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Electric Machine- II — Complete Syllabus

BTEUP Diploma in Electrical Engineering • 4th Semester • Session 2026-27

Subject 4.2 (Theory) • Total 100 Marks • 3 Credits • L 3 – P 0

Please note — cover year vs approval: BTEUP's own file for this curriculum prints “YEAR 2025-2026” on its cover, while carrying the approval line “UPDATED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P. LUCKNOW IN C.D.C MEETING HELD ON 16.07.2026” on every page. It is filed in BTEUP's 2026-27 folder (folder2627), so it is treated here as the 2026-27 syllabus on the strength of that approval. The scheme it carries is identical, subject for subject and mark for mark, to the 2025-26 scheme.

About this document: This is the theory paper 4.2. Its practical work is the separate lab subject 4.6 (Electric Machine- II (Practical)).

Examination Scheme

Code	Paper	Type	L - P	Credits	Internal	External	Total
4.2	Electric Machine- II	Theory	3 - 0	3	40	60 (3 hrs)	100
Electric Machine- II (Theory) Total				3	40	60	100

What This Subject Aims To Do

To help students maintain induction, synchronous and special electric machines (SEM) used in different applications.

Unit-Wise Complete Topic List

Unit	Topic	Periods	Marks Share
I	Three Phase Induction Motor	10	25%
II	Single phase induction motors	08	18%
III	Three phase Alternators	10	25%
IV	Synchronous Motors	08	18%
V	Special Electric Machines	06	14%

Unit - I: Three Phase Induction Motor (10 Periods, 25%)

Topics: Working principle: production of rotating magnetic field, Synchronous speed, rotor speed and slip; Locking of rotor and stator fields; Constructional details of 3 phase induction motors: Squirrel cage induction motor and Slip ring induction motor; Rotor quantities: frequency, induced emf, power factor at starting and running condition; Characteristics of torque versus slip (speed), Torques: starting, full load and maximum with relations among them; Relationship between rotor copper losses, slip and rotor input power (Power flow diagram); Starters: need and types; stator resistance, auto transformer, star delta, rotor resistance and soft starters; Speed control methods: stator voltage, pole changing, rotor resistance and VVVF; Motor selection for different applications as per the load torque-speed requirements; Cogging and Crawling.

Unit - II: Single phase induction motors (08 Periods, 18%)

Topics: Double field revolving theory, principle of making these motors self-start; Construction, working and Torque-speed characteristics: Resistance start induction run, capacitor start induction run, capacitor start capacitor run, shaded pole, repulsion type, series motor, universal motor, hysteresis motor; Motor selection for different applications as per the load torque-speed requirements.

Unit - III: Three phase Alternators (10 Periods, 25%)

Topics: Principle of working, moving and stationary armatures; Constructional details: parts and their functions, Windings: Single and Double layer; Equivalent circuit diagram, E.M.F. equation of an Alternator with numerical by considering short pitch factor and distribution factor; Necessary conditions of parallel operation of alternators; Armature reaction at various power factors and synchronous impedance; Voltage regulation: direct loading and synchronous impedance methods; Operation of synchronous machine as a motor.

Unit - IV: Synchronous Motors (08 Periods, 18%)

Topics: Principle of working, Torques: starting torque, running torque, pull in torque, pull out torque; Synchronous motor on load with constant excitation (numerical), effect of excitation at constant load (numerical); Concept of synchronous condenser; V-Curves and Inverted V-Curves; Hunting and Phase swinging; Methods of Starting of Synchronous Motor; Losses in synchronous motors and efficiency (no numerical); Applications areas.

Unit - V: Special Electric Machines (06 Periods, 14%)

Topics: Construction, working and applications: Linear Induction Motor, Synchronous Reluctance Motor, Switched Reluctance Motor, Permanent Magnet Synchronous Motors, stepper motors, AC and DC servomotors, Submersible motor.

Reference Books (as listed in the syllabus)

- P.S. Bimbhra, Electric Machines, Khanna Book Publishing Co., New Delhi (ISBN: 978-93-86173-294)
- Mittle, V.N. and Mittle, Arvind., Basic Electrical Engineering, McGraw Hill Education New Delhi, ISBN: 9780070593572
- Kothari, D. P. and Nagrath, I. J., Electrical Machines, McGraw Hill Education. New Delhi, ISBN: 9780070699670
- Bhattacharya, S. K., Electrical Machines, McGraw Hill Education, New Delhi, ISBN: 9789332902855
- Dr. T.D. Bisht, Pooja Yadav, Electrical Machine-II, Asian Publishers, Muzaffarnagar ISBN: 978-93-91541-98-9
- Theraja, B.L., Electrical Technology Vol-II (AC and DC machines), S.Chand and Co. Ltd., New Delhi, ISBN: 9788121924375
- Sen, S. K., Special Purpose Electrical Machines, Khanna Publishers, New Delhi, ISBN: 9788174091529
- Janardanan E. G, Special Electrical Machines, Prentice Hall India, New Delhi ISBN: 9788120348806
- Hughes E., Electrical Technology, ELBS
- Cotton H., Electrical Technology, ELBS

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