

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/ Backlog), April-May 2018

B. Tech in Electrical Engineering, Semester VI

Roll No.....

EE602: Power System Analysis

Time: 3 hours

Max. Marks: 100

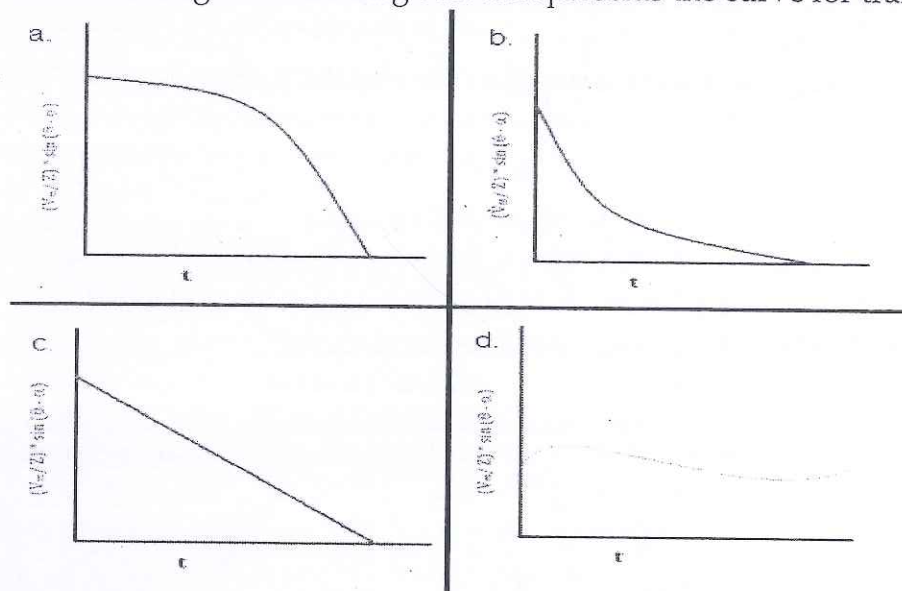
Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark)

10

- i. The per unit impedance to a line, to a 100 MVA, 33 kV base is 0.4. The per unit impedance to a 100 MVA, 11 kV base will be:
(a) 0.044 (b) 0.4 (c) 3.6 (d) 1.0
- ii. Which among the following curves represents the curve for transient current?



- (a) Only a (b) Only b (c) Only c (d) Only d
- iii. What is the multiplication factor to be multiplied with symmetrical momentary current to account for the presence of DC off set current?
(a) 1.2 (b) 1.5 (c) 1.6 (d) 2.5
 - iv. What percentage of faults occurring is single line to ground fault?
(a) 50 % (b) 60 % (c) 70 % (d) 80 %
 - v. How is the voltage and frequency controlled in automatic generation control?
(a) By controlling the excitation
(b) By controlling the turbine action
(c) Turbine speed control for voltage and excitation control for frequency
(d) Excitation control for voltage and turbine speed control for voltage.
 - vi. For a turbo alternator of 200 MVA, the inertia constant is 6. The value of H for a alternator of 300 MVA is

- (a) 9 (b) 4 (c) 6 (d) 13.5
- vii. Under what condition is the system stable under equal area criterion?
- The area under the curve $P_a - \delta$ curve must increase to ∞
 - The area under the curve $P_a - \delta$ curve must become equal to 1
 - The area under the curve $P_a - \delta$ curve must reduce to zero.
 - None of these
- viii. The following sequence current were recorded in a power system under a fault condition
 $I_{\text{positive}} = j 1.753 \text{ pu}$, $I_{\text{negative}} = -j 0.6 \text{ pu}$ and $I_{\text{zero}} = j 1.153 \text{ pu}$
 The fault is
- L-G
 - 3-phase
 - L-L
 - L-L-G
- ix. Which among the following is / are used for the solution of load flow using FDLF method?
- $[(\Delta P) / E] = [B'] [\Delta \delta]$
 - $[(\Delta Q) / E] = [B''] [\Delta E]$
 - $[(\Delta P) / E] = [B''] [\Delta \delta]$
 - Both (a) and (b)
- x. What is the main drawback in NR method?
- Slow to converge
 - A large memory allocation is required to store the jacobian matrix
 - The number of iterations is more
 - All of these

Q.2 Short answer type questions (4 questions @ 2.5 marks)

10

- Why the formation of Y_{bus} is important in load flow study?
- Which fault is more severe if it occur at generator terminals and why?
- On what factors does maximum power transfer depend?
- Why one bus as slack bus in each power system? Explain.

Q.3A How the per unit impedance of 3-phase transformer is remain same either referred to primary or referred to secondary? Explain. 05

Q.3B A 25 MVA, 11KV, 3-phase alternator has a sub transient reactance of 20%. The generator supply two motors over a transmission line with transformers at both end as shown in one line diagram of figure 1. The motors have rated inputs of 15 and 7.5 MVA, both 10 KV with 25% sub transient reactance. The three phase transformer are both rated 30 MVA, 10.8/121 KV connection delta-star with leakage reactance of 10% each. The series reactance of line is 100ohm. Draw the positive and negative sequence network of the system with reactance mark with reactance marked in per unit. 05

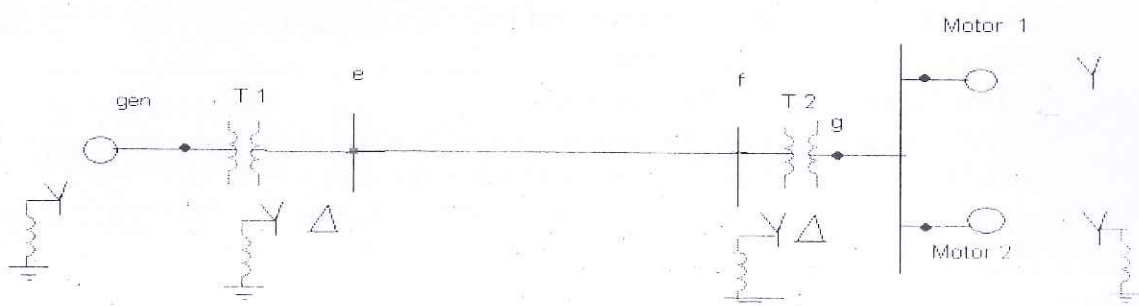


Figure 1

- Q.4A Why the admittance matrix is more suitable for load flow study? Write the algorithm of admittance matrix. 05
- Q.4B Three 6.6 KV generators A, B, and C each of 10% leakage reactance and MVA ratings 40, 50 and 25 respectively electrically, as shown in figure by a tie bar through current limiting reactors. Each of 12% reactance based upon the rating of the machine to which it is connected. A three-phase feeder is supplied from the bus bar of generator A at a line voltage of 6.6 KV. The feeder has a resistance of 0.06ohm/phase and an inductive reactance of 0.12 ohm/phase. Estimate the maximum MVA that can be fed into a symmetrical short circuit at the far end of the feeder. 05

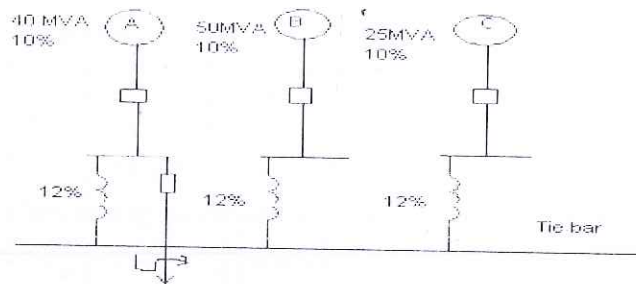


Figure 2

- Q.5A Show that positive sequence and negative sequence currents are equal in magnitude but of phase by 180° in a line to line fault. Draw a diagram showing interconnection of sequence networks for this type of fault. 05
- Q.5B Draw a general diagram which can be used to determine zero sequence network of a two winding transformer. Using this circuit, draw zero sequence network of (i) Δ - Δ (ii) Y- Δ (iii)  (iv)  (v)  05
- Q.6A Explain the static performance of a speed governing system when a generator is connected to an infinite network. 05
- Q.6B How can the transient stability of a system be improved? Discuss the traditional as well as new approach to the problem. 05
- OR
- Q.6B A 100 MVA synchronous generator operate on full load at a frequency of 50 Hz. The load suddenly increased to 50 MW. Due to time lag in the governor system, the steam valve begin to open after 0.4 sec. Determine the change in frequency that occur in this time. 05
- Given: $H = 5$ kWs/kVA of generator capacity.
- Q.7A How many variables available in the steady state load flow equation. Derive the steady state load flow equation and define clearly the restrictions and assumptions made in obtaining the solution of equations. 05
- Q.7B Explain the G-S method of load flow study. Give step by step procedure to solve the load flow solution. 05
- Q.8A What is critical clearing angle? Illustrate the application of equal area criterion to study transient stability for a fault on one of the parallel circuit of a two circuit 10

line feeding an infinite bus. The fault is very close to sending end bus and is subsequently cleared by the opening of faulted lines.

Q.8B How the active power and reactive power generation is automatically controlled at generating station? Explain with schematic diagram. 05

Q.9B Figure 3 shows a four bus system. Each line has an impedance of $j 0.5$ pu. The line shunt admittance may be neglected. The bus power and voltage specifications are given below: 15

Bus	P_L	Q_L	P_G	Q_G	V	Bus specification
1	1.0	0.5	Not specified	Not specified	$1.02 \angle 0$	Slack Bus
2	0.5	0.4	0	0	Not specified	PQ Bus
3	0.5	0.4	0	0	Not specified	PQ Bus
4	0.5	0.4	0	0	Not specified	PQ Bus

Find

(a) Admittance Matrix (Y_{Bus})

(b) P_1, Q_1, V_2, V_3, V_4 , after first iteration using Gauss-Seidel method.

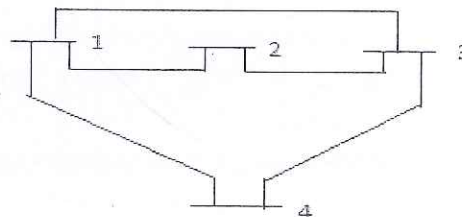


Figure 3

OR

Q.9B A synchronous generator and a synchronous motor each rated 25 MVA, 11 KV having 15% sub transient reactance are connected through transformers and a transmission line as shown in figure . The transformers are rated 25 MVA, 11/66 KV and 66/11 KV with leakage reactance of 10% each. The line has a reactance of 10% on a base of 25 MVA, 66 KV. The motor is drawing 15 MW at 0.8 power factor leading and a terminal voltage of 10.6 KV. When a symmetrical three-phase fault occurs at the motor terminals. Find the subtransient current in the generator, motor and fault. 15

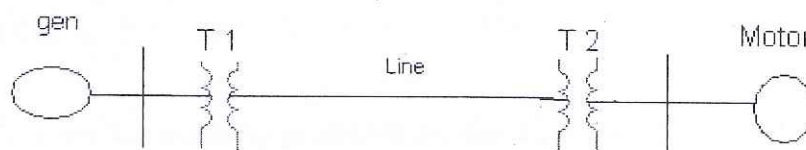


Figure 3