BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
HYDERABAD CAMPUS
INSTRUCTION DIVISION
FIRST SEMESTER 2015-2016

Course Handout

Date: 25.07.2016

In addition to general handout for all courses appended to the time table, this portion gives further specific details regarding the course.

Course No. : EEE F211/ECE F211/INSTR F211
Course Title : ELECTRICAL MACHINES Instructor-in-charge : Madhuri Bayya
Team of instructors : Dr. Alivelu Manga Parimi , Dr.RaviTeja

1. **Course Description**:
   Transformer: Constructional features, Equivalent circuit and phasor diagram , Regulation and efficiency, Parallel operation , Three phase transformer connections, Testing - open circuit, short circuit and Sumpner's test , Phase conversion – Scott Connection, Autotransformer.
   DC Machines: Construction, principle of operation, armature windings, armature voltage and torque equations, classification and applications. DC generators- armature reaction and performance characteristics; DC motors - torque/speed characteristics, speed control and braking, Testing and efficiency.
   Induction machines: Constructional features and classification, Rotating magnetic field, Equivalent circuit model. Steady state characteristics. Testing, starting and speed control. Wound rotor induction motors, Single phase induction motors - classification and equivalent circuit.
   Synchronous machines: Constructional features and classification , Synchronous generators and motors, Armature Reaction, Equivalent circuit and phasor diagram, Power and torque characteristics, Parallel operation. Synchronous impedance and its determination, Starting and speed control of synchronous motors.

2. **Scope and objective of the Course:** To obtain a thorough knowledge on the performance and control of transformers, induction machines, dc machines, synchronous machines during normal and extreme working conditions.

3. **Text Book :**
   1. Nagrath I J and D P Kothari - Electric Machines – Tata McGraw Hill, 4th edition, 2010.
   2. Electrical Machines Laboratory Manual by Nagrath I.J & M.R. Poonkuzhali (EDD Notes), 2007.

4. **Reference Books :**
   1. Edward Hughes, Electrical and Electronics Technology , Pearson, 5th edition 2012

2. Stephen J. Chapman , Electric Machinery Fundamentals , McGraw Hill , 4th Edition , 2005

3. P.C. Sen, Principles of Electric Machines and Power Electronics, John Wiley & Sons , 2nd Edition 1996

4. M.G. Say – Performance and Design of AC machines –Pitman

5. Course Plan :

Lec. No.	Learning Objectives	Topic to be covered	References
1-2	Overview of the course and Study of magnetic circuits	Magnetic Circuits Review	2.1 to 2.2 of T1 7.1 to 7.8 of R1 1.1 to 1.3 of R3
3-6	Transformer operation	Construction ,Principle of operation, Equivalent circuit, Phasor diagrams, voltage regulation, efficiency, No-load, full-load and Sumpner's test	3.1 to 3.9, 3.12 of T1 34.1 to 34.19, of R1 2.1 to 2.4 of R3
7	To learn about Auto-transformer	Use & Analysis	3.11 of T1 34.21 of R1 2.5 of R3
8-9	To learn three phase transformer operation	Connections, Phasor groups ,Applications and per unit system	3.13 of T1 2.10 of R2 2.6 to 2.8 of R3
10	To learn parallel operation of transformers	Parallel operation and Load sharing	3.14 of T1
11	To learn about phase conversions and tap changing in transformers	Three phase to two phase conversions (Scott connection) and Tap changing in transformers	3.16 to 3.17 of T1 2.11 of R2
12-15	To learn working of DC Machines	DC Machines principle of operation , Construction and classification , Armature winding ,Armature reaction	7.15 of T1 41.1 to 41.6 of R1 4.2 to 4.3 of R3
16	To review principle of operation of DC motor and its characteristics	Shunt, series & compound motors	7.15 of T1 42.1 to 42.6 of R1 4.4 of R3
17-18	Starting , Braking and Speed Control of DC motors	Shunt motor starter step calculation, Speed control, Plugging, Dynamic & Regenerative braking	7.16 to 7.18 of T1 42.7 of R1 9.4 of R2 4.4 of R3

19-20	Performance evaluation of DC machines	Efficiency & Testing of DC machines	7.19 of T1
21-24	To learn about principle of operation of three phase induction machine	Construction, Classification, Rotating Magnetic Field , Slip and frequency of rotor currents ,Equivalent Circuit Model , Power Flow and Torque slip characteristics.	9.1 to 9.3 of T1 36.5 to 36.6 and 38.1 to 38.5 of R1 5.1 to 5.7 and 5.9 to 5.10 of R3
25-29	To learn about testing starting , speed control and braking of three phase induction motor	No-Load and short circuit tests, Starting, Speed control, plugging and regeneration	9.6 to 9.10 of T1 38.6 to 38.10 of R1 5.8 , 5.13 to 5.14 of R3
30-31	Single phase induction motor	Operation & characteristics of single phase induction motor	10.1 to 10.2 of T1 38.11 to 38.14 of R1 7.1 and 7.3 of R3
32-35	To learn about synchronous machines	Operation, circuit model, armature reaction, synchronous impedance and its determination	8.1 to 8.6 of T1 36.1 to 36.4 and 37.1 to 37.3 of R1 6.1- 6.2 and 6.4 of R3
36-40	To learn about synchronizing , operating characteristics of and Power transfer in a synchronous generator	Synchronizing to infinite bus bar, Operating characteristics, Power angle characteristics, Operation at constant load with variable excitation, Power flow equation, power angle characteristics and Parallel operation	8.7 to 8.8 of T1 37.4 of R1 6.5 of R3
41-42	To learn about starting and speed control of synchronous motor.	Starting and speed control techniques of synchronous motor , Application of Synchronous condenser	8.10 to 8.12 of T1 37.6 of R1 6.3,6.7 and 6.10.1 of R3

6. Evaluation Scheme:

Component	Duration	Weightage	Date & Time	Remarks
Test 1	60 mins	45 Marks (15%)	As per time table	CB
Test 2	60 mins	45 Marks (15%)	As per time table	CB
Lab Record	-	60 Marks (20%)		OB
Lab Test	-	45 Marks (10%)		CB
Comprehensive Examination	3 Hrs	105 Marks (35%)	06/12/15 , FN	CB

7. **Make-up Policy:** Only those who apply (with genuine reason) before the start of test will be granted permission for make-up.
8. **Notices:** Notices concerning this course will be displayed on the EEE Notice Board and CMS.

Instructor-in-charge
EEE F211/ECE F211/INSTR F211