

**B.Tech Sem – VI (2007 Course) (Electrical Engg.) : WINTER -
2017**

SUBJECT: POWER SYSTEM ANALYSIS

Day: **Wednesday**
Date: **22/11/2017**

Time: **10.00 AM TO 01.00 PM**
Max Marks. 80

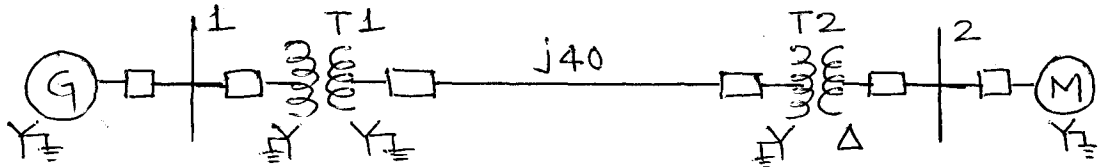
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N.B.

- 1) Q. No 1 and Q. No. 5 are **COMPULSORY**. Out of the remaining attempt any **TWO** questions from each section.
- 2) Answers to the two sections should be written in **SEPARATE** answer books.
- 3) Neat diagrams must be drawn **WHEREVER** necessary.
- 4) Figures to the **RIGHT** indicate full marks.
- 5) Use of non-programmable **CALCULATOR** is allowed.
- 6) Assume suitable data, wherever necessary.

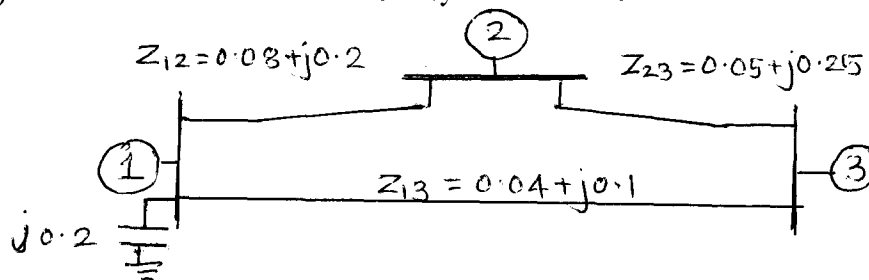
SECTION - I

- Q.1**
- a) Two voltage sources $V_1 = 110 \angle -10^\circ$ and $V_2 = 100 \angle 0^\circ$ are connected by a transmission line whose impedance is $0.5 + j5 \Omega$. Determine real and reactive power supplied by or received by each source. **(05)**
 - b) What is significance of per unit system in power system? Prove that the value remains the same irrespective of transformer primary or secondary or if the winding is star or delta. **(04)**
 - c) Explain **(05)**
 - i) Slack / Reference bus
 - ii) Load bus
 - iii) Generator bus
- Q.2**
- a) Explain necessity and importance of voltage control in power system. Explain tap-changing method of voltage control. **(04)**
 - b) Explain static VAR systems (SVS) or SVC's and discuss its advantages over other voltage control methods. **(05)**
 - c) What do you mean by complex power? Explain why complex conjugate of either voltage or current is needed for estimation of complex power. **(04)**
- Q.3**
- a) Prove that per unit quantities remains same for single phase and three phase circuits. **(06)**
 - b) Draw per unit diagram for the system shown below in single line diagram. **(07)**
Neglect resistance and use base of 100 MVA, 11kV in the motor circuits.



Generator (G): 50MVA, 33kV, $X = 30\%$
 Motor (M): 60 MVA, 11kV, $X = 40\%$
 Transformer (T1): 40 MVA, 33/220kV, $X = 10\%$
 Transformer (T2): 40 MVA, 11 / 220kV, $X = 10\%$

- Q.4**
- a) Compare Gauss Seidal method and Newton Raphson method used for load flow solutions. **(05)**
 - b) Determine Y-bus for a 3-bus system shown below. **(08)**



P.T.O.

SECTION - II

- Q.5** a) With the help of equivalent circuit and waveform explain sub-transient, transient and steady state impedances of alternator under no-load. (05)
- b) What is the significance of symmetrical components of a phasor and why they are used to analyze unsymmetrical faults? (05)
- c) Explain the term stability and various types of stabilities in power system. (04)
- Q.6** a) A 3 ϕ transmission line operating at 33kV and having resistance and reactance of 6 Ω and 15 Ω respectively is connected to a generating station busbar through a 15MVA step-up transformer with reactance of 0.05 pu. Connected to busbar are two generators, one of 10MVA having 0.2 pu reactance and another of 5MVA with 0.1 pu reactance. Calculate: (13)
- i). Short circuit MVA
ii). Fault current when 3 ϕ fault occurs at HV terminals of transformer
iii). When 3 ϕ fault occurs at load end of transmission line
- Q.7** a) Derive the relationship between symmetrical components of fault currents and voltages with phase current and voltages respectively for a Single Line to Ground fault (L-G). Also draw the sequence diagram during L-G fault. (08)
- b) Prove that for a L-G fault near the generator terminals when generator is not loaded and solidly grounded, the line to ground fault current can be more severe than 3 ϕ symmetrical fault current. Assume $X_1 = X_2 \gg X_0$ (05)
- Q.8** a) Define and state the relation between angular momentum and inertia constant of synchronous alternator. What is the role of machine constant in retention of transient stability of synchronous alternators? (06)
- b) Derive swing equation for one machine connected to infinite bus. Discuss the significance of swing equation. (07)