C.U.SHAH UNIVERSITY
Summer Examination-2018

Subject Name: Power System Analysis

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

Semester: 6   **Date: 02/05/2018**   **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) One line diagram is representation of_____.
(1) Single Phase system   (2) 3 phase unbalanced system,
(3) 3 phase balanced system   (4) simple components

b) In the case of transformer I_1/I_B is _____ I_2/I_B.
(1)Greater than   (2) equal to
(3) less than   (4) divided by

c) The per unit value of transformer impedance is _____ on primary and secondary side.
(1)different   (2) same
(3) depends upon turns ratio (4) depends upon voltage ratio

d) S = VI* Where * represents _____.
(1)remark   (2) exponent
(3)conjugate   (4) 3 phase

e) The circuit breaker current rating is decided using _____.
(1) load flow study   (2) fault analysis study
(3) stability analysis study   (4) security study

f) Usually the value of _____ reactance is maximum for a synchronous generator.
1)Transient   (2) Sub transient
3)Steady state   (4) Unstable state

g) The distortion of the supply signal in symmetrical short circuit current is due to _____.
(1)Fault impedance   (2) Prefault voltage
(3) Rotor D.C. component   (4) Unsymmetrical generator reactance

h) The _____ theorem is solution for unbalanced set of phasors in mathematical form.
(1)Constant Flux   (2)Constant Power
(3)Fortesque   (4) Berlesque

i) Three phase power is _____ of symmetrical component powers.
(1) product   (2) sum
(3) image   (4) division

j) Transformers are _____ to phase shift in case of symmetrical components.
  (1) Variant   (2) Invariant
  (3) deviant   (4) constant

k) The limit of transient stability is _____ the steady state limit.
  (1) Greater than   (2) less than
  (3) equal to   (4) none

l) The solution of point by point method is adopted to solve the swing equation for
  (1) Power Angle   (2) Critical clearing angle
  (3) both   (4) none

m) In _____ method the convergence is not affected by the choice of slack bus.
  (1) N-R   (2) G-S
  (3) Both   (4) None

n) If the torque angle increases without limit the system is _____.
  (1) Stable   (2) Marginally stable
  (3) Critically stable   (4) Unstable

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

Q-2	**Attempt all questions**	**(14)**
(a)	For the function containing n variables derive the Taylor series form in vector representation for Newton Raphson Method.	**(07)**
(b)	State the comparison of various load flow methods.	**(04)**
(c)	Briefly explain the classification of bus for load flow study.	**(03)**
Q-3	**Attempt all questions**	**(14)**
(a)	Define per unit system. Derive the formulae of per unit impedance for the single phase case.	**(07)**
(b)	Derive the formulae of peak to peak value of short circuit current when a synchronous generator terminal is subjected to 3 phase symmetrical short circuit fault.	**(07)**
Q-4	**Attempt all questions**	**(14)**
(a)	Derive the per unit model of a transformer.	**(07)**
(b)	Draw the zero sequence component for the following configuration of 3 phase transformers. (i) Star ungrounded- star grounded (ii) Star grounded- Star grounded (iii) Star grounded – Delta (iv) Delta – Delta	**(07)**
Q-5	**Attempt all questions**	**(14)**
(a)	For the graph structure shown in the figure 1 derive the suitable bus incidence matrix and evaluate the Ybus matrix if the diagonal matrix Y contains the following elements :	**(14)**

Dia [y_{10} y_{20} y_{30} y_{40} y_{34} y_{23} y_{12} y_{24} y_{13}] .. The notations have their usual meanings.
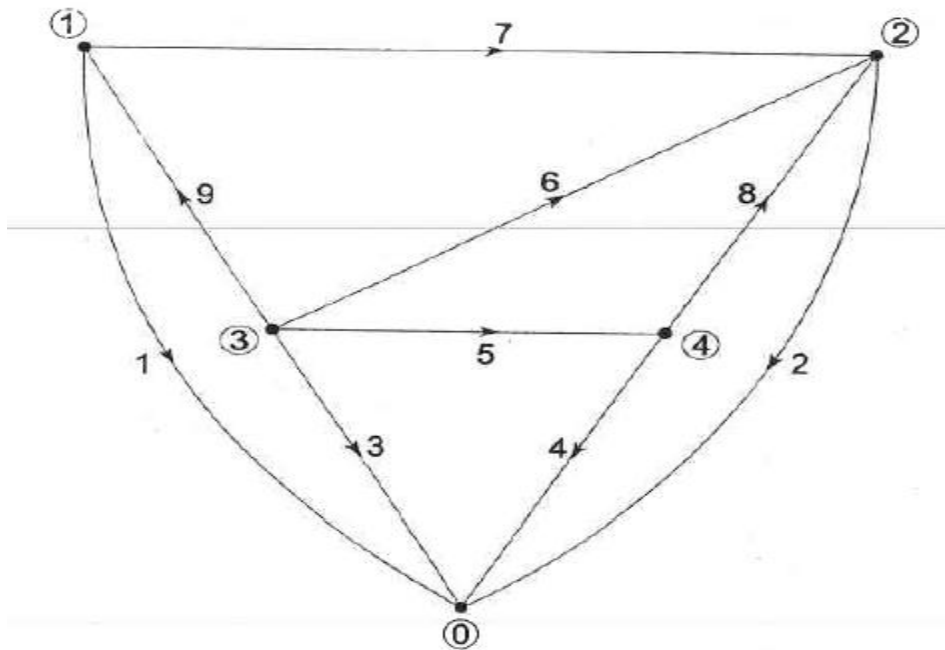
Figure 1 , Question 5 (a)

Q-6 **Attempt all questions**   **(14)**
(a) Derive the value of Current Ia_1 when a three phase transmission line is subjected to single line to ground fault. **(07)**

(b) With usual notations prove that **VP= AVS**   **(07)**

Q-7 **Attempt all questions**   **(14)**
(a) Derive the r+1 iteration of Voltage of ith bus using a Gauss Siedel Method when system contains n buses in the power system and all the buses are of type PQ bus. **(07)**

(b) Discuss the positive sequence network and negative sequence network of a synchronous generator. **(07)**

Q-8 **Attempt all questions**   **(14)**
(a) Three 6.6 kV generators A, B, C each of percentage reactance 10% and MVA rating 40,50 and 25 respectively are interconnected to one antoher as shown in figure 2 below by a tie bar through a current limiting reactor , each of 12% reactance based upon the rating of the machine to which it is connected. A three phase feeder is supplied to the bus bar of generator A to the line voltage of 6.6. kV. The feeder has a reactance of 0.06 ohm/phase and reactance of 0.12 ohm per phase. Estimate the maximum MVA that can be fed into a symmetrical short circuit at the far end of the feeder. Choose Base MVA of 50 and base voltage 6.6 kV. **(07)**
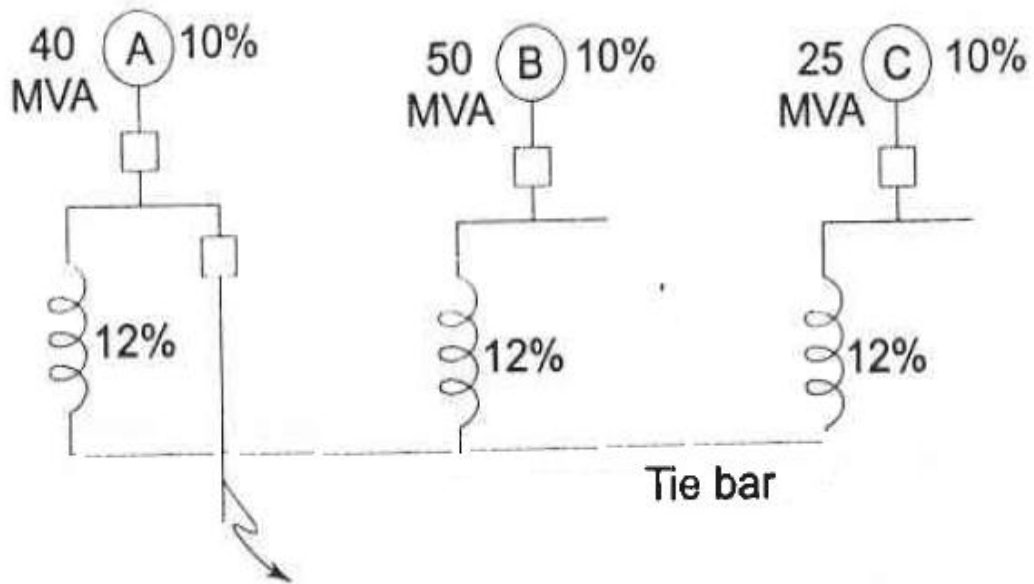
40 (A) 10%
MVA

50 (B) 10%
MVA

25 (C) 10%
MVA

12%   12%   12%

Tie bar

Figure 2   Question 8 (a)

(b) In the system shown in Figure 3,a three-phase static capacitor of reactance 1 pu per phase is connected through a switch at motor bus bar.(i) Calculate the limit of steady state power with and without reactor switch closed.(ii)Recalculate the power limit with capacitive reactor replaced by an inductive reactor of the same value . **(07)**
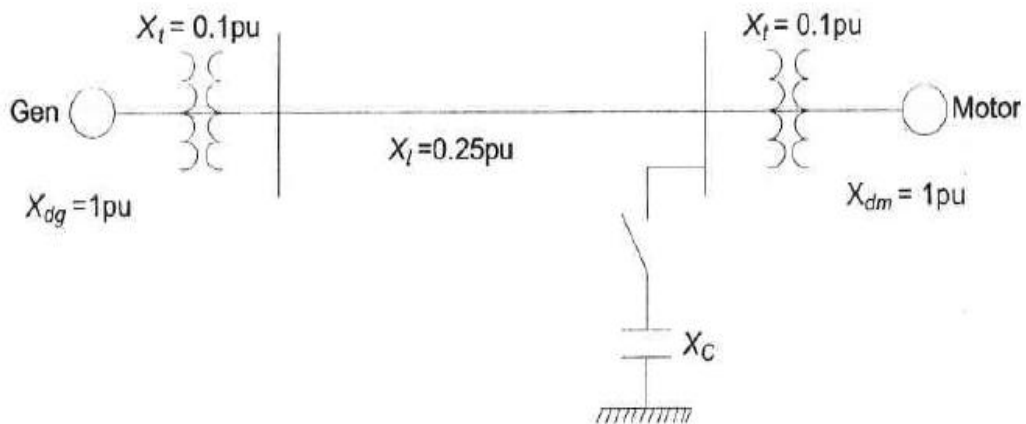

$X_t = 0.1pu$

$X_t = 0.1pu$

Gen

$X_l = 0.25pu$

$X_{dg} = 1pu$

Motor

$X_{dm} = 1pu$

X_C

Figure 3, Question 8 (b)