



Semester –VI

Subject Name: Operation and Control of Power System

Subject Code: 09EE2603

Diploma Branch in which this subject is offered: Electrical Engineering

Objective: For student of diploma engineering to work in power transmission and distribution sector, it is necessary for them to have knowledge of operation and control of power system. If they are aware of how power system works and which are the controlling methods to flow power smoothly, this skill will be advantageous for them to work better and find better opportunities in electrical power transmission and distribution sector. Hence this course is design to make them aware about different equipment and methods used to control power in power system and maintain stability of the system.

Credits Earned: 5 Credits

Course Outcomes: After completion of this course, student will be able

1. To understand voltage control in transmission line.
2. To calculate per unit value of power system parameters.
3. To understand economic load dispatch and optimal unit commitment.
4. To apply methods to maintain power system stability.
5. To understand load flow analysis for power system stability.

Pre-requisite of course: DC circuit, AC circuit, electrical power transmission and distribution, generation of electrical power.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term work	
4	0	2	5	50	30	20	25	25	150

Contents:

Unit	Topics	Contact hours	Weightage (%)
1	Fundamentals of power in power system <ul style="list-style-type: none"> • Introduction • Different power system parameters and its per unit value • Complex power (active, reactive and apparent power) and power factor, p.u. representation of complex power • The single line diagram and impedance of reactance diagram 	20	36



	<ul style="list-style-type: none">• Represent balanced three phase with single phase• Represent impedance and reactance diagram by single line diagram• Voltage control in transmission line• Need to control transmission line voltages• Concept of real and reactive power transfer in long distance transmission lines• Active and reactive power transfer in long transmission line• Methods to control active and reactive power: Automatic generation control, Transformer taps changer control, phase shifting transformer, synchronous machine excitation control• Real and reactive power control methods : series compensation and shunt compensation, load compensation and system compensation• What is FACTS, FACTS controller for active and reactive control• FACT controllers: Series, shunt, series-shunt• Pros and cons of FACTS controller		
2	Economic load dispatch and optimal unit commitment <ul style="list-style-type: none">• Introduction.• Load curve and load duration curve• Terms and factors: maximum demand, demand factor, average load, load factor and connected load• Criteria for economic load dispatch of power• Optimal unit commitment under various conditions• Constrains in unit commitment	10	18
3	Stability in power system <ul style="list-style-type: none">• Introduction• Stability in different state of power system: steady state stability, dynamic stability and transient stability• Mechanism for speed governing of steam turbine : Turbine speed governing system• Equal area criterion to maintain steady state stability in inter connected power system	12	21
4	Load flow analysis <ul style="list-style-type: none">• Introduction• Load flow in power system• Need for load flow analysis in interconnected power system• Different buses in power system• Different parameters of power system transmission line• The GS and NR method to find different parameters of transmission lines by using 3 bus power systems• Graph theory for DC load flow analysis	14	25



Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyse	Evaluate	Create
35%	35%	15%	15%	0%	0%

Suggested List of Practical/Exercise:

Sr. No.	Unit No.	Name of Topics	Contact Hours
1	1	To simulate a program to calculate per unit values of power system parameters.	4
2	1	To simulate a long transmission line and observe active power flow in power system	2
3	1	To simulate a long transmission line and observe reactive power flow in power system	2
4	2	To simulate real and reactive power control method in power system.	4
5	2	To simulate economic load dispatch in power system.	4
6	3	To develop program for unit commitment in power system.	4
7	3	To do analysis of steady state stability of power system.	4
8	3	To do analysis of transient state stability of power system.	4

Instructional Method:

- The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.
- Show video or animation of working of various types of wiring system and electrical transmission and distribution network



References:

1. S. Sivanagaraju, "*Power system operation and control*", Dorling Kindersley(India) pvt ltd, 2010
2. N V Ramana, "*Power system operation and control*", Dorling Kindersley(India) pvt ltd, 2011
3. Allen J wood, "*Power generation operation and control*", John wiley and sons , second edition,1996.
4. P S R Murty, "*Operation and control in power system*", Book Syndicate, second edition, 2011

Supplementary Resources:

1. <https://circuitglobe.com/power-system.html>
2. <https://www.sciencedirect.com/topics/engineering/power-system-operation>
3. <https://posoco.in/en/>
4. https://www.researchgate.net/publication/327968078_Introduction_to_Power_System_Operation
5. <https://electrical-engineering-portal.com/download-center/books-and-guides/electricity-generation-t-d/power-system-control-operation>