

**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI**  
**K K BIRLA GOA CAMPUS**  
**FIRST SEMESTER 2020-2021**  
**Course Handout (Part II)**

Date: 18.08.2020

In addition to part-I (General Handout for all courses appended to the Timetable) 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 :** Soumyabrata Barik, Gautam Bacher, Rakesh R Warier, Vivek Chandran, D R Karthik, Ravishankar Desai, Gopika R

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 Objectives 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, 4<sup>th</sup> ed., 2004.
4. **Reference Books:**
  1. P.S. Bimbhra, Electrical Machinery, Khanna Publishers, 7<sup>th</sup> Ed.
  2. A Fitzgerald, C Kingsley, S Umans, Electrical Machinery, Tata McGraw Hill Education Private Limited, 6<sup>th</sup> Ed, 2002
  3. Theodore Wildi, Electrical Machines, Drives and Power Systems, Pearson, 6<sup>th</sup> Ed, 2007
  4. Irving Kosow, Electric Machinery and Transformers, Pearson, 2<sup>nd</sup> 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 circuit - 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. No load test on a DC shunt generator
4. DC motor: Swinburne's test and speed control
5. Three phase alternator: Open circuit and short circuit characteristics
6. Three phase alternator: load test
7. Three phase power measurement
8. Three phase induction motor: no-load and blocked-rotor test

**7. Evaluation Scheme:**

Evaluation Component	Duration	Weightage (%)	Date and Time	Evaluation type
Test 1	30 min	15	15/09/2020, tutorial hour	OB
Test 2	30 min	15	13/10/2020, tutorial hour	OB
Test 3	30 min	15	10/11/2020, tutorial hour	OB
Quizzes (Details to be announced)	To be announced	15	Unannounced (Details to be announced)	OB
Comprehensive Examination	2 hours	25	10/12/2020, AN	CB/OB
Laboratory	-	15	-	OB

Date and time announced for the tests are tentative.

OB - Open textbook and/or handwritten notes.

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

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

No make up for unannounced evaluation components.

**10. Notices:** Notices concerning this course will be displayed on Moodle course webpage:

<https://quanta.bits-goia.ac.in/> course: ECE\_EEE\_INSTR F211

Instructor-in-charge

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