**23EE22T2-INDUCTION AND SYNCHRONOUS MACHINES (EEE)**

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| **Course Category:** | Professional core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Fundamentals of energy conversion and three phase connections  . | **Sessional Evaluation: External Exam Evaluation:**  **Total Marks:** | 30  70  100 |

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| **Course Objectives:** | Students undergoing this course are expected to learn: | | |
| 1. The construction, principle and operation of single phase and three phase induction motors 2. The construction, principle and operation of synchronous generator and synchronous motor. 3. Various applications of various alternating machines. 4. To apply the above concepts to solve various mathematical and complex problems 5. To analyze the characteristics of induction motor, synchronous motor and   synchronous generators | | |
| **Course**  **Outcomes:** | After completing the course the student will be able to | | **Blooms**  **Level** |
| CO1 | Understand the construction, principle and operation of  single phase and three phase induction motors | **L2** |
| CO2 | Understand the construction, principle and operation of  synchronous generator and synchronous motor | **L2** |
| CO3 | Understand machines various applications of various alternating | **L2** |
| CO4 | Apply the above concepts to solve various mathematical and  complex problems | **L3** |
| CO5 | Analyze the characteristics of induction motor, synchronous  motor and synchronous generators | **L4** |
| **Course Content:** | **UNIT I**  **3-phase induction motors:**  Construction of Squirrel cage and Slipring induction motors– production of rotating magnetic field – principle of operation – rotor emf and rotor frequency  – rotor current and power factor at standstill and during running conditions– rotor power input, rotor copper loss and mechanical power developed and their inter-relationship –equivalent circuit – phasor diagram, Applications.  **UNIT II**  **Performance of 3-Phase induction motors:**  Torque equation – expressions for maximum torque and starting torque – torque-slip characteristics – double cage and deep bar rotors – No load, Brake test and Blocked rotor tests – circle diagram for predetermination of performance- methods of starting –starting current and torque calculations - speed control of induction motor with V/f control method, rotor resistance control and rotor emf injection technique –crawling and cogging – induction generator operation. | | |

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| **Course Content:** | **UNIT III**  **Single Phase Motors:**  Single phase induction motors – constructional features – double revolving field theory, Cross field theory – equivalent circuit- starting methods: capacitor start capacitor run, capacitor start induction run, split phase & shaded pole, AC series motor, Applications.  **UNIT IV**  **Synchronous Generator**:  Constructional features of non-salient and salient pole type alternators- armature windings – distributed and concentrated windings – distribution & pitch factors – E.M.F equation – armature reaction – voltage regulation by synchronous impedance method – MMF method and Potier triangle method – two reaction analysis of salient pole machines - methods of synchronization- Slip test – Parallel operation of alternators.  **UNIT V**  **Synchronous Motor:**  Synchronous motor principle and theory of operation – Effect of excitation on current and power factor– synchronous condenser –expression for power  developed –hunting and its suppression – methods of starting, Applications. |
| **Text books & Reference books:** | **Textbooks:**   1. Electrical Machinery, Dr. P.S. Bhimbra, Khanna Publishing, 2021, First Edition. 2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.   **Reference Books:**   1. Electrical machines, D.P. Kothari and [I.J. Nagrath](https://www.amazon.in/s/ref%3Ddp_byline_sr_book_2?ie=UTF8&field-author=I.J.%2BNagrath&search-alias=stripbooks), McGraw Hill Education, 2017, Fifth Edition. 2. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria & Sons,2007. 3. Electric Machinery, A.E.Fitzgerald, Charles kingsley, Stephen   D.Umans, McGraw-Hill, 2020, Seventh edition. |
| **e- Resources** | https://nptel.ac.in/courses/108/105/108105131 https://nptel.ac.in/courses/108106072 <http://freevideolectures.com/university/iitm> |