Enrollment No: _____   **Exam Seat No:** _____

C. U. SHAH UNIVERSITY
Summer Examination-2022

Subject Name : Power System Analysis

Subject Code : 4TE06PSA1   **Branch: B.Tech (Electrical)**

Semester : 6   **Date : 06/05/2022**   **Time : 02:30 To 05:30**   **Marks : 70**

Instructions:
  (1) Use of Programmable calculator & any other electronic instrument is prohibited.
  (2) Instructions written on main answer book are strictly to be obeyed.
  (3) Draw neat diagrams and figures (if necessary) at right places.
  (4) Assume suitable data if needed.

Q-1   **Attempt the following questions:**   **(14)**

A.   For which among the following cases is the equal area criterion of stability used?
a. One machine and infinite bus bar
b. No load on bus bar
c. Many machines and infinite bus bar
d. All of these
e. None of these

B.   What kind of differential equation is swing equation?
a. Linear second order
b. Non linear first order
c. Linear first order
d. Non linear second order

C.   What is the fault current expression in case of LLG faults?

a. $I_f = 3\ I_{a1}$
b. $I_f = 0$
c. $I_f = 3\ I_{a0}$
d. $I_f = I_{a1}$

D.   Which among the following methods are highly accurate?
a. Gauss Seidel method
b. Newton Raphson method
c. Fast decoupled low flow method
d. All of these
e. None of these

E.   What is the main cause of voltage instability?
a. Generators
b. Transformers

c. Loads
d. Line losses

F.   What type of convergence takes place in NR method?
a. Linear convergence
b. Geometric convergence
c. Quadratic convergence
d. All of these
e. None of these

G.   What is transient stability limit?
a. The maximum flow of power through a particular point in the power system without loss of stability when small disturbances occur.
b. The maximum power flow possible through a particular component connected in the power system.
c. The maximum flow of power through a particular point in the power system without loss of stability when large and sudden disturbances occur
d. All of these
e. None of these

H.   What percentage of fault occurring in the power system is LLG fault?
a. 20 %
b. 30 %
c. 5 %
d. 10 %

I.   What is the value of zero sequence impedance in line to line faults?
a. $Z_0 = 1$
b. $Z_0 = \infty$
c. $Z_0 = 3 Z_n$
d. $Z_0 = 0$

J.   What is the main drawback in NR method?
a. Slow to converge
b. A large memory allocation is required to store the jacobian matrix
c. The number of iterations is more
d. All of these
e. None of these

K.   Which among the following is the main assumption to solve a load flow problem by GS method?
a. All the buses are to be considered as PQ bus including the slack bus.
b. All the buses are to be considered as PV bus including the slack bus.
c. All the buses are to be considered as PQ bus excluding the slack bus.
d. All the buses are to be considered as PV bus excluding the slack bus.

L.   Which among theses quantities are to be determined in slack bus?
a. P and Q

b. Q and |V|

c. |V| and δ

d. Q and δ

M. Phase shift of symmetrical components happens in which among the following?

a. Delta - delta

b. Star – delta

c. Delta – star

d. Both (b) and (c)

e. All of these

N. What is the value of the letter 'a' or 'α' which is commonly used in symmetrical components?

a. $1 \angle 90°$

b. $1 \angle 30°$

c. $1 \angle 120°$

d. $1 \angle -120°$

Attempt any four questions from Q-2 to Q-8

Q-2   **Attempt all questions**   (14)

(a) Compare G-S method and N-R methods of load flow solutions.

(b) Define symmetrical and unsymmetrical faults.

Q-3   **Attempt all questions**   (14)

(a) Explain clearly with detailed flowchart, the computational procedure for load flow solution using N-R method when the system contains all types of buses.

(b) Define per unit system. Derive the formula of per unit impedance for the single phase case.

Q-4   **Attempt all questions**   (14)

(a) Explain bus classification in power flow analysis with their known and unknown quantities.

(b) What do you understand by percentage reactance ? Why do we prefer to express the reactances of various elements in percentage values for short-circuit calculations ?

Q-5   **Attempt all questions**   (14)

(a) Derive an expression for fault current for single line-to-ground fault by symmetrical components method.

(b) Discuss the positive sequence network and negative sequence network of a synchronous generator.

Q-6   **Attempt all questions**   **(14)**
   (a)   Derive the per unit model of a transformer
   (b)   Derive Network Model for Four bus structure Power System having generator at each bus.

Q-7   **Attempt all questions**   **(14)**
   (a)   Derive the formula of equal area criterion for the stability of the system.
   (b)   Derive swing equation governing the rotor dynamics for rotor of an alternator.

Q-8   **Attempt all questions**   **(14)**
   (a)   A 3-phase, 20 MVA, 10 kV alternator has internal reactance of 5% and negli-gible resistance. Find the external reactance per phase to be connected in series with the alternator so that steady current on short-circuit does not exceed 8 times the full load current.
   (b)   A 50 MVA, 11 kV three-phase alternator was subjected to different types of faults. The fault currents are as under :
3-phase fault = 2000 A ; Line-to-Line fault = 2600 A ; Line-to-ground fault = 4200 A
The generator neutral is solidly grounded. Find the values of the three sequence reactances of the alternator. Ignore resistances.