POWER SYSTEM OPERATION AND CONTROL

Subject Code : EE702PC

Regulations : R18 - JNTUH

Class : III Year B.Tech EEE II Semester

Department of Electrical and Electronics and Engineering

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

Ibrahimpatnam - 501 510, Hyderabad

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
COURSE DESCRIPTION FORM
2020-2021 (II SEMESTER)

Course Title	POWER SYSTEM OPERATION AND CONTROL			
Course Code	EE702PC			
Class	B.Tech. III Year II Semester EEE			
Regulations	JNTUH - R18			
Course Structure	Lectures	Tutorials /Bridge	Practical	Credits
	3	0	-	3
Course Coordinator	K Srinivasa Rao, Assistant Professor			
Team of Instructors	K Srinivasa Rao, Assistant Professor			

I. COURSEOVERVIEW:

This subject deals with the economic operation of power systems. It emphasizes on load flow studies, single area and two area load frequency control and reactive power control. Computer control of power systems.

Course Objectives:

- To understand real power control and operation
- To know the importance of frequency control
- To analyze different methods to control reactive power
- To understand unit commitment problem and importance of economic load dispatch
- To understand real time control of power systems

II. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	3	3	1. Power systems-I 2. Power systems II

III. MARKSDISTRIBUTION:

Sessional Marks	University End Exam marks	Total marks

Midterm Test: There shall be *Two Mid-Term Examinations*. Each mid-term examination consists of one objective paper, one descriptive paper and one assignment. The objective paper and the essay paper shall be for 10 marks each with a total duration of 1 hour 20 minutes (20 minutes for objective and 60 minutes for essay paper). The objective paper is set with 20 bits of multiple choice, fill-in the blanks and matching type of questions for a total of 10 marks. The essay paper shall contain 4 full questions out of which, the student has to answer 2 questions, each carrying 5 marks.	**25**	
While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus. Five marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid- examination, and the second assignment should be submitted before the conduct of the second mid-examination. The total marks secured by thestudentineachmid-termexaminationareevaluatedfor25marks, and the *Average of the Two Mid-Term Examinations* shall be taken as the final marks secured by each student in internals/sessionals **End Semester Examinations:** • The end semester examinations will be conducted for 75 marks consisting of two parts viz. i) Part- A for 25 marks, ii) Part - B for 50marks. • Part-A is compulsory question which consists of ten sub-questions. The first five sub-questions are from each unit and carry 2 marks each. The next five sub- questions are one from each unit and carry 3 markseach. • Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the twoquestions.	75	100

IV. EVALUATIONSCHEME:

S. No.	Component	Duration	Marks
1	I Mid Examination	1 hour 20 minutes	20
2	I Assignment	-	5
3	II Mid Examination	1 hour 20 minutes	20
4	II Assignment	-	5
5	External Examination	3 hours	75

V. COURSE OBJCTIVES:

1 To understand real power control and operation

2 To know the importance of frequency control

3 To analyze different methods to control reactive power

4 To understand unit commitment problem and importance of economic load dispatch

5 To understand real time control of power systems

VI. COURSE OUTCOMES:

At the end of the course the student will be able to:

S. No	Description	Bloom's taxonomy level
1	Understand operation and control of power systems	Knowledge, Understand (Level 1, Level 2)
2	Analyze various functions of Energy Management System (EMS) functions	Knowledge, Understand (Level 1, Level 2)
3	Analyze whether the machine is in stable or unstable position	Knowledge, Apply (Level 2, Level 3)
4	Understand power system deregulation and restructuring	Understand, Apply, Evaluate (Level 2, Level 3, Level 5)
5	Understand the concept of computer control of power systems and data acquisition.	Knowledge, Understand (Level 1, Level 2)

VII. HOW PROGRAM OUTCOMES ARE ASSESSED

Program Outcomes		Level	Proficiency assed by
PO1	**Engineering knowledge:** To Apply the knowledge of mathematics, science, and engineering fundamentals/principles, and Electrical & Electronics Engineering to the solution of complex engineering problems encountered in modern Engineering practice.	3	Seminars, Assignments, Mock tests,
PO2	**Problem analysis:** Ability to Identify, formulate, review research literature, and analyze complex engineering problems related to Electrical and Electronics Engineering and reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	Assignments, Mock tests
PO3	**Design/development of solutions:** Design solutions for complex engineering problems related to Electrical and Electronics Engineering and design system components or processes that meet the desired needs within realistic consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2	Assignments, Mock tests
PO4	**Conduct investigations of complex problems:** Use research--based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	Projects
PO5	**Modern tool usage:** Create, select, and apply appropriate	1	Projects

	techniques, skills, resources, and modern Electrical and Electronics Engineering tools including prediction and modeling to complex engineering activities with an understanding of the limitations.		
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Electrical and Electronics Engineering professional engineering practice.	-	-
PO7	**Environment and sustainability:** Understand the impact of the Electrical and Electronics Engineering professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	-	-
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	-	-
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary teams.	-	-
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	Student Seminars
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	-	-
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	Competitive Exams

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED

Program Specific Outcomes	Level	Proficiency assed by

PSO1	Talented to analyze, design and implement electrical & electronics systems and deal with the rapid pace of industrial innovations and developments	2	Projects
PSO2	Skillful to use application and control techniques for research and advanced studies in Electrical and Electronics engineering domain	2	Projects

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

IX. COURSE CONTENT:

JNTUH SYLLABUS

UNIT – I Load Flow Studies

Introduction, Bus classification -Nodal admittance matrix - Load flow equations - Iterative methods -Gauss and Gauss Seidel Methods, Newton-Raphson Method-Fast Decoupled method-Merits anddemerits of the above methods-System data for load flow study

UNIT – II Economic Operation of Power Systems

Distribution of load between units within a plant-Transmission loss as a function of plant generation,Calculation of loss coefficients-Distribution of load between plants.

UNIT – III Load Frequency Control

Introduction, load frequency problem-Megawatt frequency (or P-f) control channel, MVAR voltages (orQ-V) control channel-Dynamic interaction between P-f and Q-V loops. Mathematical model of speed governing system-Turbine models, division of power system into control areas, P-f control of singlecontrol area (the uncontrolled and controlled cases)-P-f control of two area systems (the uncontrolledcases and controlled cases)

UNIT – IV Power System Stability

The stability problem-Steady state stability, transient stability and Dynamic stability-Swing equation.Equal area criterion of stability-Applications of Equal area criterion, Step by step solution of swingequation-Factors affecting transient stability, Methods to improve steady state and Transient stability,Introduction to voltage stability

UNIT – V Computer Control of Power Systems

Need of computer control of power systems. Concept of energy control center (or) load dispatch centerand the functions - system monitoring - data acquisition and control. System hardware configuration –SCADA and EMS functions. Network topology – Importance of Load Forecasting and simple techniquesof forecasting.

NPTEL WEB:

https://nptel.ac.in/downloads/108101040/

NPTEL VIDEOS:

https://nptel.ac.in/courses/108101040/

GATE SYLLABUS:

Voltage and Frequency control

ESE SYLLABUS:

Voltage control and economic operation

SUGGESTED BOOKS:

TEXT BOOKS

1. C. L. Wadhwa, Electrical Power Systems, 3rd Edn, New Age International Publishing Co., 2001.
2. D. P. Kothari and I. J. Nagrath, Modern Power System Analysis, 4th Edn, Tata McGraw Hill Education Private Limited 2011.

REFERENCES:

1. D. P. Kothari: Modern Power System Analysis-Tata Mc Graw Hill Pub. Co. 2003.
2. Hadi Sadat: Power System Analysis –Tata Mc Graw Hill Pub. Co. 2002

X. COURSE PLAN:

Lecture No.	Unit No.	Date	Topics to be covered	Link for PPT	Link for PDF	Link for Small Projects/ Numericals(if any)	Course learning outcomes	Teaching Methodology	Reference
1	1	30/03/2021	Introduction to POWER SYSTEM OPERATION AND CONTROL	https://drive.google.com/file/d/1ubJB3MgUD8HTtznjexkBWVxJQGq8zuEg/view?usp=sharing	https://drive.google.com/file/d/1JeU0uA7Yovv-Z2E8BS_-42teCsSOQufh/view?usp=sharing	https://drive.google.com/file/d/1WMDPfMu6QR0HA7oxUeGhKX2LKWYlODxw/view?usp=sharing	KNOWLEDGE	CHALK PPT WHITE BOARD	
2		31/03/2021	UNIT - I Load Flow Studies Introduction, Bus classification				UNDERSTANDING	CHALK PPT WHITE BOARD	
3		6/4/2021	Nodal admittance matrix		https://drive.google.com/file/d/1REPX3UbAtO1eWvNy808bh6QWyQhVhc1l/view?usp=sharing		ANALYSIS	CHALK PPT WHITE BOARD	
4		7/4/2021	Problems on Y bus formation& Load flow equations				KNOWLEDGE	CHALK PPT WHITE BOARD	
5		12/4/2021	Iterative methods - Gauss method		https://drive.google.com/file/d/11oC7ki_hTIf5-tzPBeKBQh3tWJg20zF2/view?usp=sharing		ANALYSIS	CHALK PPT WHITE BOARD	
6		19/04/2021	Gauss Seidel Methods				ANALYSIS	CHALK PPT WHITE BOARD	

7		20/04/2021	Newton-Raphson Method		https://drive.google.com/file/d/1zP4bvPbyhrYbHrK0K8DKKABo4q8v8Dv_/view?usp=sharing		NUMERICAL	CHALK PPT WHITE BOARD
8		26/04/2021	Fast Decoupled method		https://drive.google.com/file/d/1z5oXCLnLwueI3J0O5Vf0R1BP66HSaqBJ/view?usp=sharing		APPLICATION	CHALK PPT WHITE BOARD
9		27/04/2021	Merits and demerits of the above methods		https://drive.google.com/file/d/1NvTNdAf8oJBE5bWOteEnOBH1f4i9_wbd/view?usp=sharing		NUMERICAL	CHALK PPT WHITE BOARD
10		28/04/2021	System data for load flow study				**NUMERICAL**	
11	**II**	3/5/2021	UNIT - II Economic Operation of Power Systems	https://drive.google.com/file/d/1o-3n6zS3tzMYgJITfd0e1BzXlsgNEKR1/view?usp=sharing	https://drive.google.com/file/d/1SLm6Ejf6AuVgcuYmVxF8y5btB7x_Mlce/view?usp=sharing	https://drive.google.com/file/d/1WMDPfMu6QR0HA7oxUeGhKX2LKWYlODxw/view?usp=sharing	ANALYSIS	CHALK PPT WHITE BOARD
12		4/5/2021	Distribution of load between units within a plant		https://drive.google.com/file/d/1h1wS2WlULsHJeVp1cjRghczqpZzPNJ0U/view?usp=sharing		**NUMERICAL**	
13		5/5/2021	Transmission loss as a function of plant generation		https://drive.google.com/file/d/14IM8wv2baGk4S0csQguFHN_uxbBG4ILL/view?usp=sharing		ANALYSIS	CHALK PPT WHITE BOARD
14		10/5/2021	Calculation of loss coefficients		https://drive.google.com/file/d/1lwKei0zTZ32SgNyctTysaNQUdKhyel1F/view?usp=sharing		**UNDERSTANDING**	CHALK PPT WHITE BOARD
15		11/5/2021	Distribution of load between plants				**NUMERICAL**	CHALK PPT WHITE BOARD
16	**III**	12/5/2021	UNIT - III Load Frequency ControIntroduction, load frequency problem	https://drive.google.com/file/d/1QbP99_Xg59ydoK7f-KmQCnTfmoTyQJ9L/view?usp=sharing	https://drive.google.com/file/d/1xKs260HFAA4C6WU6eFMTBL3kKBM0Lu8g/view?usp=sharing	**https://drive.google.com/file/d/1WMDPfMu6QR0HA7oxUeGhKX2LKWYlODxw/view?usp=sharing**	ANALYSIS	CHALK PPT WHITE BOARD
17		7/6/2021	Megawatt frequency (or P-f) control channel				**NUMERICAL**	CHALK PPT WHITE BOARD
18		8/6/2021	MVAR voltages (or Q-V) control channel				UNDERSTANDING	CHALK PPT WHITE BOARD
19		9/6/2021	Dynamic interaction between P-f				ANALYSIS	CHALK PPT WHITE

			and Q-V loops					BOARD
20		14/06/2021	Mathematical model of speed governing system				**NUMERICAL**	CHALK PPT WHITE BOARD
21		15/06/2021	Turbine models, division of power system into control areas				**NUMERICAL**	CHALK PPT WHITE BOARD
22		16/06/2021	P-f control of single control area (the uncontrolled and controlled cases				KNOWLEDGE	CHALK PPT WHITE BOARD
23		21/06/2021	P-f control of two area systems (the uncontrolled cases and controlled cases)				**NUMERICAL**	CHALK PPT WHITE BOARD
24	**IV**	22/06/2021	UNIT - IV Power System Stability The stability problem- Steady state stability	https://drive.google.com/file/d/1dhXvpzw29WcllriwoB8E9E38C-F0kGa5/view?usp=sharing	https://drive.google.com/file/d/1a3zP_vZM_JM28MwxmNlvHlB3VfJmgOGI/view?usp=sharing	**https://drive.google.com/file/d/1WMDPfMu6QR0HA7oxUeGhKX2LKWYlODxw/view?usp=sharing**	UNDERSTANDING	CHALK PPT WHITE BOARD
25		23/06/2021	transient stability and Dynamic stability				ANALYSIS	CHALK PPT WHITE BOARD
26		28/06/2021	Swing equation Equal area criterion of stability Applications of Equal area criterion				UNDERSTANDING	CHALK PPT WHITE BOARD
27		29/06/2021	Step by step solution of swing equation Factors affecting transient stability				APPLICATION	CHALK PPT WHITE BOARD
28		5/7/2021	Methods to improve steady state and Transient stability				UNDERSTANDING	CHALK PPT WHITE BOARD
29		6/7/2021	Problems				SOLVE	CHALK PPT WHITE BOARD
30			**I Mid Examinations**					

31		7/7/2021	UNIT - V Computer Control of Power Systems-Need of computer control of power systems				KNOWLEDGE	CHALK PPT WHITE BOARD	
32		12/7/2021	Concept of energy control centre (or) load dispatch centre and the functions				UNDERSTANDING	CHALK PPT WHITE BOARD	
33		13/07/2021	Concept of energy control centre (or) load dispatch centre and the functions				UNDERSTANDING	CHALK PPT WHITE BOARD	
34		14/07/2021	system monitoring - data acquisition and control.	https://drive.google.com/file/d/1D-9tkpYNEJHTNdtZ-bv9iZ_UEjoQt1u5/view?usp=sharing	https://drive.google.com/file/d/1UX4nlJ3TZ6i1EzPy6DjnYokbjieDts7d/view?usp=sharing	**https://drive.google.com/file/d/1WMDPfMu6QR0HA7oxUeGhKX2LKWYlODxw/view?usp=sharing**	KNOWLEDGE	CHALK PPT WHITE BOARD	
35	**V**	19/07/2021	System hardware configuration				UNDERSTANDING	CHALK PPT WHITE BOARD	
36		21/07/2021	SCADA and EMS functions				UNDERSTANDING	CHALK PPT WHITE BOARD	
37		26/07/2021	Network topology				KNOWLEDGE	CHALK PPT WHITE BOARD	
38		27/07/2021	Importance of Load Forecasting and simple techniques of forecasting				ANALYSIS	CHALK PPT WHITE BOARD	
39		28/07/2021	Importance of Load Forecasting and simple techniques of forecasting				ANALYSIS	CHALK PPT WHITE BOARD	
II Mid Examinations									

XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes (PO)												Program Specific Outcomes (PSO)	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**

CO1	3	2	2	2	2	-	-	-	-	-	2	1	2	2
CO2	3	2	2	2	2	-	-	-	-	-	1	2	2	2
CO3	3	3	2	2	2	-	-	-	-	-	2	1	2	2
CO4	3	2	2	2	2	-	-	-	-	-	2	1	2	2
CO5	2	-	2	1	1	-	-	-	-	-	1	1	1	1
AVG	**2.8**	**2.25**	**2**	**1.8**	**1.8**	-	-	-	-	-	**1.6**	**1.2**	**1.8**	**1.8**

1: Low **2. Moderate** **3.High** **-.None**

XII. QUESTION BANK: (JNTUH)

DESCRIPTIVE QUESTIONS:

UNIT-I

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Define loadbus, slack bus and generator bus	Knowledge	1
2	What are the disadvantages of the Gauss Seidel Load FlowAnalysis?	Apply	1
3	What is the advantage of using acceleration factor in Gauss-siedel loadflow method?	Understand	1
4	Which quantities are specified at voltage controlledbus?	Knowledge	1
5	What are the advantages of conducting power flowstudies?	Knowledge	1
6	What is the data for power flowstudies?	Analyze	1
7	What is the normal value of acceleration factor used in GSmethod?	Analyze	1

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Compare the different methods of load flow techniques?	Knowledge	1
2	There is no mutual coupling, the diagonal and off-diagonal elements of Y Bus can be computed from Yii = sum (yij) and Yij = sum (yij) .	Evaluate	1
3	Explain the Derivation of Static load flow equations – Load flow solutions using Gauss Seidel Method?	Evaluate	1
4	Explain Load flow solution with and without P-V buses, Algorithm and Flowchart?	Knowledge	1
5	Explain the advantages and disadvantages of G-S method?	Evaluate	1
6	Explain Injected Active and Reactive Powers (Sample One Iteration only)?	Evaluate	1
8	Explain finding Line Flows/Losses for the given Bus Voltages.	Evaluate	1
9	Write the algorithm for FDLF method?	Understand	1
10	Compare G-S method and N-R methods.	Understand	

UNIT-2

Short Answer Questions

S.No	Question	Blooms	Course

		Taxonomy Level	Outcome
1	Define incremental fuel cost	Knowledge	1
2	What is langrangian multiplier	Knowledge	1
3	What is economic load dispatch?	Knowledge	1
4	Explain input – output characteristics of thermal power stations.	Analyze	1

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Derive the optimum generator allocation with line losses	Knowledge	1
2	Derive the optimum generator allocation without line losses	Knowledge	1
3	Discuss the general problem of economic operation of large inter connected area	Knowledge	1

UNIT-3

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	What is flat frequency control	Knowledge	1
2	Explain about control area and control area error	Apply	1
3	Explain how the tie-line power deviation can be unincorporated in two-area system Block diagram.	Understand	1
4	What are the features of the dynamic response of a two area system for step load disturbances?	Knowledge	1
5	What the advantages are of inter connected operation of power system? Explain	Knowledge	1
6	Explain in detail in selecting frequency bias parameters?	Analyze	1
7	Explain the state-space model of synchronous machine	Analyze	1

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Derive the transfer function of speed governing system?	Knowledge	1
2	Explain the necessity of maintaining a constant frequency in power system operation	Evaluate	1
3	Two generators rated 100MW and 400MW are operating in parallel. The drop characteristics of their governors are 2% and 4% respectively from no-load to full load, Assuming that the generators are operating at 50Hz at no-load, how would a load of 500MW be shared between them? What will be the system frequency at this load? Assume free governor operator. a. Without proportional plus integral controller and b. With proportional plus integral control	Evaluate	1
4	A 500 MW generator has speed regulation of 4%. If the frequency drops by 0.12Hz with unchanged reference, determine the increase in turbine power. Also find by how much the reference power setting be changed if the turbine power remain unchanged.	Knowledge	1
5	Explain in detail the importance of load frequency problem.	Evaluate	1

6	A 100MVA synchronous generator operates on full load at a frequency of 50Hz. The load is suddenly reduced to 50 MW. Due to time log in governor system, the steam value begins to close after 0.4 seconds. Determine the change in frequency that occurs in this time. Given the initial constant H = 5 KW – Sec/KVA of generator rating.	Evaluate	1
8	Two areas of a power system network are inter connected by a tie-line, whose capacity is 500MW, operating at a power angle of. If each area has a capacity of 5000MW and the equal speed regulation of 3Hz/puMW, determine the frequency of oscillation of the power for step change in load. Assume that both areas have the same inertia constants of H = 4 Sec.	Evaluate	1
9	Distinguish between load frequency control and economic dispatch control	Understand	1

UNIT-4

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Define stability, steady state stability, transient stability and dynamic stability?	Understand	1
2	Derive the swing equation?	Applying	1
3	Derive the transient stability by using equal area criterion?	Applying	1
4	What are the applications of equal area criterion?	Knowledge	1
5.	Define critical clearing angle?	Understand	1
6.	Define critical clearing time?	Understand	1
7.	Briefly explain about Power-Angle curve?	Knowledge	1
8.	What are the methods to improve stability?	Knowledge	1

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Derive and explain of Swing Equation?	Knowledge	1
2	A synchronous generator is operating at an infinite bus and supplying 45% of its Peak power capacity. As soon as a fault occurs, the reactance between the generator and the line becomes four times its value before the fault. The peak power that can be delivered after the fault is cleared is 70% of the original maximum value. Determine the critical clearing angle.	Evaluate	1
3	A 50 Hz, three-phase synchronous generator delivers 1.00 p.u. powers to an infinite Bus bar through a network in which resistance is negligible. A fault occurs which reduces the maximum power transferable to 0.40 p.u. whereas, before the fault, this power was 1.8 p.u. and, after the clearance of the fault 1.30 p.u. By the use of equal area criterion, determine the critical angle.	Evaluate	1
4	Explain Determination of Transient Stability by Equal Area Criterion	Analyze	1

	and write Application of Equal Area Criterion?		
5	Explain Solution of Swing Equation: Point-by-Point Method?	Analyze	1
6.	Explain about Power Angle Curve and Determination of Steady State Stability?	Knowledge	1
7.	Explain about steady state stability power limit and synchronizing power co-efficient?	Analyze	1
8.	What is meant by power angle curve and write its significance.	Knowledge	1

UNIT-5

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	What is the function of Energy control center?	Knowledge	1
2	What is meant by SCADA	Knowledge	1
3	What are the functions of EMS	Knowledge	1

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain about the Need of computer control of power systems	Understand	1
2	Explain in detail about the Concept of energy control centre.	Understand	1
3	Why is SCADA necessary?.How is it done?.	Knowledge	1
4	Explain about EMS?.	Analyze	1
5	What is load forecasting? Explain in detail.	Analyze	1

OBJECTIVE QUESTIONS:

FILL UP THE BANKS:

UNIT-1

1.Thefrequency of the power system controls the _____.

2. Single control area fitted with proportional plus integral controller is_____.

3. The synchronizing coefficient between two area of a 2 area power system is _____.

4. If the two generators have individual ratings of 10MW each& a system load of 16 MW should be share as _____.

5. Load frequency control uses_____.

UNIT-2

1. The specified variables at PQ buses are_____.

2 .In case of transmission line the capacitance is a_____.

3. Series Capacitors are used to _____.

4.Synchronous motor can operate at_____.

5.Under heavy loading condition , the reeceving end bus should be _____.

UNIT-III:

1. The unit of heat rate is _____.

2. The unit of langrangian multiplier ʯ is _____.

3. For a slack bus ,the penalty factor is _____.

4. Incremental transmission lloss of grid is _____.

5 .IFC is given by _____.

UNIT-IV:

1. The constraint equation in computing economic criteria is given by _____.

2. The units can be started within a short duration of time to meet the change in load when a particular unit fails in the power system is called _____.
3. The constraints placed on the system operation by reliability considerations the system will be operated most_____.
4. The unit is running it should not be turned off immediately this is called as _____
5.. What are the methods of finding economic dispatch _____.

UNIT-V:

1. Define SCADA _____.
2. Application of SCADA reduce _____.
3. State estimation uses techniques like _____.
4. State the functions of energy control center _____.
5. State the functions of load dispatch center _____.

JNTUH:

UNIT-1

1. In load flow analysis, the load connected at a bus is represented as ( )
   a. Constant current drawn from the bus
   b. Constant impedance connected at the bus
   c. Voltage and frequency dependent source at the bus
   d. constant real and reactive drawn from the bus

   Ans c
2. Two power plants A and B are inter connected by a ( )
   a. long line b.short line c.both d.none

   Ans d

3.In the single area case we could thus represent the frequency deviations by the ( )
   a. single variable b.two variable
   c. three variable d.four variable

   Ans.a
4. Power transmitted from the area 1 is equation ( )
   a. a.power equation b.torque
   c. c.current d.all

   Ans.a
5. All quantities other than frequency are in ( )

   a.p.u b.apm d.volt d.ohm Ans.a

UNIT-2

1.. Shunt capacitors ( )
   a. fixed capacitor is connected across a load
   b. at a consumers premises c. both d. none

   Ans.c

2. An excitation system should have ( )

a. low time constant b. high transient response c. high reliability d. all the above

Ans.d

3. A power system needs injection of VARS ( )

a. at peak load b. at off-peak load c. both (a) & (b) none

Ans.c

4. The change in reactive power at a bus have a great effect on the voltage magnitude ( )

a. of that bus b. of distant busses c. of all the busses d. none

Ans.a

5.The injection of reactive power is needed ( )

a. to get a good voltage profile b. to increase the voltage at the receiving end

c. to compensate for line losses. D. to supply a part of active power requirement of the load.

Ans.a

UNIT-3

1. Equality constraints are ( )
   a. Generator constrains b. Current constraints
   c. magnetic constraints d. none of the above
   Ans a
2. Heat rate curve is defined as ( )
   a. Fuel i/p to the power o/p b.Power o/p to the fuel i/p
   b. Both d.none of the above
   Ans a
3. Optimal operation of generator is ( )
   a.To maximize the total cost b.To minimize the total cost
   c. Both d.all the above
   Ans c

4. The fuel cost is included in ( )
   a. Annual fived cost b. Annual operating cost c.. Both (a) & (b) d. None
Ans.b
5. The penalty factor ( )
a. is always less than 1. b.is always more than 1 c. may be more or less than 1.
d. is equal to 1 or less than 1.
Ans .b

UNIT -4

1. Operation of the system the having ( )
   a. Hydro b.Thermal
   c.both d.none
   Ans.c
2. The hydroelectric project consists of ( )
   a. body of water impounded by a dam b. body of water impounded by a station
   c.both d.All of the above
   Ans.a
3. The water level bay is influenced by flow out of the ( )
   a.reservoir b.dam
   c.hydroplant d.none
   Ans: b
4. The run off river plants have very high firm capacity ( )
   a. True b. False
   Ans.b
5. The units for heat rate are ( )

a. k cal/kwh b.kwh/k calc.kcal/hour d.kw
Ans.a

UNIT -5

1. Electrical energy can be stored in large amounts False
2. Load forecasting is done only for long term. False
3. Application of SCADA reduce man power requirement. True
4. SCADA is used only by utilities and not in any industry. False.
5. State estimation uses techniques like weighted least square method. True

GATE:

1. The fuel cost functions of two power plants are

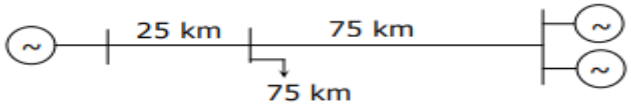
$$C_1 = 0.05Pg_1^2 + APg_1 + B$$

$$C_2 = 0.10Pg_2^2 + 3APg_2 + 2B$$

where, Pg1 and Pg2 are the generated powers of two plants, and A and B are the constants. If the two plants optimally share 1000 MW load at incremental fuel cost of 100 Rs/MWh, the ratio of load shared by plants P1 and P2 is (A) 1:4 (B) 2:3 (C) 3:2 (D) 4:1

2. A 50 Hz generating unit has H-constant of 2 MJ/MVA. The machine is initially operating in steady state at synchronous speed, and producing 1 pu of real power. The initial value of the rotor angle δ is o5 , when a bolted three phase to ground short circuit fault occurs at the terminal of the generator. Assuming the input mechanical power to remain at 1 pu, the value of δ in degrees, 0.02 second after the fault is _____..

3. A load center of 120MW derives power from two power stations connected by 220kV transmission lines of 25km and 75km as shown in the figure below. The three generators G1,G2 and G3 are of 100MW capacity each and have identical fuel cost characteristics. The minimum loss generation schedule for supplying the 120 MW load is



(A).P1 80MW losses P2 20MW P3 20MW (B) P1 60MW P2 30MW losses P3 30MW
(C) P1 40MW P2 40MW P3 40MW losses (D) P1 30MW losses P2 45MW P3 45MW

XIII. WEBSITES:

1. www.eng.fsu.edu.in
2. www.scribd.com
3. http://nptelonlinecourses.iitm.ac.in

XIV. EXPERT DETAILS:

1. Dr. A.Jayalakshmi, Professor, JNTUH
2. Dr. Suryakalaavthi,, Professor, JNTUH

XV. JOURNALS:

1. IEEE Transaction on Power systems.
2. IEEE Power and Energy Technology Systems Journal
3. IEEE Power Engineering Journal.

XVI. LIST OF TOPICS FOR STUDENT SEMINARS:

1. Optimal operation of generators in Thermal power stations
2. Optimal generation allocation including the effect of transmission line losses
3. Hydroelectric power plant models
4. Modeling of Excitation system
5. Necessity of frequency constant
6. Block diagram representation of an isolated power system
7. Load frequency control of two-area system
8. Proportional plus integral control of single area and its block diagram representation

XVII. CASE STUDIES / SMALL PROJECTS

1. Load frequency control and Economic dispatch control
2. Overview of Reactive power control
3. Reactive power compensation in transmission system
4. Specifications of load compensator
5. Uncompensated and compensated transmission lines
6. Shunt and series compensation
7. General transmission line loss formula

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