford.
R3 P.S. Bimbhra, "Electrical Machinery", Khanna Publishers.

4. Course Plan:

Lecture No.	Topic to be Covered	Learning Objectives	Reference to Text Book (T1)
1	Introduction to the Course	Overview of Electrical Machines	1.1, 1.2, 1.3
2-3	Transformer: Single-Phase	Construction, Principle of Operation, Ideal Transformer, Equivalent Circuit	3.2, 3.4, 3.5
4-5		Practical Transformer, Transformer on No-load and on Load, Equivalent Circuit	3.3, 3.5

6-7		Transformer Losses, Testing, Efficiency, Voltage Regulation, Harmonics in Transformer	3.6, 3.7, 3.9, 3.10
8		Parallel Operation of Transformers	3.14
9-11	Transformer: Three-Phase	Three Winding Transformers, different 3-phase transformer connections, Phase Conversion (Scott Connection), Equivalent Circuits	3.13, 3.15, 3.16,
12	Autotransformer	Single Phase Autotransformer	3.11
13-14	DC Machines: DC Motors	Construction, Principle of Operation, Armature Windings, EMF, Torque, Circuit Model, Armature Reaction, Commutation	7.1, 7.2, 7.4 - 7.8
15-16		Methods of Excitation, Characteristics of DC Motors	7.9, 7.15
17-18		Starting of DC Motors, Braking of DC Motors	7.16, 7.18
19-20		Speed Control of DC Motors, Speed Regulation, Efficiency	7.17, 7.19
21		Swinburne's Test and Hopkinson's Test on DC Motors	7.20
22-23	DC Machines: DC Generators	Operating Characteristics of DC Generators, Parallel Operation of DC Generators	7.10, 7.13
24-25	Three-Phase Induction Motors	Constructional features, Principle of operation, Rotating Magnetic Field, Circuit Model, Phasor diagram	9.2 - 9.5
26-28		Steady State Characteristics, Speed Control	9.5, 9.10
29-30		Starting, Cogging, Crawling, Braking Methods	9.8, 9.9
31		Testing on 3-phase induction motors	9.6
32-33	Synchronous Machines	Constructional features, synchronous generator and motor, equivalent circuit, phasor diagram	8.2, 8.3
34-35		Determination of synchronous reactance	8.4
36		Nature of Armature Reaction, Synchronizing to infinite bus bar	8.8, 8.9
37		Operating characteristics	8.10
38		Efficiency, Power flow equation, Power and Torque Characteristics, Capability Curve	8.11 - 8.13
39		Synchronizing Power (Torque), Slip Test, Hunting, Starting	8.15, 8.16, 8.18, 8.19
40		Parallel Operation of Synchronous Generators	8.17
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**	**90**	7/10 2:00 - 3:30 PM	**CB**
Quiz	20 Min	30	During Tutorial Hours	CB
Comprehensive Examination	**180 Min**	**120**	7/12 FN	**CB + OB**
Practical: Punctuality, Lab Report & Viva	-------	30	Regular Lab Sessions	------
Lab Test	-------	30	To be Announced	CB

6. List of Experiments:

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: **Thursdays, 4:00 PM to 06:00 PM.**

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

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. Pradyumn Chaturvedi
Instructor I/C
Electrical Machines (EEE/INSTR F211)