

BITS, PILANI – K K BIRLA GOA CAMPUS
INSTRUCTION DIVISION
FIRST SEMESTER 2018-2019
Course Handout (Part II)

Date: 02.08.2018

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. : ECE F211 / EEE F211 / INSTR F211

Course Title : Electrical Machines

Instructor-in-charge : NARAYAN S MANJAREKAR

Team of Instructors : Shashidhara M Kotian, Gautam Bacher, Vivek Chandran, D R Karthik, Ravishankar Desai

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		Special transformers- CT PT	3.18
13,14	AC Armature winding	AC windings	Ch 6
15-16	Introduction to DC Machines	DC Machines: emf and torque, circuit model	7.2-7.5
17-19	Characteristics of DC machines	Methods of excitation, Operating characteristic of DC generator, self excitation, Parallel operation	7.9-7.14
20,21		Characteristics of DC motors	7.15
22	DC machine operations	Speed control , braking, efficiency and testing	7.17-20
23,24	Basics of rotating machines	Elementary machines, Generated emf	5.2, 5.3
25,26		mmf of distributed AC winding, Rotating magnetic field, Torque in round rotor machines	5.4, 5.5, 5.6
27		Operation of basic machine types, Magnetic leakage in rotating machines	5.7, 5.9
28,29	Introduction to synchronous machines	Basic synchronous machine model, circuit model, determination of synchronous reactance	8.1 – 8.4
30		Armature reaction	8.8
31,32	Synchronous machine operations	Synchronization, operating characteristics	8.9 -8.10
33-34		Efficiency, power flow	8.11-8.12
35,36	To learn basic principle of 3phase Induction Machines	Induction machines: Construction, principle of operation	9.1-9.3
37-39	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
40	Circle diagram	Circle diagram	9.7
41,42	Starting and speed control	Starting, speed control	9.8,9.10

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. DC motor: Swinburne's test and speed control
8. No load test on a DC shunt generator

7. Evaluation Scheme :

Evaluation Component	Duration	Weightage (Marks)	Date and Time	Evaluation type
Assignments	-	40	To be announced later	OB
Midsemester examination	90 min	60	12/10/2018, 9.00-10.30 AM	CB
Quiz		20	To be announced later	CB
Comprehensive examination	3 hours	100	05/12/2018, FN	CB
Laboratory	-	80	-	CB/OB*

OB* - Open textbook and/or handwritten notes only.

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 Moodle course webpage

Instructor-in-charge

ECE F211/EEE F211/INSTR F211