SARDAR RAJA COLLEGE OF ENGINEERING, ALANGULAM

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

MICRO LESSON PLAN

SUBJECT : POWER SYSTEM OPERATION AND CONTROL

CODE : EE2401

CLASS : IV Year / VII SEM

STAFF: Mrs. R.NAFEENA,
A.P/EEE

EE2401 POWER SYSTEM OPERATION AND CONTROL **L T P C**

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1. INTRODUCTION 9

System load – variation - load characteristics - load curves and load-duration curve (daily, weekly and annual) - load factor - diversity factor. Importance of load forecasting and simple techniques of forecasting. An overview of power system operation and control and the role of computers in the implementation. (Qualitative treatment with block diagram).

2. REAL POWER - FREQUENCY CONTROL 9

Basics of speed governing mechanism and modeling - speed-load characteristics – load sharing between two synchronous machines in parallel. Control area concept LFC control of a single-area system. Static and dynamic analysis of uncontrolled and controlled cases. Integration of economic dispatch control with LFC. Two-area system – modeling - static analysis of uncontrolled case - tie line with frequency bias control of two-area system - state variable model.

3. REACTIVE POWER – VOLTAGE CONTROL 9

Basics of reactive power control. Excitation systems – modeling. Static and dynamic analysis - stability compensation - generation and absorption of reactive power. Relation between voltage, power and reactive power at a node - method of voltage control – tap-changing transformer. System level control using generator voltage magnitude setting, tap setting of OLTC transformer and MVAR injection of switched capacitors to maintain acceptable voltage profile and to minimize transmission loss.

4. UNIT COMMITMENT AND ECONOMIC DISPATCH 9

Statement of economic dispatch problem – cost of generation – incremental cost curve - co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. (No derivation of loss coefficients).

Statement of Unit Commitment problem – constraints; spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints. Solution methods - Priority-list methods - forward dynamic programming approach. Numerical problems only in priority-list method using full-load average production cost.

5. COMPUTER CONTROL OF POWER SYSTEMS 9

Need of computer control of power systems. Concept of energy control centre (or) load dispatch centre and the functions - system monitoring - data acquisition and control. System hardware configuration – SCADA and EMS functions. Network topology - state estimation - security analysis and control. Various operating states (Normal, alert, emergency, in-extremis and restorative). State transition diagram showing various state transitions and control strategies.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2003.
2. Chakrabarti & Halder, "Power System Analysis: Operation and Control", Prentice Hall of India, 2004 Edition.

REFERENCES

1. D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003. (For Chapters 1, 2 & 3)
2. L.L. Grigsby, 'The Electric Power Engineering, Hand Book', CRC Press & IEEE Press, **2001**
3. Hadi Saadat, "Power System Analysis", (For the chapters 1, 2, 3 and 4)11th Reprint 2007.
4. P.Kundur, 'Power System Stability and Control' MC Craw Hill Publisher, USA, 1994.
5. Olle.I.Elgerd, 'Electric Energy Systems theory An introduction' Tata McGraw Hill Publishing Company Ltd. New Delhi, Second Edition 2003.

SUBJECT DESCRIPTION AND OBJECTIVES

SUBJECT DESCRIPTION:

Electrical Technology was founded on the remarkable discovery by Faraday that a changing magnetic flux creates an electric field. Out of that discovery, grew the largest and most complex engineering achievement of man : the electric power system.

Indeed, life without electricity is now unimaginable. Electric power systems form the basic infrastructure of a country. Even as we read this, electrical energy is being produced at rates in excess of hundreds of giga-watts (1 GW = 1,000,000,000 W).

Giant rotors spinning at speeds up to 3000 rotations per minute bring us the energy stored in the potential energy of water, or in fossil fuels.

This subject reveals the knowledge of Power system by learning the milestones below Features:

- Real & Reactive power control
- Digital Computer Configuration
- Automatic Generation Control
- Area Control Error
- Operation With Central Computers
- Expression for Tie Line Flow
- Parallel Operation of Generators

OBJECTIVES:

i. To have an overview of power system operation and control.
ii. To model power-frequency dynamics and to design power-frequency controller.
iii. To model reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
iv. To study the computer control of Power system.

MICRO LESSON PLAN

	Hours	LECTURE TOPICS	READING
	Unit I – INTRODUCTION		
I	1	System load – variation	T1
	2	Load characteristics	T1
	3	Load curves and load-duration curve (daily, weekly and annual)	R3
	4	Load factor	R3
	5	Diversity factor	R3
II	6	Importance of load forecasting	R1
	7	Simple techniques of forecasting	R1
	8,9	An overview of power system operation and control and the role of computers in the implementation. (Qualitative treatment with block diagram).	T2
III	Unit II - REAL POWER - FREQUENCY CONTROL		
	10	Basics of speed governing mechanism and modeling	T1
	11	Speed-load characteristics – load sharing between two synchronous machines in parallel, Control area concept LFC control of a single-area system	R5
	12,13	Static and dynamic analysis of uncontrolled and controlled cases, Integration of economic dispatch control with LFC	R1
IV	14,15	Two-area system – modeling	R1
	16	Static analysis of uncontrolled case	R1
	17,18	Tie line with frequency bias control of two - area system - state variable model	R1
	Unit III - REACTIVE POWER–VOLTAGE CONTROL		
V	19	Basics of reactive power control	T2
	20	Excitation systems – modeling	T2
	21	Static and dynamic analysis - stability compensation	R1
	22	Generation and absorption of reactive power	R1
	23	Relation between voltage, power and reactive power at a node	T2