

**DEPARTMENT OF ELECTRICAL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, JAMSHEDPUR**

JHARKHAND-831014

AUTUMN SEMESTER - 2020

Course Handout

Date 11.08.2020

COURSE NO. : EE 1502
COURSE TITLE : ELECTRICAL MACHINES-II
FACILITATOR : Dr. K. B. Yadav

COURSE DESCRIPTION :

Induction Machines: deep bar and double cage motors, effects of space harmonics on induction machine performance- crawling and cogging, induction generators.

Induction motors with injected emf in the rotor; Induction regulators, Linear Induction Motors.

Single-phase induction motors, AC commutator machines – universal and repulsion motors.

Synchronous Machines : Construction and type, windings, generator and motor operation, Armature reaction, Phasor diagram, Two–axis theory, voltage regulation, Parallel operation of alternators, Starting of synchronous motors, V- Curves, torque- angle characteristic, hunting.

Permanent Magnet (PM) stepper motors, Variable Reluctance (VR) stepper, torque-pulse rate characteristics, Applications of stepping motors.

SCOPE:

- To start with generalized approach of explaining the principles of electrical machines and their applications.
- To provide a fundamental exposure to the characteristics of rotating electrical machinery in terms of useful facts and figures.
- To make the learners aware with basic tools of modeling, simulation & analysis of machines performance under different operating conditions.
- To improve the analytical skill of beneficiaries when deals with the individual machines.

OBJECTIVES:

At the end of this course the students will have

- ❖ Clear understanding of construction, operating principle & characteristic of studied machines.
- ❖ In-depth and updated knowledge regarding the performance & behavior of rotating ac machineries
- ❖ Ability to plan, design, analyzes & recommends a suitable machine for a particular application for utility.

TEXT BOOKS:

- T1. Stephen J. Chapman, “Electric Machinery Fundamentals”, 5th Edition-2012, McGraw-Hill Edition, New York.
- T2. Asfaq Hussain “Electric Machines”, 2nd Edition, Dhanpat Rai & Co., Delhi.

REFERENCE BOOK:R1. S.K. Bhattacharya, “Electrical Machines”, 3rd Edition, Tata McGraw-Hill Edition, New Delhi

R2: S. K. Sahdev, “Electrical Machines”, Cambridge University Press 2018

COURSE PLAN & FLOW

| Lecture No. | Learning objectives | Topic to be covered | Refer to book |
|-------------|--|---|---------------|
| 1-2 | Overview & Perspective of the course | Introduction, detailed course plan & review of course | T1,T2 & R1 |
| 3-8 | Induction Machines performance in motoring and generating mode | Constructional features, Electrical equivalent circuit, Power flow diagram, Development of torque equation, Deep bar and double cage motors, effects of space harmonics on induction machine performance- crawling and cogging, | T1,T2 & R1,R2 |
| 9-12 | Induction machines operation as a motor | Induction motors with injected emf in the rotor; Induction generators, Induction regulators, Linear Induction Motors. | T1 & R1 |
| 14-20 | Single phase induction machine & its application | Single-phase induction motors, AC commutator machines – universal and repulsion motors | T1,T2 & R1 |
| 21-25 | Synchronous Machines | Constructional details, classifications & winding | T1&R2 |
| 26-30 | Synchronous Machines operation as generator | Armature reaction, Phasor diagram, Two – axis theory, voltage regulation, Parallel operation of alternators | R1&R2 |
| 31-36 | Synchronous Machines operation as motor | Starting of synchronous motors, V- Curves, torque- angle characteristic, hunting | T1,T2 & R1 |
| 37-41 | Synchronous Machines Applications | Permanent Magnet (PM) stepper motors, Variable Reluctance (VR) stepper, torque-pulse rate characteristics | T1,T2 & R1 |

EVALUATION SCHEME

| EC No. | Evaluation Component | Duration | Weightage (%) | Date | Nature of the component |
|--------|----------------------|------------------------|---------------|-----------------------------|------------------------------------|
| 1 | Mid Semester Exam. | 1 Hr | 30 | Institute Academic Calendar | Open Book |
| 2 | End Semester Exam. | 02 Hrs | 40 | Institute Academic Calendar | Open Book |
| 3 | Teacher Assessment | Throughout the session | 30 | During course | Attendance, Quiz Test & Discipline |

N. B. # Consultation hour: Wednesday 4 pm to 5 pm in official Chamber

Notices regarding the course will be displayed only on the Departmental notice board

Faculty-in-charge

NOTICE

The Academic session for the Autumn semester shall commence as per the Academic Calendar below in the Online Mode. ACADEMIC CALENDAR FOR AUTUMN SEMESTER 2020-21 Except 1st Semester (Blended mode)

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|---|---|
| Present Mode: Online Autumn semester begins | 12/08/2020 (Wednesday) |
| Registration for Autumn Semester 2020-21 (UG, PG, & Ph.D) | 12/08/2020 (Wednesday) to 21/08/2020 (Friday) No registration shall be allowed after this date. Un registered students name shall not be displayed in the roll sheet and the link for the Online classes. |
| Class work commences (UG, PG & Ph.D) | 17/08/2020 (Monday) |
| Mid Semester Examination (UG, PG & Ph.D) | 14/10/2020 (Wednesday) 21/10/2020 (Wednesday) |
| Declaration of Marks (Mid Semester) | 29/10/2020 (Thursday) |
| End of Class (UG, PG & Ph.D) | 04/12/2020 (Friday) |
| Lab examination | 07/12/2020 (Monday) to 10/12/2020 (Thursday) |
| End semester examination (UG, PG & Ph.D) | 14/12/2020 (Monday) to 21/12/2020 (Monday) |
| Declaration of result (UG, PG & Ph.D) | 24/12/2020 (Thursday) |
| Semester break | 25/12/2020 (Friday) |
| Spring Semester begins 2020-2021 | 04/01/2021 (Monday) |