Hall Ticket No | | | | | | | | | | | Question Paper Code: BPSB01

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER

M.Tech I Semester End Examinations, November- 2019

Regulations: R18

MODERN POWER SYSTEM ANALYSIS

(Electrical Power Systems)

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

UNIT – I

1. a) Describe the various components of power system with a neat diagram. **[7M]**

   b) Discuss Formation of Y bus by using direct inspection method. **[7M]**

2. a) The single line diagram of a simple power system is shown in Fig. The rating of the generators and transformers are given below: **[7M]**

   Generator 1: 25MVA, 6.6KV, X=0.2p.u

   Generator 2: 5MVA, 6.6KV, X=0.15p.u

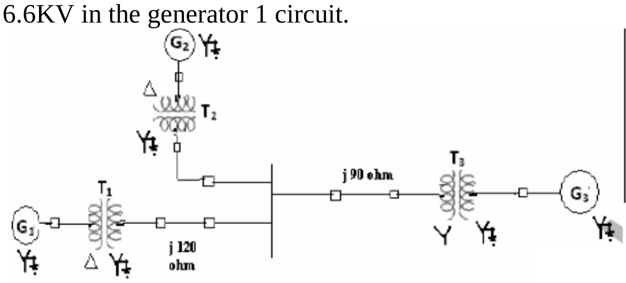
   Generator 3: 30MVA, 13.2KV, X=0.15p.u

   Transformer1: 30MVA, 6.9Δ/115Y KV, X=10%

   Transformer2: 15MVA, 6.9Δ/115Y KV, X=10%

   Transformer3: Single phase units each rated 10MVA, 6.9/69 KV, X=10%

   Examine the impedance diagram and mark all values in p.u choosing a base of 30MVA, 6.6KV in the generator 1 circuit.



   b) Discuss about algorithm for the modification of Z bus matrix for addition of element between two old buses. **[7M]**

UNIT – II

3. a) Explain Gauss-Seidel iterative method for power flow analysis of any given power system with a flow chart. **[7M]**

b) The system data for a load flow problem are given in table. **[7M]**

i. Compute Y bus.

ii. Solve bus voltages at the end of first iteration by G-S method by taking α =1.6

Line no	Bus code	Admittance in pu
1	1-2	2-j8
2	1-3	1-j4
3	2-3	0.6-j2.6

4. a) Line data: **[7M]**

Bus code	Admittance(p.u.)
1-2	1+j6
1-3	2-j3
2-3	0.8-j2.2
2-4	1.2-j2.3
3-4	2.1-j4.2

Load Data:

Bus No.	P (p.u.)	Q (p.u.)	V (p.u.)	Remarks
1	-	-	1.03	Slack
2	0.52	0.23	1.0	PQ
3	0.42	0.32	1.0	PQ
4	0.4	0.12	1.0	PQ

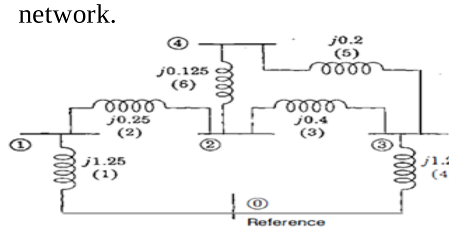
Determine the voltages at all the buses at the end of first iteration using GS method.

b) Explain with a flow chart the computational procedure for load flow solution using DLF Method. **[7M]**

UNIT – III

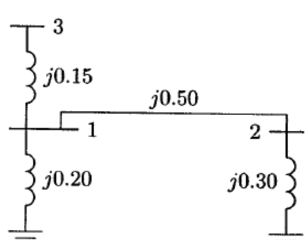
5. a) Explain the step by step procedure for systematic fault analysis for a three phase fault using bus impedance matrix. **[7M]**

b) Examine the bus impedance matrix using bus building algorithm for the given network. **[7M]**



6. a) Point out Bus impedance matrix. Describe the construction of Bus impedance matrix ZBus using Bus building algorithm for lines without mutual coupling. **[7M]**

b) Using the method of building algorithm, find the bus impedance matrix of the network shown in figure. **[7M]**



UNIT – IV

7. a) Describe the various operating states of a power system with a neat sketch. **[7M]**

b) Construct the column of bus impedance matrix when one line is added to the network. **[7M]**

8. a) Explain the steps involved in contingency analysis with an example. **[7M]**

b) A four bus system Zbus is given in per unit by **[7M]**

$$\begin{array}{c|cccc} & (1) & (2) & (3) & (4) \\ \hline (1) & j0.041 & j0.031 & j0.027 & j0.018 \\ (2) & j0.031 & j0.256 & j0.035 & j0.038 \\ (3) & j0.027 & j0.035 & j0.158 & j0.045 \\ (4) & j0.018 & j0.038 & j0.045 & j0.063 \end{array}$$

has bus voltages $V_1 = 1.0\angle 0^0, V_2 = 0.98\angle 0^0, V_3 = 0.96\angle 0^0, V_4 = 1.04\angle 0^0$. Using the compensation current methods determine the change in voltage at bus 2due to the outage of line 1-3with series impedance j0.3 per unit.

UNIT – V

9. a) Describe the steps involved in state estimation of AC networks **[7M]**

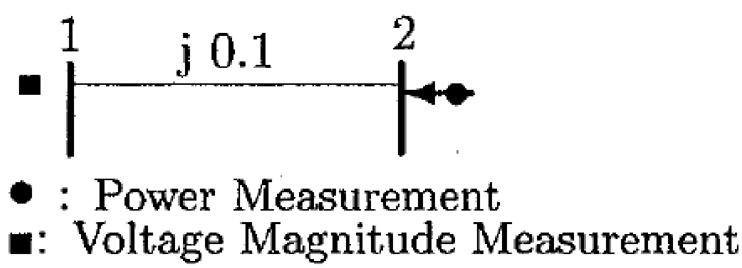
b) Describe the method of orthogonal decomposition for state estimation. **[7M]**

10. a) Explain the line only algorithm for static state estimation of power systems **[7M]**

b) A 2-bus power system is shown in Figure. Assume that the following measurement set is available for estimation: **[7M]**

$$[z]^T = [P_2 Q_2 V_1] = [-0.30, -0.15, 1.0]$$

Assume that the measurements are equally accurate.



(a) Find the WLS estimator for V_2 and θ_2.

(b) What is the value of the objective function $J(x)$ at the optimal solution?

COURSE OBJECTIVES:

The course should enable the students to:

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I	Explain the basic components and restructuring of power systems.
II	Understand power flow analysis using various methods.
III	Describe fault analysis for balanced and unbalanced faults.
IV	Describe power system security concepts and study the methods to rank the contingencies.
V	Explain the need of state estimation and study simple algorithms for state estimation.

COURSE OUTCOMES (COs):

CO 1	Describe the basic components, restructuring and formulation of bus matrices for power system networks.
CO 2	Solve power flow analysis problems using various methods.
CO 3	Discuss various methods for short circuit analysis of balanced and unbalanced networks.
CO 4	Describe the operating states of power system and its contingency analysis.
CO 5	Implement the various algorithms for state estimation.

COURSE LEARNING OUTCOMES (CLOs):

BPSB01.01	Describe the basic components of power system and its restructuring.
BPSB01.02	Understand the single line diagram, per unit and per phase calculations of power system network.
BPSB01.03	Understand the representation of power system components.
BPSB01.04	Determine the bus impedance and admittance matrices for power system.
BPSB01.05	Understand the importance of power flow analysis in planning and operation of power systems.
BPSB01.06	Describe the power flow models in complex variable and polar forms.
BPSB01.07	Use different numerical methods to determine unknown parameters at various buses and to draw relevant algorithms.
BPSB01.08	Describe the optimal power flow solution using FACTS devices.
BPSB01.09	Use Thevenin’s theorem and Z-bus building algorithm for balance short circuit fault analysis using Z-bus computations.
BPSB01.10	Calculate the electrical parameters under symmetrical fault conditions and understand symmetrical component theory.
BPSB01.11	Use Thevenin’s theorem and Z-bus matrix for fault analysis of sequence networks.
BPSB01.12	Discuss the operating states and security monitoring of power systems.
BPSB01.13	Describe the various techniques for contingency evaluation and analysis.
BPSB01.14	Calculation of new bus voltages using contingency analysis by adding/removal of lines.
BPSB01.15	Understand the requirements of state estimation methods for power systems.
BPSB01.16	Use various methods for state estimation of power system networks.

BPSB03.17	Explain network observability and pseudo measurements

MAPPING OF SEMESTER END EXAMINATION - COURSE OUTCOMES

SEE Question No		Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level
1	a	BPSB01.01	Describe the basic components of power system and its restructuring.	CO 1	Remember
	b	BPSB01.04	Determine the bus impedance and admittance matrices for power system.	CO 1	Understand
2	a	BPSB01.02	Understand the single line diagram, per unit and per phase calculations of power system network.	CO 1	Understand
	b	BPSB01.04	Determine the bus impedance and admittance matrices for power system.	CO 1	Understand
3	a	BPSB01.07	Use different numerical methods to determine unknown parameters at various buses and to draw relevant algorithms.	CO 2	Remember
	b	BPSB01.07	Use different numerical methods to determine unknown parameters at various buses and to draw relevant algorithms.	CO 2	Remember
4	a	BPSB01.07	Use different numerical methods to determine unknown parameters at various buses and to draw relevant algorithms.	CO 2	Remember
	b	BPSB01.08	Describe the optimal power flow solution using FACTS devices.	CO 2	Understand
5	a	BPSB01.09	Use Thevenin's theorem and Z-bus building algorithm for balance short circuit fault analysis using Z-bus computations.	CO 3	Remember
	b	BPSB01.09	Use Thevenin's theorem and Z-bus building algorithm for balance short circuit fault analysis using Z-bus computations.	CO 3	Remember
6	a	BPSB01.09	Use Thevenin's theorem and Z-bus building algorithm for balance short circuit fault analysis using Z-bus computations.	CO 3	Remember
	b	BPSB01.09	Use Thevenin's theorem and Z-bus building algorithm for balance short circuit fault analysis using Z-bus computations.	CO 3	Remember
7	a	BPSB01.12	Discuss the operating states and security monitoring of power systems.	CO 4	Understand
	b	BPSB01.13	Describe the various techniques for contingency evaluation and analysis.	CO 4	Understand
8	a	BPSB01.13	Describe the various techniques for contingency evaluation and analysis.	CO 4	Understand
	b	BPSB01.14	Calculation of new bus voltages using contingency analysis by adding/removal of lines.	CO 4	Analyze
9	a	BPSB01.16	Use various methods for state estimation of power system networks.	CO 5	Analyze
	b	BPSB01.16	Use various methods for state estimation of power system networks.	CO 5	Analyze
10	a	BPSB01.15	Understand the requirements of state estimation methods for power systems.	CO 5	Understand
	b	BPSB01.16	Use various methods for state estimation of power system networks.	CO 5	Analyze

Signature of Course Coordinator **HOD, EEE**