

GANPAT UNIVERSITY
B. TECH SEM- VI (ELECTRICAL)
REGULAR EXAMINATION APRIL-JUNE 2017
2EE602: POWER SYSTEM ANALYSIS

TIME: 3 Hrs

TOTAL MARKS: 60

Instructions: (1) This Question paper has two sections. Attempt each section in separate answer book.
 (2) Figures on right indicate marks.
 (3) Be precise and to the point in answering the descriptive questions.

SECTION-I

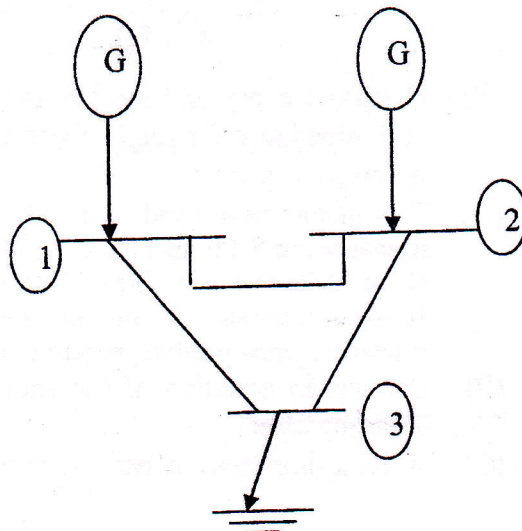
- Que.-1** (A) A synchronous generator rated 3-phase 11 kV, 100 MVA has $X_1 = X_2 = j0.1$ p.u and $X_0 = j0.04$ p.u. Determine the fault current and line-to-line voltages during the fault condition (a) if a single line-to-ground (SLG) fault occurs on the generator terminals (b) if the generator neutral is solidly grounded (c) if the generator is operating at no-load and rated voltage prior to the fault. [05]
- (B) Derive an expression for the fault current and terminal voltages for a line-to-line Fault which occurs at the terminals of an unloaded 3- Φ , alternator. Assume that the alternator has an isolated neutral. [05]

OR

- Que.-1** (A) Enlist different types of faults and compare various fault analysis. [05]
- (B) A 20MVA, 11KV, 3- Φ , 50Hz generator has its neutral earthed through a 5% reactor. It is in parallel with another identical generator having its neutral earthed through a 5% reactor. Each generator has positive, negative and zero sequence reactance which are 20%, 10%, and 15% respectively. If a line-to-ground short circuit occurs in the common bus bar, determine the fault current. [05]
- Que.-2** (A) Discuss importance of Z bus in SC studies and develop the Z bus building algorithm. [05]
- (B) A 30 MVA, 11KV, 3- Φ synchronous generator has a direct sub-transient reactance of 0.25 per unit. The negative and zero-sequence reactance are 0.35 and 0.1 per unit respectively. The neutral of the generator is solidly grounded. Determine the sub-transient current in the generator and the line-to-line voltage for sub-transient conditions when a single line-to-ground fault occurs at the generator terminals with the generator operating unloaded at rated voltage. [05]

OR

- Que.-2** (A) Write a short note on selection of circuit breaker. [05]
- (B) The data is given below for a system as shown in figure. Transient reactance of each generator = 0.15 pu. Leakage reactance of each transformer = 0.05 pu. $Z_{12} = j0.1$, $Z_{13} = j0.12$, $Z_{23} = j0.08$. For a solid three phase fault on bus 2, find [05]
- (i) All post fault bus voltages
 (ii) Short circuit fault current
 (iii) All post fault currents in lines.



Que.-3 Attempt any Two:

[10]

- (A) Justify "For fully transposed three phase transmission line sequence networks are mutually decoupled."
- (B) Analyze the double conductor open fault and also draw the connection diagram of sequence network under this fault.
- (C) For n bus system having short circuit on r^{th} bus, prove that post fault voltage is $V_r^f = (Z^f / Z^f + Z_{rr}) * V_r^0$

SECTION-II

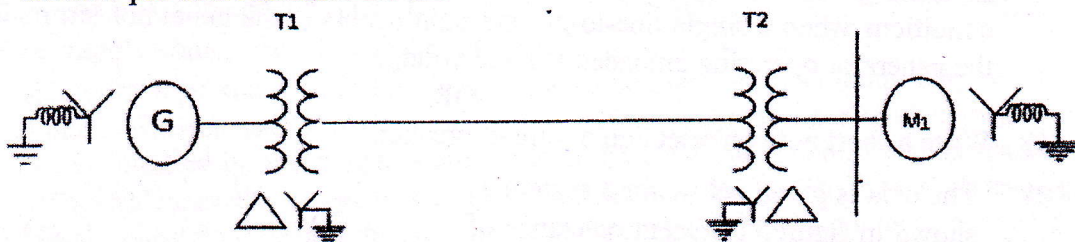
- Que.-4 (A) An overhead line with surge impedance 400 ohms bifurcates into two lines of surge impedance 350 ohms and 50 ohms respectively. If a surge of 100kV is incident on the overhead line, determine the magnitudes of voltage and current which enter the bifurcated lines. [05]
- (B) Discuss and draw the variation of voltage and current in a short ended line. [05]

OR

- Que.-4 (A) A rectangular surge of 100 kV travels along an overhead line of surge impedance of 400 ohms, towards a junction with another an underground cable with surge impedance of 50 ohms. Find the reflected and refracted voltage and current as the surge reaches the junction. [04]
- (B) Discuss the Wilson's theory of charge separation related to lightning phenomenon. [03]
- (C) Draw and explain the working of any one types of lightning arresters. [03]
- Que.-5 (A) (i). Enlist the assumptions for preparing the impedance diagram and reactance diagram from any one-line diagram. [02]
- (ii). Draw the circuit and proper graph which shows the transient in DC operated R-L circuit. [02]
- (B) Discuss modelling of synchronous generator on no load with equivalent circuit for short circuit studies and discuss the effect of load on equivalent circuit, [06]

OR

- Que.-5 (A) Figure shows a one-line diagram of a power system. The ratings and reactance are as : Generator : 20 MVA, 11 kV, $X = 15\%$; Transformer T_1 : 25 MVA, 12.5 / 132 kV, $X = 10\%$; Transformer T_2 : 20 MVA, 11 / 132 kV, $X = 10\%$; Motor M_1 : 15 MVA, 11kV, $X = 15\%$; Transmission line : $(200 + j500) \Omega$. Take 20MVA as base value and base voltage of 132 kV for the transmission line. Find out the new per unit reactance for all. [05]



- (B) Discuss the per unit system and its advantages and disadvantages. Derive the per unit impedance for single phase system. [05]

Que.-6 Attempt any two:

[10]

- (A) Two motors have rated inputs of 15 & 7.5 MVA both of 10kV with 25% sub transient reactance are fed from a 25MVA, 11 kV, three phase generator with $x'' = 20\%$ through two 3 phase Delta-star connected 30MVA, 10.8/121 kV transformer with leakage reactance of 10% on each side of transmission line. Assume all neutrals are earthed through 10% reactance. Draw positive, negative and zero sequence networks with all appropriate values.
- (B) Deduce an equation of the short circuit current of transmission line and discuss doubling effect.
- (C) Write a short note on per unit representation of transformer.

END OF PAPER