

ELECTRICAL MACHINES-II**BTechIIYearIISem**

CourseCode	Category	Hours/ Week			Credits	MaximumMarks		
23EE403	ProfessionalCore	L	T	P	3	CIE	SEE	TOTAL
		3	0	0		40	60	100
ContactClasses:48	TutorialClasses:	PracticalClasses: Nil				TotalClasses:48		

Prerequisites: Electrical Circuit Analysis-1 & Electrical Circuit Analysis-2 & Electrical Machines-I

CourseObjectives:

1. To deal with the detailed analysis of poly-phase induction motors & Alternators
2. To understand operation, construction and types of single-phase motors and their applications in household appliances and control systems.
3. To introduce the concept of parallel operation of alternators.

CourseOutcomes: After learning the contents of this paper the student must be able to

1. Understand the concepts of rotating magnetic fields.
2. Examine the operation of ac machines
3. Analyze performance characteristics of ac machines.

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2									1	3
CO2	3	2	1								1	3
CO3	3	2	2	1							1	3
CO4	3	2	1	1							1	3
CO5	3	2	1	1							1	3

UNIT-I:

POLY-PHASE INDUCTION MACHINES: Constructional details of cage and wound rotor machines production

of a rotating magnetic field - principle of operation - rotor EMF and rotor frequency - rotor reactance, rotor current and Power factor at standstill and during operation. Rotor power input, rotor copper loss and mechanical power developed and their inter relation.

UNIT-II:

CHARACTERISTICS OF INDUCTION MACHINES: Torque equation-expressions for maximum torque and starting torque - torque slip characteristic - equivalent circuit - phasor diagram - crawling and cogging, No-load Test and Blocked rotor test - Predetermination of performance-Methods of starting and starting current and Torque calculations, Applications.**SPEED CONTROL METHODS:** Change of voltage, change of frequency, voltage/frequency, injection of an EMF into rotor circuit (qualitative treatment only)-induction generator-principle of operation.

UNIT-III:

SYNCHRONOUS MACHINES:Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation. Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics. Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction analysis – experimental determination of X_d and X_q (Slip test) Phasor diagrams – Regulation of salient pole alternators.

UNIT-IV:

PARALLEL OPERATION OF SYNCHRONOUS MACHINES:Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing -Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactance's and Applications.

SYNCHRONOUS MOTORS:Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed. – Hunting and its Suppression – Methods of starting – synchronous induction motor.

UNIT-V:

SINGLE PHASE MACHINES:Single phase induction motor – Constructional Features- Double revolving field theory – split-phase motors – AC series motor- Universal Motor- - Shaded pole motor and Applications.

.

TEXT BOOKS:

1. P.S.Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I.J.Nagrath and D.P.Kothari, "Electric Machines", McGraw Hill Education, 2010

REFERENCE BOOKS:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, "Electrical Machines", Oxford, 2017.
2. M.G.Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A.E.Fitzgerald and C.Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013
4. A.E.Clayton and N.N.Hancock, "Performance and design of DC machines", CBS Publisher, 2004.

