RK UNIVERSITY

SYLLABUS

| Course Title | Power System Dynamics, Control & Operation | |
|---|---|---|
| Course Code | EPS202 | |
| Course Credit | Lecture | : 04 |
| | Practical | : 00 |
| | Tutorial | : 01 |
| | Total | : 05 |

**Course Objective**

**The objective of the course is:**
To enable the students acquire a comprehensive idea on various aspects of power system optimization and control. To understand about the unit commitment problem and various solution techniques. To enrich knowledge in various aspects of Generator Modelling.

**Detailed Syllabus**

| Sr. No. | Name of chapter & Details | Hours Allotted |
|---|---|---|
| | **Section – I** | |
| 1 | **Reference frame theory**<br>Introduction, Equation of transformation, Stationary circuit variables transformed to the arbitrary reference frame- commonly used reference frames- transformation between reference frame, Transformation of a balanced set, balanced steady state phasor relationships, Balanced steady state voltage equations | **7** |
| 2 | **Generator Modeling - I (Machine Viewpoint):**<br>Classical Machine Description, Voltage Generation, Open-Circuit Voltage, Armature Reaction, Terminal Voltage, Power Delivered by Generator, Synchronizing Generator to an Infinite Bus, Synchronous Condenser, Role of Synchronous Machine, Excitation in Controlling Reactive Power | **8** |
| 3 | **Generator Modeling – II (Circuit Viewpoint):**<br>Energy Conversion, Application to Synchronous Machine, The Park Transformation, Park's Voltage Equation, Park's Mechanical Equation, Circuit Model, Instantaneous Power Output, Applications, Synchronous Operation, Steady-state Model, Simplified Dynamic Model, Generator Connected to Infinite Bus (Linear Model) | **8** |
| 4 | **Analysis of Single Machine System & Multi machine system:**<br>Small Signal Analysis with Block Diagram Representation, Characteristic Equation (CE) and Application of Routh-Hurwithz Criteion , Synchronizing and Damping Torque Analysis, Small Signal Model : State Equation, Nonlinear Oscillations – Hopf Bifurcation, Simplified system Model, Detailed models: Case I, Detailed models: Case II | **7** |
| | **Section – II** | |
| 5 | **Excitation and Prime Mover Controllers:**<br>Excitation System, Excitation System Modeling, Excitation System – | **8** |

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|---|---|---|
| | Standard Block Diagram, System Representation by State Equation Prime Mover Control System. | |
| 6 | **Transmission Lines, SVC and Loads:** Transmission Lines, D-Q Transmission using Variables, Static VAR Compensators, Loads | **7** |
| 7 | **Dynamics of a Synchronous Generator Connected to Infinite Bus:** System Model, Synchronous Machine Model, Application of Model, Calculation of Initial Conditions, System Simulation, Consideration of Other Machine Model, Inclusion of SVC Model | **8** |
| 8 | **Unit commitment and Maintenance Scheduling:** Unit commitment, Constraints, Solutions by priority list methods, dynamic programming method, Backward and forward restricted search range, Factors considered in maintenance scheduling for generating units ,turbine, boilers, Introduction to maintenance scheduling using mathematical programming. | **7** |

**Instructional Method and Pedagogy:**

- Lectures will be conducted with the aid of multi-media projector, black board, Transparencies etc.
- Assignments and Exercise will be given to the students for each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
- Self study assignments, seminar from students can be conducted

**Students Learning Outcomes:**

At the end of the course students will be able

- To understand about the unit commitment problem and various solution techniques.
- To enrich knowledge in various aspects of Generating units, turbine and boilers.
- Analysis of Single Machine System & Multi machine system

**Reference Books/Text book:**

1. Power Systems Analysis By Vijay Vittal, Bergen , Pearson Education.
2. Power System Dynamics By K R Padiyar, B S Publications.
3. Power System Stability & Control, By- P.Kundur,Tata Mcgraw hill.
4. Allan J Wood and Bruce F Wollenberg, “Power generation and control”, John Wiley and Sons, 1984.
5. Murthy P.S.R, “Power system operation and control”, Tata McGraw Hill,1987.

**Additional Resources:**

www.sciencedirect.com
www.delnet.nic.in