Course No | Course Name | L-T-P-Credits | Year of Introduction
---|---|---|---
EE202 | Synchronous and Induction Machines | 3-1-0-4 | 2016

Prerequisite: NIL

**Course Objectives**

To give exposure to the students about the concepts of alternating current machines including the constructional details, principle of operation and performance analysis.

To learn the characteristics of induction machines and to learn how it can be employed for various applications.

**Syllabus**

Alternators – basic principle, constructional details, armature windings, armature reaction, voltage regulation and determination of regulation by different methods; parallel operation of alternators and synchronization; Synchronous motors – principle, performance and power relations; synchronous induction motors.

Induction motors – basic principle, rotating magnetic field, constructional details, mechanical power and torque, performance analysis, starting methods, braking, testing, equivalent circuit and circle diagrams; single phase induction motors.

Induction generator – principle of operation.

**Expected Outcome**

After the successful completion of this course, the students will be able to

1. identify alternator types, and appreciate their performance
2. determine the voltage regulation and analyse the performance of alternators
3. describe the principle of operation of synchronous motor and different applications.
4. describe the principle of operation of 3-phase induction motors and select appropriate motor types for different applications.
5. analyse the performance of 3-phase induction motors
6. familiarize with principle of operation and application of 1-phase induction motors.

**Text Book**


**Reference Books**


**Course Plan**

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<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Semester Exam Marks</th>
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<tbody>
<tr>
<td>1</td>
<td>Alternators - basic principle, constructional features of salient pole type and cylindrical type alternators, advantages of stationary armature, turbo-alternator. Armature winding – types of armature winding- single layer, double layer, full pitched and short pitched winding.</td>
<td>8 hours</td>
<td>15%</td>
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<td>Performance of an alternator – Causes for voltage drop in alternators armature resistance, armature leakage reactance – armature reaction, synchronous reactance, synchronous impedance, experimental determination – phasor diagram of a loaded alternator. Voltage regulation – EMF, MMF, ZPF and ASA methods – numerical problems.</td>
<td>9 hours 15%</td>
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<td>FIRST INTERNAL EXAMINATION</td>
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<td>Theory of salient pole machine – Blondel’s two reaction theory – direct axis and quadrature axis synchronous reactances – phasor diagram and determination of $X_d$ and $X_q$ by slip test. Parallel operation of alternators – necessity of parallel operation of alternators, methods of synchronisation– dark lamp method and bright lamp method, synchroscope, Synchronising current, synchronising power, synchronising torque. Effects of changing excitation of alternators, load sharing of two alternators in parallel operation.</td>
<td>9 hours 15%</td>
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<tr>
<td>Synchronous motor – construction and principle of synchronous motor, methods of starting. Effects of excitation on armature current and power factor, v-curve and inverter v-curve, load angle, torque and power relationship, phasor diagram, losses and efficiency calculations. Three phase induction motor – constructional features, slip ring and cage types. Theory of induction motor with constant mutual flux, slip, phasor diagram, expression for mechanical power and torque, torque-slip characteristics, starting torque, full load and pull out torque, equivalent circuit.</td>
<td>9 hours 15%</td>
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<td>Circle diagrams – tests on induction motors for determination of equivalent circuit and circle diagram.</td>
<td>10 hours 20%</td>
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END SEMESTER EXAM

10 hours 20%

QUESTION PAPER PATTERN (End semester exam)

Part A: 8 questions.

One question from each module of Module I - IV; and two each from Module V & VI.

Student has to answer all questions. (8 x5)=40

Part B: 3 questions uniformly covering modules I&II

Student has to answer any 2 questions: (2 x 10) =20

Part C: 3 questions uniformly covering modules III&IV

Student has to answer any 2 questions: (2 x 10) =20

Part D: 3 questions uniformly covering modules V&VI

Student has to answer any 2 questions: (2 x 10) =20

Note: Each question can have maximum of 4 sub questions, if needed.

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