**19EE2204-ELECTROMECHANICAL ENERGY CONVERSION - II**

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| **Course Category:** | Professional core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-1-0 |
| **Pre-requisite:** | Fundamentals of energy conversion and three phase connections | **Sessional Evaluation:****External Exam Evaluation:****Total Marks:** | 4060100 |

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| **Course Objectives:** | Students undergoing this course are expected to learn : |
| 1. The construction, principle of operation and slip-torque characteristics of an Induction motor.
2. The testing of Induction motor and performance calculations.
3. The speed control of Induction motor.
4. The construction, EMF equation, equivalent circuit of alternator and voltage regulation of an alternator.
5. The theory of salient pole machine and parallel operation of Alternators.
6. The operation, Starting methods of Synchronous motor and single phase Induction motors.
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| **Course Outcomes:** | After completing the course, the student will be able to: |
| CO1 | Understand the principle, construction and operation of Induction Motor.  |
| CO2 | Assess the performance and characteristics of an Induction motor using different testing methods. |
| CO3 | Know the speed control techniques of an Induction Motor and understand the principles of double cage motor and Induction generator. |
| CO4 | Understand the construction and working of an alternator and determine the voltage regulation using different experimental methods. |
| CO5 | Understand the operating principle of salient pole machine and parallel operation of synchronous generators with infinite bus-bars. |
| CO6 | Analyze the working and performance of the synchronous motor and understand the construction, operation of single phase induction motor. |
| **Course Content:** | **UNIT-I****3-ф Induction motor:** Constructional details, types, production of rotating magnetic field,principle of operation, Torque equation, Starting and maximum torques, Maximum output, Slip for maximum output, Torque-slip characteristic, losses and efficiency, phasor diagram, Equivalent circuit.  **UNIT-II****Testing and starting of 3-ф Induction motor:** No load and blocked rotor tests, determination of equivalent circuit parameters, Brake test, Pre-determination of performance from no loadand blocked rotor tests, circle diagram, Auto transformer, star delta and rotor resistance starters.**UNIT-III****Speed control of Induction motors:** Change of voltage, Change of frequency, introduction to V/f control of three phase Induction motor, injection of EMFinto rotor circuit (Principle of operation only), Induction generator (Principle of operation only).**UNIT-IV****Synchronous generators**: Construction, types of alternators, armature windings, distribution, pitch and winding factors, EMF equation, armature reaction, leakage flux, synchronous reactance, equivalent circuit, phasor diagram.**Voltage regulation of synchronous generators:** Voltage regulation, Pre-determination of regulation by synchronous impedance, ampere turn and Potier triangle methods, SCR and its importance.**UNIT-V****Theory of salient pole machines:** Two reaction theory, phasor diagram, determination of Xd and Xq from slip test, expression for power output of cylindrical and salient pole alternators, power angle characteristics.**Parallel operation of alternators:** Parallel operation, load sharing, synchronizing alternators with infinite bus bars, Synchronizing power and synchronizing torque, effect of change of excitation and change of mechanical input.**UNIT-VI****Synchronous motor:** Theory of operation, phasor diagrams, variation of current and power factor with excitation, hunting and its suppression, determination of V and inverted V curves, synchronous condenser, methods of starting.**Single phase induction motor**: Constructional features, Double revolving field theory, split-phase motors, shaded pole motor. |
| **Text Books** **&** **Reference Books:** | **TEXT BOOKS:**1. “Theory and performance of Electrical machines”, by J.B Gupta, SK Kataria publishers, 2013 Reprint.
2. “Electrical Machines”, by Ashfaq Hussain , Dhanpat Rai & Co, 3rd Edition,2016.
3. 3. “Principles of Electrical Machines”, by VK Mehta, Rohit Mehta-S.Chand,
4. Reprint Edition 2006.

**REFERENCE BOOKS:**1. “Electrical Machinery”, by Dr. P.S Bimbhra, Khanna publishers, 2011.
2. “Electrical Machines”, by I.J.Nagarath and D.P.Kothari 4th Edition, Tata

 Mc Graw-Hill, 2010.1. “Performance & Design of Alternating Current machines”, by M. G. Say, CBS publishers, 2012.
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| **e-Resources:** | http://nptel.ac.in/courseshttp://iete-elan.ac.inhttp://freevideolectures.com/university/iitm |