



ELECTRICAL MACHINES - II

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Department of Electronics and Communications
IIT Kharagpur

TYPE OF COURSE : Rerun | Core | UG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 23 Apr 2022

PRE-REQUISITES : Basic Electrical Technology: Circuit analysis, Principle of working of transformer and its equivalent circuit representation.

INTENDED AUDIENCE : UG Electrical Engineering as core subject. UG Mechanical and Mining Engineering as Elective subject.

INDUSTRIES APPLICABLE TO : BHEL, CESC, NTPC, WBPDC

COURSE OUTLINE :

The course will begin with explaining basic underlying principles of working of various types of electrical rotating machines. The conditions to be fulfilled for the steady production of electromagnetic torque (T_e). Motoring and generating mode of operation. Primary focus will be on the operation of 3-phase induction machine, single phase induction motor, and synchronous machines. A fair knowledge of distributed windings is essential in order to understand the working of rotating machines more effectively – few lectures will be devoted on this topic. Concept of electrical and mechanical angles will be explained. Nature of magnetic flux distribution along the air-gap of a rotating machine will be discussed. Clear concept of Rotating magnetic field is so important in understanding the operation of induction and synchronous machines.

ABOUT INSTRUCTOR :

Prof. Tapas Kumar Bhattacharya has over thirty years of teaching experience at IIT Kharagpur. Taught Signals & System core course at IIT Kharagpur several times. Area of research interest is in the field of electrical machines and special electrical machines and circuits..

COURSE PLAN :

- Week 1:** Brief review of transformer. Rotating machine: general constructional features. Conditions for steady production of electromagnetic torque.
- Week 2:** MMF and flux density distribution along the air-gap of a rotating machine by a single coil and by multiple coils.
- Week 3:** Production of rotating field by a 3-phase winding
- Week 4:** The expression of induced voltage in a coil when it moves relative to a field distribution
- Week 5:** Types and constructional features of 3-phase induction motor. Slip and its importance.
- Week 6:** Typical torque slip characteristic. Fixing operating point when load torque is present.
- Week 7:** Estimation of equivalent circuit parameters from no load and locked (blocked) rotor tests. Problem solving.
- Week 8:** Single phase induction motor: double revolving field theory and development of equivalent circuit and expression for torque.
- Week 9:** Synchronous machine: Types and constructional features . EMF equation and concept of synchronous reactance.
- Week 10:** Synchronous machine connected to bus and operating as motor .Phasor diagram under various operating conditions.
- Week 11:** Salient pole synchronous machine : concept of direct axis and quadrature axis reactances.
- Week 12:** Swing equation under dynamic condition. Equal area criteria. Steady state and transient stability limits.