

BITS, PILANI – K K BIRLA GOA CAMPUS

INSTRUCTION DIVISION

FIRST SEMESTER 2016-2017

Course Handout (Part II)

Date: 02.08.2016

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 : Prof. K E Raman

Team of Instructors : Narayan S Manjarekar, K Chandram, Shashidhara M Kotian, C Balakrishna Moorthy, R Femi, Metilda M, Bharatbushan.

1. **Course Description:** Theory, performance, testing, applications and control of DC machines, induction machines, synchronous machines and transformers. Experiments on testing and control of machines and transformers. Fractional HP motors and miniature motors.
2. **Scope and objective of the Course :** The course aims at
 - Understanding the construction and operation of electrical machines.
 - Modeling of electrical machines
 - Performance analysis of electrical machines in steady state.
 - Understanding real life applications of electrical machines.
 - Aspects in controlling electrical machines
3. **Text Book :** D P Kothari and Nagrath I J - Electric Machines - TMH, 4th ed., 2004.
4. **Reference Books :**
 1. P.S. Bimbhra, Electrical Machinery, Khanna Publishers, 7th Ed.
 2. A Fitzgerald, C Kingsley, S Umans, Electrical Machinery, Tata Mcgraw Hill Education Private Limited, 6th Ed, 2002
 3. Theodore Wildi, Electrical Machines, Drives and Power Systems, Pearson, 6th Ed, 2007
 4. Irving Kosow, Electric Machinery and Transformers, Pearson, 2nd Ed, 2007

5. Course Plan :

Lec No	Learning Objective	Topics to be covered	References (T1)
1,2	Introduction	Introduction to Electric Machines	Chapter 1
3	Introduction to transformers	Transformer on no load, ideal transformer, Real-life transformer	3.3, 3.4, 3.5
4,5	Modeling and Testing	Equivalent ckt - exact and approximate, name-plate rating, phasor diagram	3.5
6,7		Losses, Testing- OC SC Sumpner's Test	3.6, 3.7
8		PU system, efficiency, regulation	3.8, 3.9
9,10	Autotransformer, 3-phase transformer	Autotransformer, 3-phase transformer	3.11, 3.13
11	Transformer operation	Parallel operation	3.14
12		Phase conversion - Scott connection, Special transformers- CT PT	3.16, 3.18
13,14	Basics of rotating machines	Elementary machines, Generated emf	5.2, 5.3
15,16		mmf of distributed AC winding, Rotating magnetic field, Torque in round rotor machines	5.4, 5.5, 5.6
17		Operation of basic machine types, Magnetic leakage in rotating machines	5.7, 5.9
18	Introduction to DC Machines	DC Machines: emf and torque, circuit model	7.2-7.5
19		Armature reaction, compensating winding, commutation	7.6-7.8
20,21	Characteristics of DC machines	Methods of excitation, Operating characteristic of DC generator, self excitation, Parallel operation	7.9-7.14
22,23		Characteristics of DC motors	7.15
24,25	DC machine operations	Speed control , braking, efficiency and testing	7.17-20
26	Dynamics of DC machines	DC machine dynamics, applications	7.21, 7.23
27,28	Introduction to synchronous machines	Basic synchronous machine model, circuit model, determination of synchronous reactance, mmf method	8.1 - 8.5
29		Armature reaction	8.8
30,31	Synchronous machine operations	Synchronization, operating characteristics	8.9 -8.10
32		Efficiency, power flow	8.11-8.12
33	Stable operation of alternators	Staying in synchronism, hunting	8.15, 8.18
34,35	To learn basic principle of 3phase Induction Machines	Induction machines: Construction, principle of operation	9.1-9.3
36-38	To learn modeling and testing of 3phase Induction Motor	Equivalent circuit, Power across air gap-power output, Determination of circuit model	9.4-9.6
39-41	Starting and speed control	Starting, Cogging-crawling, speed control	9.8-9.10
42	Special machines	Brushless DC Machines, Fractional KW motors	Class notes

6. LABORATORY COMPONENT : The list of experiments to be performed is as follows

1. Tests on a Single phase transformer
2. Load test on a DC shunt generator
3. Three phase power measurement
4. Three phase alternator: Open circuit and short circuit characteristics
5. Three phase induction motor: no-load and blocked-rotor test
6. Three phase alternator: load test
7. Transformer: Sumpner's test
8. DC motor: Swinburne's test and speed control
9. DC generator OC SC characteristics

7. Evaluation Scheme :

Evaluation Component	Duration	Weightage (Marks)	Date and Time	Evaluation type
Test I	60 min	45	23/09/2016, 8.30-9.30 AM	CB
Test II	60 min	45	28/10/2016, 8.30-9.30 AM	CB
Quizzes / Assignments	-	20	To be announced later	CB/OB*
Comprehensive	3 hours	100	10/12/2016, FN	CB/OB*
Laboratory	-	90	-	CB/OB*

OB* - Open textbook and/or handwritten notes only. Minimum 20% of the evaluation component will be OB.

8. Chamber Consultation Hour: To be announced in the class.

9. Make up Policy: Make up will be granted **only on genuine grounds**.

10. Notices: Notices concerning this course will be displayed on the EEE&I Notice Board and Moodle course webpage

Instructor-in-charge

EEE F211/INSTR F211