**20EE41EC-POWER SYSTEM OPERATION AND CONTROL**

**(EEE)**

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| **Course Category:** | Professional core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Generation of electric power, power systems, control systems, & electrical machines | **Sessional Evaluation:**  **External Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Objectives:** | Students undergoing this course are expected to learn: | |
| 1. The basics of power system control. 2. The analytical methods of arriving at the optimal operating strategies which must meet the minimum standards of reliability. 3. About hydro thermal scheduling and unit commitment. 4. The modeling of synchronous generator and exciters. 5. The importance of frequency control, automatic load frequency control mechanism of single area and two area systems. 6. The control operation of a power system using ALFC system. | |
| **Course Outcomes:** | After completing the course the student will be able to: | |
| **CO1** | Understand the economic load dispatch problems and solution methods. |
| **CO2** | Solve problems by posing different problem models related to economic load dispatch. |
| **CO3** | Acquire knowledge on forecasting of base load and unit commitment using different methods. |
| **CO4** | Demonstrate the modeling of synchronous generator and exciters. |
| **CO5** | Design the automatic load frequency controller. |
| **CO6** | Analyse to control the operation of a power system using Automatic load frequency control (ALFC) system. |
| **Course Content:** | **UNIT-I**  **Economic operation of power systems –I :** Optimal operation of generators in thermal power stations, statement of economic dispatch problem, heat rate curve, cost curve, incremental fuel and production costs, input- output characteristics, optimal operations of generators on a bus bar without losses.  **UNIT –II**  **Economic operation of power systems –II:** Optimum generation allocation including the effect of transmission line losses, loss coefficients, derivation of transmission loss formula.  **UNIT-III**  **[[**  **Hydrothermal scheduling**: Introduction, hydroelectric power plant model, scheduling problems, short term hydrothermal scheduling problem.  **Unit commitment**: Need for unit commitment, constraints on unit commitment problem, solution methods for unit commitment problems, priority lists method, dynamic programming method.  **UNIT-IV**  **Reactive power and voltage control-I**: Basic generator control loops, introduction to D.C and A.C excitation systems, types of exciters , exciter modeling, generator modeling, static performance of AVR loop, generation and absorption of reactive power, relation between voltage, power and reactive power at a node, single machine infinite bus systems, methods of reactive power control.  **UNIT-V**  **Reactive power and voltage control-II:** Overview of reactive power control-Power flow through a transmission line-Voltage control and line compensation-introduction-Shunt capacitors-Series capacitors-Synchronous compensation, Receiving end power circle diagrams.  **UNIT- VI**  **Automatic load frequency control (ALFC)**: Automatic load frequency control of single area systems, model of turbine speed governing system, turbine model, generator load model, block diagram representation of ALFC of an isolated power system, steady state analysis, and dynamic response, concept of control area, integral control, two area load frequency control concept and block diagram. | |
| **Text books**  **&**  **Reference books:** | **Text books**:  1.“Modern power system analysis”, by I.J.Nagrath & D.P.Kothari Tata Mc  Graw – Hill Publishing Company Ltd, 4th Edition.  2.“Electrical power systems”, by C.L.Wadhwa, Newage International,  3rd Edition  3 “Power system analysis”, by Hadi Saadat – TMH Edition.  4. “A text book on power system engineering”, by M.L. Soni, P.V. Gupta,  U.S. Bhatnagar- DhanpatRai & co  5. “Switch Gear and Protection”, by Sunil S. Rao, Khanna Publishers,  New Delhi.  **Reference books:**  1. “Power generation, operation and control”, by Allen J Wood  &Woollenberg. John Wiley and Sons.  2. “Electrical energy systems theory”, by O.J Elgerd.  3. “Power system analysis, operation and control”, by Abhijit Chakrabarti and  Sunita Halder, PHI.  4. “Electric power systems”, by B.M.Weedy and B.J. Cory. | |
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