# Power System Analysis-2 (18EE71) Odd Sem 2021-22

# Question Bank

**Mr. Kubera U**

**Assistant Professor**

**Department of EEE, SJB Institute of Technology**

# Power System Analysis-2
# Question Bank

## Module 1

1. Define the following and give an illustrative example: i) tree and co-tree ii) Basic loops iii) Basic cut sets iv) primitive network v) Bus frame of reference. vi) path vii) link viii) oriented connected graph ix) primitive network x) sub-graph

   June 2015,Dec 2016, Dec 2015, June 2017

2. Derive an expression for obtaining Y-bus using singular transformations.

   June 2016,Dec 2016,Dec 2015, June 2017

3. Given that the self-impedances of the elements of a network referred by the bus incidence matrix given below are equal to: Z1=Z2=0.2, Z3=0.25, Z4=Z5=0.1 and Z6=0.4 units, draw the corresponding oriented graph, and find the primitive network matrices. Neglect mutual values between the elements.

$$A = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \\ 1 & -1 & 0 \\ 0 & 1 & -1 \\ 1 & 0 & -1 \end{bmatrix}$$

   Dec 2016

4. What is primitive network? Explain with circuit and equations the significance of it in both impedance and admittance forms.Dec 2015,June 2016, June 2017

5. For the sample network-oriented graph shown in Figure below by selecting a tree, T(1,2,3,4), obtain the incidence matrices A and Aˆ . Also show the partitioned form of the matrix-A.

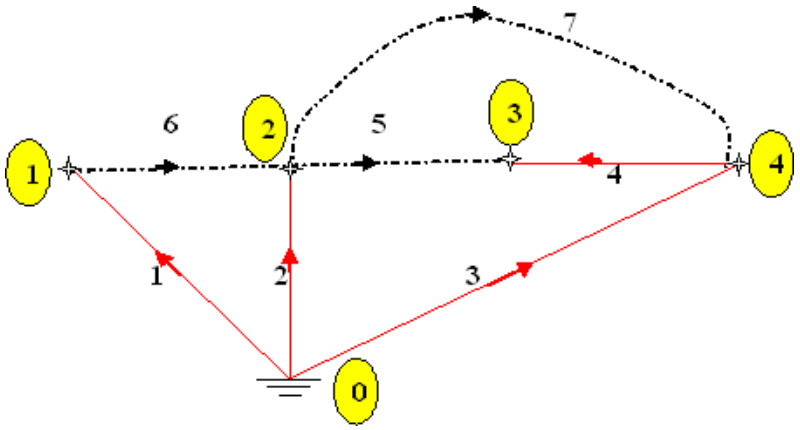



**Fig. Sample Network-Oriented Graph**

June 2017,June 2015, Dec 2015,June 2016

6. For the sample-system shown in Fig. E3, obtain an oriented graph. By selecting a tree, T(1,2,3,4), obtain the incidence matrices A and Aˆ . Also show the partitioned form of the matrix-A.

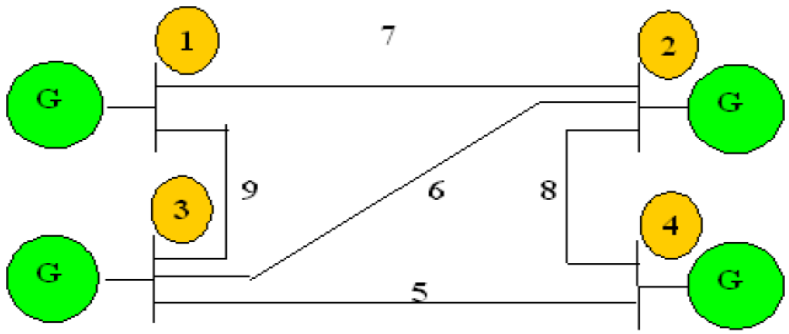
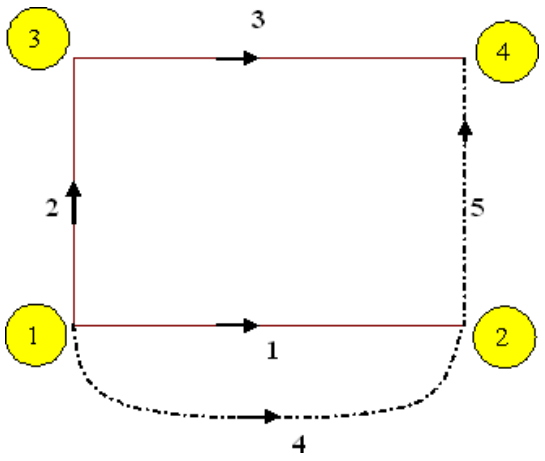



**Fig. E3a. Sample Example network**

June 2017,June 2015

7. For the network of Fig E8, form the primitive matrices [z] & [y] and obtain the bus admittance matrix by singular transformation. Choose a Tree T(1,2,3). The data is given in Table .

June 2016




| Elements | Self impedance | Mutual impedance |
|---|---|---|
| **1** | j 0.6 | - |
| **2** | j 0.5 | j 0.1(with element 1) |
| **3** | j 0.5 | - |
| **4** | j 0.4 | j 0.2 (with element 1) |
| **5** | j 0.2 | - |

8. Derive the expression for $Y_{bus}$ using Inspection method. June 2015,June 2016

1. Obtain the general expressions for $Z_{bus}$ building algorithm when a branch is added to the partial network. June 2016

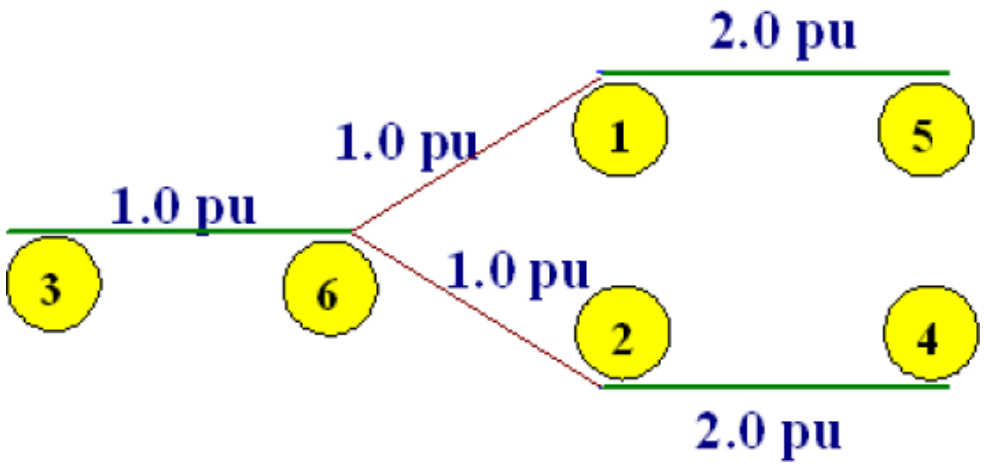
2. Obtain the general expressions for $Z_{bus}$ building algorithm when a Link is added to the partial network. Dec 2016

3. Prepare the $Z_{bus}$ for the system shown using $Z_{bus}$ building algorithm forthe positive sequence network data shown in table below, obtain $Z_{BUS}$ by building procedure.

| Sl. No. | p-q (nodes) | Pos. seq. reactance in pu |
|---|---|---|
| 1 | 0-1 | 0.25 |
| 2 | 0-3 | 0.20 |
| 3 | 1-2 | 0.08 |
| 4 | 2-3 | 0.06 |

June 2015,Dec 2016

4. Prepare the $Z_{bus}$ for the system shown using $Z_{bus}$ building algorithm




June 2016

5. Explain the formation of $Z_{bus}$using$Z_{bus}$ building algorithm.

Dec 2016

# Module 2 & 3

1. Using generalized algorithm expressions for each case of analysis, explain the load flow studies procedure, as per the G-S method for power system having PQ and PV buses, with reactive power generations constraints. June 2016,June 2015

2. Derive the expression in polar form for the typical diagonal elements of the sub matrices of the Jacobian in NR method of load flow analysis.
June 2017,Dec 2015,June 2015

3. Compare NR and GS method for load flow analysis procedure in respect of the following i) Time per iteration ii) total solution time iii) acceleration factor iv)number of iterations. Dec 2016, Dec 2015, June 2017

4. Explain briefly fast decoupled load flow (FDLF) solution method for solving the nonlinear load flow equations. Dec 2015,June 2017

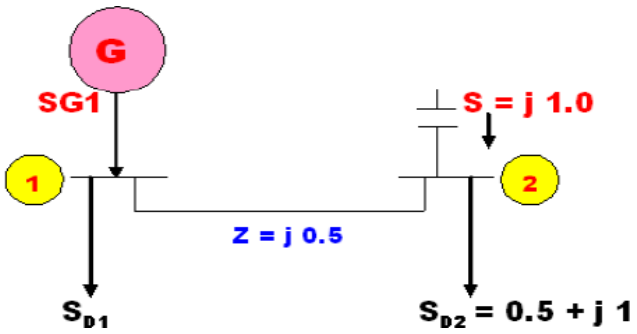
5. What are the assumptions made in fast decoupled load flow method? Explain the algorithm briefly, through a flow chart.
June 2015,Dec 2016

6. Explain the representation of transformer with fixed tap changing during the load flow studies
June 2017

7. What is load flow analysis? What is the data required to conduct load flow analysis? Explain how buses are classified to carry out load flow analysis in power system. What is the significance of slack bus? Dec 2015,Dec 2016,June 2017

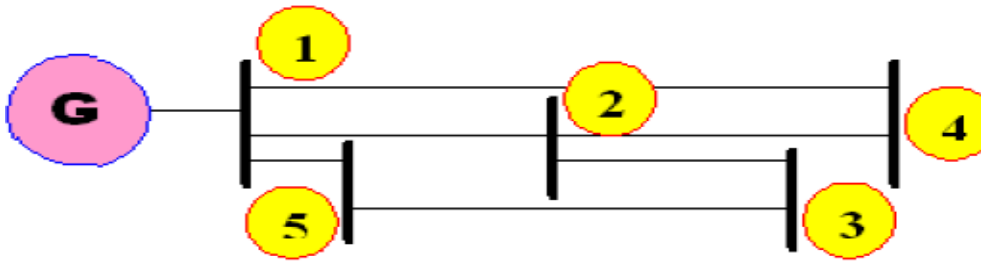
8. Write a short note on i) acceleration factor in load flow solution.
June 2016

9. For the power system shown in fig. below, with the data as given in tables below, obtain the bus voltages at the end of first iteration, by applying GS method.




Dec 2015,Dec 2016

10. For the power system shown in fig. below, with the data as given in tables below, obtain the bus voltages at the end of first iteration, by applying GS method. June 2017




**Power System of Example 2**

**Line data of example 2**

| SB | EB | R (pu) | X (pu) | $\frac{B_C}{2}$ |
|---|---|---|---|---|
| 1 | 2 | 0.10 | 0.40 | - |
| 1 | 4 | 0.15 | 0.60 | - |
| 1 | 5 | 0.05 | 0.20 | - |
| 2 | 3 | 0.05 | 0.20 | - |
| 2 | 4 | 0.10 | 0.40 | - |
| 3 | 5 | 0.05 | 0.20 | - |

**Bus data of example 2**

| Bus No. | $P_G$ (pu) | $Q_G$ (pu) | $P_D$ (pu) | $Q_D$ (pu) | $\lvert V_{SP}\rvert$ (pu) | δ |
|---|---|---|---|---|---|---|
| 1 | - | - | - | - | 1.02 | $0^o$ |
| 2 | - | - | 0.60 | 0.30 | - | - |
| 3 | 1.0 | - | - | - | 1.04 | - |
| 4 | - | - | 0.40 | 0.10 | - | - |
| 5 | - | - | 0.60 | 0.20 | - | - |

11. Obtain the load flow solution at the end of first iteration of the system with data as given below. The solution is to be obtained for the following cases

(i) All buses except bus 1 are PQ Buses

(ii) Bus 2 is a PV bus whose voltage magnitude is specified as 1.04 pu

(iii) Bus 2 is PV bus, with voltage magnitude specified as 1.04 and 0.25_Q2_1.0 pu.

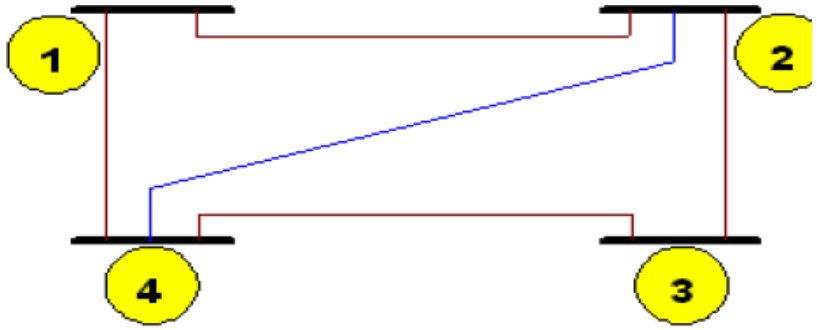



**Fig. System for Example 3**

**Table: Line data of example 3**

| SB | EB | R (pu) | X (pu) |
|---|---|---|---|
| 1 | 2 | 0.05 | 0.15 |
| 1 | 3 | 0.10 | 0.30 |
| 2 | 3 | 0.15 | 0.45 |
| 2 | 4 | 0.10 | 0.30 |
| 3 | 4 | 0.05 | 0.15 |

**Table: Bus data of example 3**

| Bus No. | $P_i$ (pu) | $Q_i$ (pu) | $V_i$ |
|---|---|---|---|
| 1 | – | – | $1.04\angle 0^0$ |
| 2 | 0.5 | – 0.2 | – |
| 3 | – 1.0 | 0.5 | – |
| 4 | – 0.3 | – 0.1 | – |

June 2015, June 2016

12. What are the advantages of Y-bus and Z-bus for load flow studies?

June 2015

## Module 4

1. Derive the necessary condition for optimal operation of thermal power plants with the transmission losses considered.

   Jan 2014, June 2016

2. What are B- coefficients? Derive the matrix form of transmission loss equation. Explain the method of equal incremental cost for the economic operation of generators with transmission loss considered.

   June 2015, June 2017,Dec 2016, Dec 2015

3. Explain problem formation and solution procedure of optimal scheduling for hydro thermal plants. June 2016**,** Dec 2015

4. Explain the equal incremental cost criterion with reference to economic operation of power systems. June 2016,Dec 2015

5. Derive the necessary condition for optimal operation of thermal power plants without the transmission losses considered.

   Jan 2014, June 2017, June 2015

6. The fuel cost in $ / h for two 800 MW plants is given by

   $F_1 = 400 + 6.0\ P_{G1} + 0.004\ P_{G1}^2$

   $F_2 = 500 + b_2\ P_{G2} + c_2\ P_{G2}^2$

   where $P_{G1}$, $P_{G2}$ are in MW

   (a) The incremental cost of power, $\lambda$ is $8 / MWh when total demand is 550MW. Determine optimal generation schedule neglecting losses.

   (b) The incremental cost of power is $10/MWh when total demand is 1300 MW. Determine optimal schedule neglecting losses.

   (c) From (a) and (b) find the coefficients $b_2$ and $c_2$.

Draw and explain the following i) input-output curve ii) cost curve iii) incremental cost curve iv) Heat rate curve

June 2016, June 2015

# Module 5

1. With the help of a flowchart, explain the method of finding the transient stability of a given power system, based on Runge-Kutta method. June 2015,Dec 2015

2. With necessary equations and flow chart describe the solution of swing equations using modified Eulers method in a multi-machine stability analysis.
June 2015,Dec 2016, Dec 2015,June 2017,June 2016

3. Explain with necessary equations the solution of swing equation by step by step method? How discontinuities can be handled.
June 2017,June 2015,Dec 2016, Dec 2015

4. Explain clearly the representation of synchronous machine and load for transient stability studies. Dec 2015, June 2017

5. Derive the swing equation for a two-machine system.

----------**********----------