Syllabus Electrical Machines

Subject Code: ELE-405 L T P: 2 1 0 Credits: 03

Module I

Transformers: Operating principle, classification, construction, emf equation, phasor diagrams, equivalent circuit model, losses & efficiency, voltage regulation, frequency response, polarity test, autotransformers, three-phase transformer connections, impedance matching, isolation & instrument transformers.

Module II

D.C. Machines: Operating principle, generator & motor action, construction, types of excitation, emf & torque equations, power stages & efficiency. Commutation & Armature Reaction, characteristics & application of d.c generators, starting & speed control of d.c motors, characteristics & applications of d.c motors, electric braking.

Design of D.C Machines: Output equation, Main dimensions, Armature design, Armature windings, Design of commutator and brushes, Design of Field systems, Design of interlopes.

Module III

Induction Machines: Three-phase induction motors. Principle of operation, construction, types. Rotating magnetic field, emf equation of an AC Machine, torque developed in an induction motor, equivalent circuit model, torque-speed characteristics, starting & speed control. Single phase induction motors, starting, application.

Module IV:

Synchronous Machines: Construction, types & operating principle of synchronous generator, A.C armature windings, equivalent circuit, phasor diagrams, voltage regulation, parallel operation, synchronization, Power Angle characteristics, effect of field excitation change. Synchronous Motor, principle, starting, hunting, damper windings.

Special Purpose Motors: Stepper Motor, Universal Motor, shaded-pole Motor.

TEXT BOOKS:

- 1. "Electric Machinery", Fitzgerald, Kingslay, Umans, Tata McGraw-Hill.
- 2. "Electric Machinery Fundamentals", Chapman, McGraw-Hill Higher Education.
- 3. "Electric Machines", Nagrath and Kothari, Tata McGraw-Hill.

REFERENCE BOOKS:

- 1. Electric Machinery and Transformer, Guru, Hiziroglu, Oxford University press.
- 2. Electric Machinery, P.S.Bimbhra, Khanna Publishers.
- **3.** Basic Electric Machines, Vincent Deltoro, Prentice Hall.

Course Outcomes (COs)_Electrical Machines (ELE-405)

CO No:	Cos		
1	To study transformer construction, operation, various tests, efficiency and		
	voltage regulation.		
2	To study about DC machines, operation, performance, applications,		
	recent advancements.		
3	To study induction motor operation, find efficiency and speed regulation.		
4	To study of synchronous machine and its applications.		

Module	Syllabus	Material Link	NPTEL Lecture / Video/ Transcript/ PDF Number
I	Transformers: Operating principle, classification, construction	https://nptel.ac. in/courses/1081 05017/	1, 2
	Emf equation, phasor diagrams		3
	Equivalent circuit model		4
	Losses & efficiency		5,6
	Voltage regulation		7
	Frequency response, polarity test		6
	Autotransformers, Isolation & instrument transformers		17
	D.C. Machines: Operating principle, generator & motor action, construction,	https://nptel.ac. in/courses/1081 05017/	21, 22
II	Types of excitation		22
	Emf & torque equations		23
	Power stages & efficiency		35
	Commutation		25
	Armature Reaction,		24
	Characteristics & applications of d.c generators		30
	Starting & speed control of d.c motors,		31, 32
	Characteristics & applications of d.c motors		36, 40
	Induction Machines: Three-phase induction motors. Principle of operation, construction, types	https://nptel.ac.	34, 35
	Rotating magnetic field, emf equation of an AC Machine	in/courses/1081	35
	Torque developed in an induction motor	<u>05131/</u>	40, 47
III	Equivalent circuit model	Only Videos are downloadable (PDFs are unavailable)	41, 42, 43
	Torque-speed characteristics		51, 60
	Starting & speed control.		57
	Single phase induction motors		65 to 73
	Starting, application		65 to 73
IV	Synchronous Machines: Construction, types & operating principle of synchronous generator	https://nptel.ac. in/courses/1081 05131/	74, 75
	A.C armature windings		79
	Equivalent circuit,		77
	Phasor diagrams		79
	Voltage regulation, parallel operation, synchronization		76
	Power Angle characteristics, effect of field excitation change	are	83
	Synchronous Motor, principle, starting	downloadable (PDFs are	82
	Special Purpose Motors: Stepper Motor Universal Motor, Shaded-pole Motor	unavailable)	Follow Text Book (link is provided below)