



Sixth Semester B.E./B.Tech. Degree Examination, June/July 2026 Power System Analysis - II

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain the following terms in network topology with an example.
i) Tree ii) Basic loops iii) Basic Tie sets (06 Marks)
- b. Refer to the following oriented graph show below Fig Q1(b), build element node incidence matrix and bus incidence matrix.

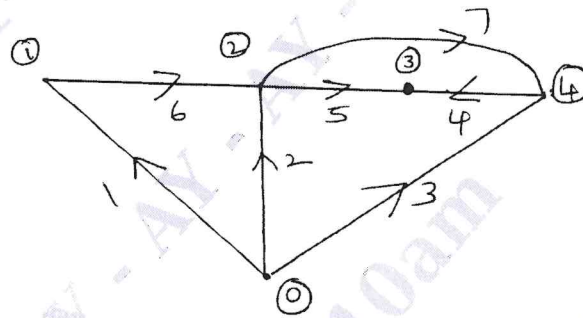


Fig Q1(b)

- c. A power system consists of four buses. The generators are connected between buses 1-2, 1-4, 2-3 and 3-4 which have reactance of $j0.3$, $j0.5$, $j0.4$ and $j0.1$ respectively. Develop a bus admittance matrix by direct inspection method. Choose bus 1 or reference. (06 Marks)

OR

- 2 a. Define primitive network and explain its two forms with neat representation circuit. Also, derive their respective performance equations. (10 Marks)
- b. Refer to the following oriented graph shown below in Fig Q2(b). Build basic cut set incidence matrix and branch path incidences matrix.

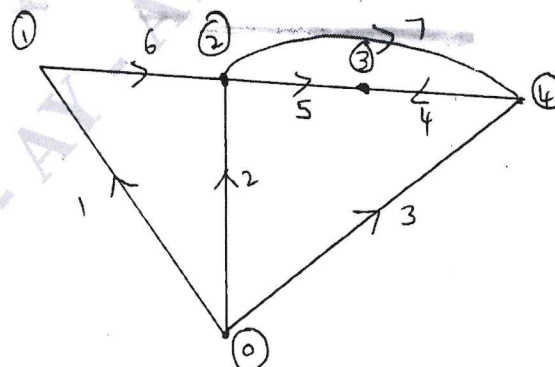


Fig Q2(b)

Module-2

- 3 a. Classify buses and explain each bus.

(06 Marks)

- b. For the power system network shown below in Fig Q3(b), the line impedances are marked in P.U. The bus data of the power system are shown below table Q3(b). Compute the voltage in all buses other than slack at the end of first iteration, using Gauss – Siedel method. Take $0 < Q_2 < 0.35$ P.U.

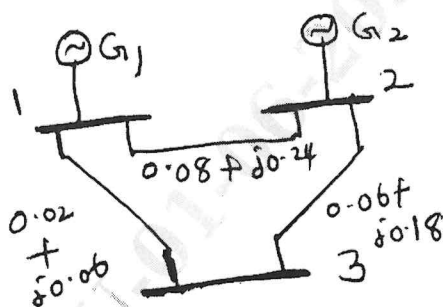


Fig Q3(b)

Bus No	Voltage (P.U)	Generator		Load	
		P_G	Q_G	P_D	Q_D
1	$1.0 \angle 0^\circ$	—	—	—	—
2	1.03	0.2	—	0.5	0.2
3	—	0	0	0.6	0.25

Table Q3(b)

(14 Marks)

OR

- 4 a. Explain algorithm for Gauss-Siedel method to obtain load flow solution of a power system network with the absence of PU buses.

(10 Marks)

- b. For a four bus power system network shown below in Fig Q4(b), the generators are connected at all four buses, while loads are connected at buses 2 and 3. The real and reactive powers are listed below in Table Q4(b). Assuming a flat voltage start computing the unknown variable in all the buses other than the slack at the end of the first iteration. Take acceleration factor as 1.4.

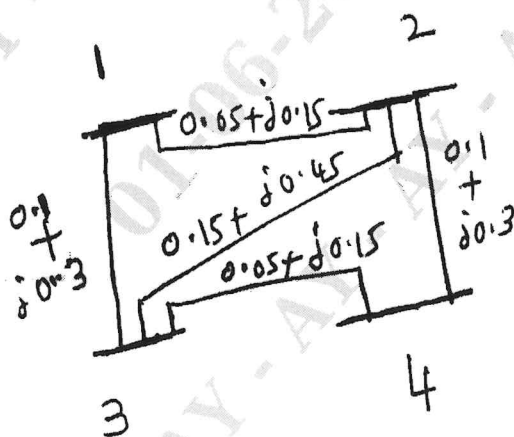


Fig Q4(b)

Bus No	P_i (P.U)	Q_i (P.U)	V_i (P.U)
1	—	—	$1.04 \angle 0^\circ$
2	0.5	-0.2	—
3	-1	0.5	—
4	0.3	-0.1	—

Table Q4(b)

(10 Marks)

Module-3

- 5 a. Derive the general expression for Jacobian elements in polar form with usual notation in NR method to obtain load flow solution. (10 Marks)
- b. Explain algorithm of fast recoupled load flow method with a neat flow chart for the load flow solution of a power system network. (10 Marks)

OR

- 6 a. Compare Gauss-Siedel, Newton Raphson and Fast decoupled load flow method of Load flow solution. (10 Marks)
- b. The load flow data for the sample power system are given below. The voltage magnitude at bus 2 is to be maintained at 1.04 p.u. The maximum and minimum reactive power limits of the generator at bus 2 are 0.35 p.u and 0.0 p.u respectively. Determine the set of load flow equations at the end of first iteration by using NR method.

Impedance for the sample system		
Bus code	Impedance	Line charging admittance
1-2	$0.08 + j0.24$	0.0
1-3	$0.02 + j0.06$	0.0
2-3	$0.06 + j0.18$	0.0

Schedule of Generation and Loads					
Bus code	Assumes voltages	Generation		Load	
		MW	MVAR	MW	MVAR
1	$1.06 + j0.0$	0	0	0	0
2	$1.0 + j0.0$	0.2	0	0	0
3	$1 + j0.0$	0	0	0.6	0.25

(10 Marks)

Module-4

- 7 a. The fuel inputs per hours of plants 1 and 2 are given as

$$F_1 = 0.2 P_1^2 + 40P_1 + 120 \text{ Rs per hr}$$

$$F_2 = 0.25 P_2^2 + 30P_2 + 150 \text{ Rs per hr}$$

(10 Marks)

Determine the economic operating schedule and the corresponding cost of generation if the maximum and minimum loading on each unit is 100 mW and 25 mW, the demand is 180 mW and transmission losses are neglected. If the load is equally shared by both the units, determine the saving obtained by loading the units per equal incremental production cost.

- b. Explain various constraints involved in unit commitment solution.

(10 Marks)

OR

- 8 a. Explain Dynamic Program algorithm with the recursive relation. (10 Marks)
- b. A two bus system is shown in Fig Q8(b). If a load of 125 mW is transmitted from plant 1 to the load, a loss of 15.625 mW is incurred. Find the generation schedule and the load demand if the cost of received power is Rs. 24/mW hr. solve the problem using coordination equations and penalty factor method approach. The incremented cost of the plant are :

$$\frac{dF_1}{dP_1} = 0.025P_1 + 15$$

$$\frac{dF_2}{dP_2} = 0.05P_2 + 20$$



Fig Q8(b)

(10 Marks)

Module-5

- 9 a. Explain the algorithm for short circuit studies to be conducted in large power systems. (10 Marks)
- b. Explain numerical solution of swing equation by point by point method. (10 Marks)

OR

- 10 a. Build an algorithm for numerical solution of swing equation by Runge-Kutta Method. (10 Marks)
- b. Determine the critical fault clearing angle for the network shown in Fig Q10(b) when a three phase fault occurs at B and the breakers at A and B operate simultaneously. The generator is delivering 1.0 P.u power before the fault takes place. Assume inertia constant $H = 4.0$.

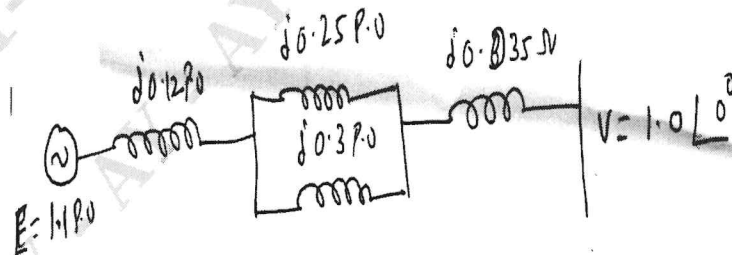


Fig Q10(b)

(10 Marks)
