Subject Description Form

Subject Code	EE3002 / EE3002A / EE3002B
Subject Title	Electromechanical Energy Conversion
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite for EE3002: EE2002 Pre-requisite for EE3002A: EE2002A Pre-requisite for EE3002B: EE2002B
Objectives	1. To provide students a general knowledge on common types of electric machines. 2. To provide students the basic techniques of steady-state electric machine analysis.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Explain the construction, operating principles, performance characteristics, control and applications of major types of rotating electric machines. b. Analyse the steady-state performance of electric machines using appropriate equivalent circuit models. c. Operate practical electric machines and to conduct relevant tests and experiments. d. Present results of electric machine studies in the form of tables, graphs, and written reports.
Subject Synopsis/ Indicative Syllabus	1. ***Introduction*****:** Principles of motors and generators. Materials for electric machines. Types of electric machines and applications. Losses and efficiency. 2. ***Machine rating*****:** Temperature rise and cooling methods. Heating and cooling curves. Thermal ratings. Machine nameplate. 3. ***Windings*****:** Phase and commutator windings. Winding factors. E.M.F. equation. Harmonics. Production of rotating magnetic field. 4. ***D.C. machines*****:** Construction. E.M.F equation. Armature reaction and commutation. Characteristics of shunt, series and compound machines. Testing. Speed control. Universal motor. Brushless d.c. motor. 5. ***Synchronous machines*****:** Construction. Synchronous impedance. Voltage regulation. Synchronising. Performance on infinite busbars. Power/load angle relationship. Stability. Synchronous motor. 6. ***Induction machines*****:** Squirrel cage and wound-rotor types. Equivalent circuit. Torque-slip relationship. Starting, braking and generating. Testing. Speed control. Single-phase induction motors. **Laboratory Experiments:** Load test, efficiency and speed control of a d.c. motor. Performance evaluation of a three-phase cage induction motor. Synchronous generator synchronization.

Teaching/Learning Methodology

Delivery of the subject is mainly through formal lectures and complemented by tutorials. Excel programmes are used to clarify concepts of electric machines learnt and for conducting 'what-if' analysis. Laboratory work provides students hands-on experience in operation and control of practical machines, while report-writing enables students to practise written and graphic presentation skills.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	✓	✓	✓	
Tutorials	✓	✓		
Laboratory work		✓	✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	✓	✓	✓	✓
2. Mid-term Test	20%	✓	✓	✓	
3. Laboratory work and reports	15%		✓	✓	✓
4. Assignment	5%	✓	✓		
Total	100%				

It is a fundamental subject on electric machines and transformers. The outcomes on concepts, operating principles and applications are assessed by the usual means of assignment, tests, and examination. The outcomes on practical operation of electric machines and technical communication are evaluated by laboratory work and reports.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial	33 Hrs.
▪ Laboratory	6 Hrs.
Other student study effort:	
▪ Revision, self-study, and assignment	48 Hrs.
▪ Write-up of laboratory reports	18 Hrs.
Total student study effort	105 Hrs.

Reading List and References

Reference books:

1. M.S. Sarma And M.K.Pathak, "Electric Machines", Cengage Learning, 2012.
2. S.A. Nasar, Schaum's Outline of Theory and Problems of Electric Machines and Electromechanics, 2nd Edition, McGraw-Hill, 1998