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/108105017/	**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**
II	**D.C. Machines:** Operating principle, generator & motor action, construction,	https://nptel.ac.in/courses/108105017/	**21, 22**
	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**
III	**Induction Machines:** Three-phase induction motors. Principle of operation, construction, types	https://nptel.ac.in/courses/108105131/ **Only Videos are downloadable (PDFs are unavailable)**	**34, 35**
	Rotating magnetic field, emf equation of an AC Machine		**35**
	Torque developed in an induction motor		**40, 47**
	Equivalent circuit model		**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/108105131/ **Only Videos are downloadable (PDFs are unavailable)**	**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		**83**
	Synchronous Motor, principle, starting		**82**
	Special Purpose Motors: Stepper Motor		**Follow Text Book (link is provided below)**
	Universal Motor, Shaded-pole Motor		

Text Book link: https://drive.google.com/file/d/1DhGf43DiVe4JsPwJswVNaVyb_f3dCOxA/view