Birla Institute of Technology and Science, Pilani
Mid Semester Exam (II Semester 2022-23)– Power System (EEE F312)
Open Book
Date: 15/03/2023 Duration: 90 Minutes Max Marks: 90

[Assume suitable data, if necessary]

Q.1 Draw the one-line diagram and Y-bus matrix of the power system given below. **[20]**

Bus Code	*Impedance*
1–2	$0.02 + j0.08$
1–3	$0.06 + j0.24$
2–3	$0.04 + j0.16$
2–4	$0.04 + j0.16$
3–4	$0.01 + j0.04$

Q.2 A load of 50 MW at 132 kV and 0.8 lagging power factor is being supplied by two parallel medium length transmission lines. Each line is represented as a two port network. Line 1 has $\mathbf{A_1}$ = 0.97 ∠0.6° pu and $\mathbf{B_1}$ = 60 ∠60° Ω while line 2 has $\mathbf{A_2}$ = 0.97 ∠0.4° pu and $\mathbf{B_2}$ = 50 ∠76° Ω. Determine the sending end voltage (line to line) and equivalent series resistance of the combination. Assume **Π** model and medium transmission line, if necessary. **[20]**

Q.3 A 3-phase transmission line is connecting two buses in one village in Rajasthan as shown in Fig Q.3. It has copper conductors of cross section 90 mm^2 and diameter of 1.30 cm and are placed at the vertices of an equilateral triangle of side 1 metre. The line is 25 km long and delivers a load of 3 MW at 11 KV and p.f. 0.85 (lagging). Neglect capacitance. Assume resistivity of copper to be 1.77×10^{-8} ohm-meter, if required. Voltage rating of 3-phase transformer connected at receiving end is 33 kV/11 kV.

(i) Determine the line resistance and reactance.

(ii) Determine the line current in transmission line.

(ii) Determine the line-to-line voltage at Bus 1.

(iii) Determine the efficiency and regulation of the line. **[25]**

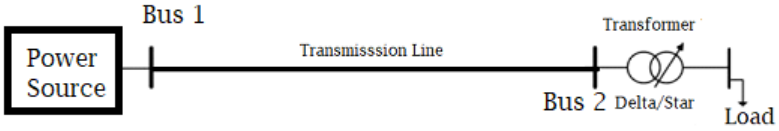

Fig Q.3

P.T.O.

Q.4 A 3-bus system is given in Fig. Q.4. The ratings of the various components are listed below:

Generator 1 = 50 MVA, 14 kV, X" = 0.15 p.u.

Generator 2 = 40 MVA, 13 kV, X" = 0.20 p.u.

Generator 3 = 30 MVA, 11 kV, X" = 0.25 p.u.

Star-Star Transformers = 25 MVA, 12.5 kV/115 kV, X = 0.15 p.u.

Delta-Star Transformers = 40 MVA, 13 kV /110 kV, X = 0.1 p.u.

1. Determine the impedances/reactances of all lines and transformers in per unit.
2. Draw neat impedance diagram with calculated values of parameters.
3. What is rated current of Generator 1, Generator 2 and Generator 3 in kA?
4. What is the maximum load (in kW) this system can supply if overall power factor is 0.9 lagging (neglect losses)?

Use base quantities of the generator which has highest rated current. **[25]**

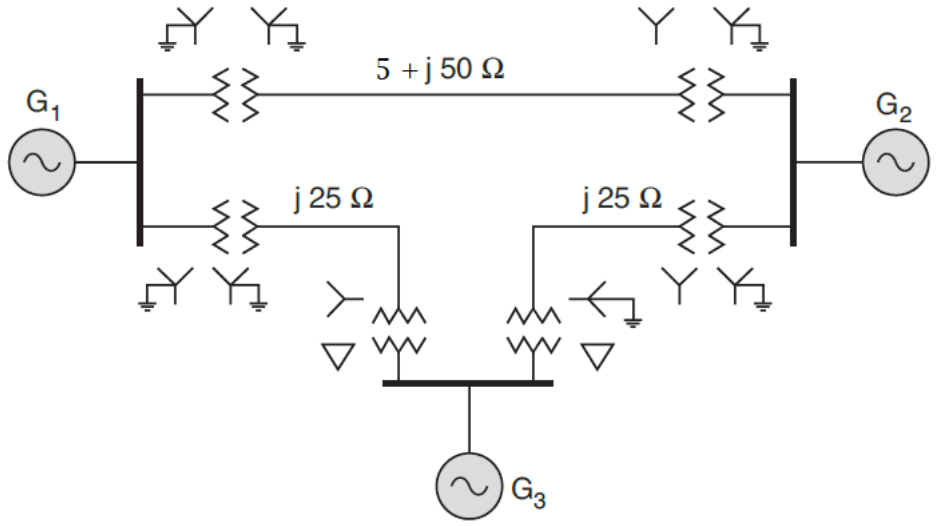

Fig Q.4

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