FIRST SEMESTER 2025-2026

Course Handout (Part II)

Date: 05.08.2025

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. : **EEE F211 / ECE F211 / INSTR F211**

Course Title : **Electrical Machines**

Instructor-in-charge : Sudarshan Swain

Team of Instructors : Mahendra Singh Tomar, Martin Cheerangal Joy, Gautam Bacher, Narayan S. Manjarekar, Mriganka Biswas.

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, 4th ed., 2004.

4. **Reference Books:**
   I. P.S. Bimbhra, Electrical Machinary, Khanna Publishers, 7th Ed.
   II. A Fitzgerald, C Kingsley, S Umans, Electrical Machinary, Tata Mcgraw Hill EducationPrivate Limited, 6th Ed, 2002
   III. Theodore Wildi, Electrical Machines, Drives and Power Systems, Pearson, 6th Ed, 2007
   IV. Irving Kosow, Electric Machinery and Transformers, Pearson, 2nd Ed, 2007

5. **Method of conduct of the course:** Lectures will be conducted as per the timetable from AUGSD using slide/blackboard.

6. **Course Plan:**

Lec. No	Learning Objective	Topics to be covered	References (T1)
1-3	Introduction	Introduction to Electric Machines	Chapter 1
4	Introduction to transformers	Transformer on no load, ideal transformer, Real-life transformer	3.3, 3.4, 3.5
5-7	Modeling and Testing	Equivalent circuit - exact and approximate, name-platerating, phasor diagram	3.5
8-9		Losses, Testing- OC SC Sumpner's Test	3.6, 3.7
10		PU system, efficiency, regulation	3.8, 3.9
11	Autotransformer, 3-phasetransformer	Autotransformer, 3-phase transformer	3.11, 3.13
12	Transformer operation	Parallel operation	3.14
		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 DCgenerator, 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 inrotating machines	5.7, 5.9
28-29	Introduction to	Basic synchronous machine model, circuit model,	8.1 – 8.4

	synchronousmachines	determination of synchronous reactance	
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 3phaseInduction Machines	Induction machines: Construction, principle of operation	9.1-9.3
37-39	To learn modeling and testing of3phase Induction Motor	Equivalent circuit, Power across air gap-power output,Determination of circuit model	9.4-9.6
40-41	Starting and speed control	Starting, speed control	9.8,9.10

7. 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. DC motor: Swinburne's test and Speed Control
4. Three phase alternators: Open circuit and short circuit characteristics
5. Three phase induction motor: no-load and blocked-rotor test

8. Evaluation Scheme:

Evaluation Component		Duration	Weightage(%)	Date & Time	Evaluation type
Mid-semester Examination		90 min	25 (75 Marks)	09/10/25 (11:30AM - 1:00 PM)	CB
Theory quizzes /Assignments	Quiz-1	40 min	10 (30 Marks)	26/09/2025	1 best out of 2 OB
	Quiz-2	40 min		22/11/2025	
	Assignment-1	30 min	5 (15 Marks)	01/09/2025	OB
	Assignment-2	30 min	5 (15 Marks)	03/11/2025	OB
Comprehensive Examination		3 hours	30 (90 Marks)	08/12/25 (AN)	CB
Laboratory (Exp./Reports,Lab comprehensive)			25 (75 Marks)	TBA	CB

CB - Closed-book.
OB - Open textbook and/or handwritten class notes (in hard-copy format) only.

9. **Chamber Consultation Hour:** To be announced in the class.
10. **Make up Policy:** Make up will be granted **only on genuine grounds**.
    No make up for theory quizzes/assignments.
11. **Notices:** Notices regarding this course will be displayed on Moodle course webpage:https://quantaaws.bits-goa.ac.in/ course: EEE F211 ECE F211 INSTR F211

Instructor-in-charge

EEE F211 / ECE F211 / INSTR F211