ELECTRICAL MACHINES - I

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PRE-REQUISITES : Basic Electrical Technology: Knowledge of elementary calculus

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

INDUSTRIES APPLICABLE TO : BHEL, CESC, NTPC, WBPDCL

COURSE OUTLINE :

Transformer and D.C rotating machine will be the main topics to be discussed in this course. Working principle of ideal transformer and its equivalent circuit referred to two sides. Analysis of practical transformer & its equivalent circuit. Equivalent circuit referred to different sides and phasor diagram. Core loss and copper loss. Regulation & efficiency. Three phase transformer connection & vector group. Parallel operation of transformers. Autotransformer. Basic constructional features of D.C machine. Elementary lap and wave winding used in armature. Emf and torque equations of D.C. machine – generator and motor mode. Armature reaction and its effect. Compensationg winding. Shunt, series and compound machines. Generator characteristics. Motor characteristics. Efficiency, Basic tests.

ABOUT INSTRUCTOR :

Prof. Tapas Kumar Bhattacharya has over thirty years of teaching experince at IIT Kharagpur. He have 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**:** Single phase Ideal transformer and basic equations. Its equivalent circuit.

Week 2**:** Core loss: Eddy current and hysteresis loss

Week 3: Taking Leakage flux, winding resistances and core loss in the equivalent circuit of the transformer.

Week 4: Exact and approximate equivalent circuit. Phasor diagram. Regulation & efficiency.

Week 5: Open circuit and short circuit tests. Estimation of equivalent circuit parameters.

Week 6: Three phase transformer and various connections with vector groups.

Week 7: DC machine constructional features and basic idea of its operation. Armature winding, commutator segments and brushes.

Week 8: Lap and wave windings and number of parallel paths in armature circuit. Emf equation.

Week 9: Torque equation. Separately excited and shunt generator characteristics.

Week 10: Armature reaction and its ill effects. How to nullify the effects of armature reaction.

Week 11: Shunt, series and compound motor characteristic.

Week 12: Starting, speed control and braking of DC motor. Testing.