Printed Pages: 7 **EEE-601**

(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 121602 **Roll No.** | | | | | | | | | |

B. TECH.

Theory Examination (Semester-VI) 2015-16

POWER SYSTEM ANALYSIS

Time : 3 Hours ***Max. Marks : 100***

Section-A

1. **Attempt all parts. All parts carry equal marks. Write answer of each part in short.** (2×10 = 20)

(a) Represent the reactance diagram of a power system with justification.

(b) Show that

$$Z_{p\mu(new)} = Z_{px(old)} \times \left(\frac{Kv_{(old)}}{Kv_{(new)}}\right)^2 \times \frac{\text{MVA}_{(new)}}{\text{MVA}_{(old)}}$$

(c) Derive the equation $[Y_{Bus}] = [\text{A}][\text{Y}][\text{A}]^{\text{T}}$ using singular transformation.

(d) Discuss the significance of Slack or Swing bus in case of load flow study.

(e) What are the assumptions made to make the load flow equations decoupled?

(f) Name the factors which affect the transient stability.

(g) Define steady state and Transient stability in respect of a power system. Also define their stability limit.

(h) A 50Hz four pole turbogenerator rated 20MVA, 13.2KV has an inertia constant (H) = 9.0kW-sec/KVA. Determine the kinetic energy stoped in the rotor.

(i) Derive the expression of a transmission line for wave propagation.

(j) Discuss the propagation of a wave travelling along a line and then enters the cable.

Section-B

2. Attempt any five questions from this following.

(5×10 = 50)

(a) Prepare a perphase schematic of the system shown in Fig-1 and show all impedences in per unit (p.u.) on a 100MVA, 32kV base in the transmission line circuit. The necessary data for this problem are as follow :

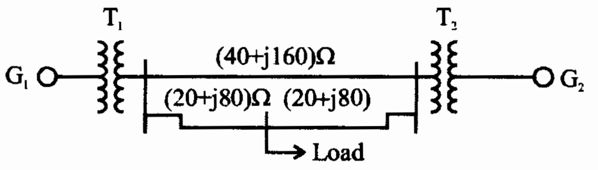

Fig. 1

G_1 : 50MVA, 12.2kV, X = 0.15 p.u.

G_2 : 20MVA, 13.8 kV, X = 0.15 p.u

T_1 : 80MVA, 12.2/161kV, X = 0.10 p.u

T_2 : 40MVA, 13.8/161kV, X = 0.10 p.u.

Load : 50MVA, 0.80 PF lagg, operating at 154KV

Determine the impedance of the load for the load modelled as a series combination of resistance and inductance.

(b) Draw the sequence network connections for L-G fault occurring in the network shown in Fig. 2 with proper justification.

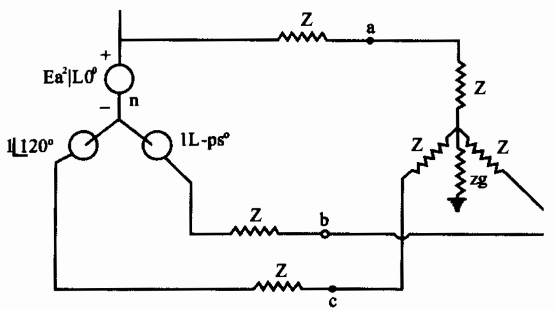

Fig. 2

(c) (i) Discuss the 3-phase short circuit transient on a transmission line.

(ii) Explain the terms (i) subtransient reactance (x^{ii}) (ii) transient reactance (x^1) and synchronous reactance for a synchronous machine.

(d) Draw the zero sequence network for the system shown in fig. (3). Assume zero sequence reactances for the generator and motors of 0.06 pμ. Current limiting reactors of 2.5 ohms each are connected in the neutral of generator and motor No. 2. The zero sequence reactance of the transmission line in 300 ohm.

Data :

G : 25MVA, 11kV, $X'' = 20\%$; M_1: 15MVA, 10KV, $x'' = 25\%$

$M_2 = 7.5$ MVA, 10kV, $x'' = 25\%$

T_1&T_2: 30MVA, 10.8/121KV, X=10% each

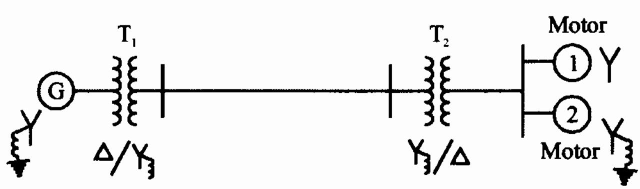

Fig.3

The series reactance of the line in 100 ohms.

Select the generator rating as base in the generator circuit.

(e) Classify the buses for load flow study. Formulate the load flow problem (in polar form) to be solved by newton - Raphson method. Also discuss its solution algorithm.

(f) Derive Swing equation with the help of equal area criterion. Discuss the case of occurrence of fault and is cleared after some time with the help of equal area criterion.

(g) What are the various method of improving transient stability? Discuss in brief.

(h) A surge of 15kV magnitude travels along a cable towards a junction with an overhead line. The inductance and capacitance of the cable and overhead line are respectively 0.3 mH, 0.4μF and 1.5mH, 0.012μF per kilometre. Find the voltage at the junction due to this surge.

Section-C

Note: Attempt any two questions from this section.

(2×15=30)

3. Discuss clearly the problem formulation and solution algorithm for Fast decoupled method for load flow study of a power system.

4. The following in the system data for the load flow solution using G-5 method:

Line admittances :

Bus Cose		Admittance
1-2	⟶	2 - j 8.0
1-3	⟶	1 - j 4.0
2-3	⟶	0.666 - j 2.664
2-4	⟶	1 - j4.0
3-4	⟶	2- j8.0

The schedule of active and reactive powers :

Bus Cod	P	Q	V	Remarks
1	–	–	1.06	slack
2	0.5	0.2	1+j0.0	P.V; $0.2 \leq Q \leq 1.0$
3	0.4	0.3	1+j0.0	P-Q
4	0.3	0.1	1+j0.0	P-Q

Determine the bus voltages at the end of first iteration using Gauss-Seidel method. Take acceleration factor 1.6.

5. Determine the critical clearing angle for the network shown in fig. 4. When the 3-phase fault occurs at B and the breakers

A and B operates simultaneously. The generator is delivering 1.0 p.µ. before the fault tabes place.

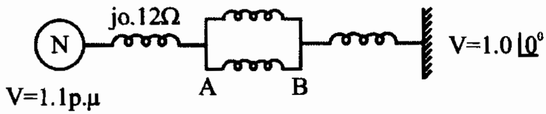

Fig. 4