Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY

Summer Examination-2016

Subject Name : Power System Analysis

Subject Code :4TE06PSA1 Branch : B.Tech (EEE,EE)
Semester : 6 Date : 13/05/2016 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)

1) The most severe fault current is observed in case of
   (a) 3 phase symmetrical fault on the power system
   (b) Line to line fault on the power system
   (c) Double line to ground fault occurring on the power system
   (d) Single line to ground fault occurring near the terminal of alternator in the power system.
2) The system is said dynamically stable if
   (a) oscillations does not cross certain magnitude and dies out in the time periods of few seconds
   (b) The system must be responsive to each and every changes taking place in the power system for normal operation
   (c) The system must be responsive to each and every changes taking place in the power system for normal as well as abnormal operation
   (d) The system should remain range bound.
3) The synchronizing co-efficient of the system is indicator of
   I. fault condition of the power system if positive
   II. steady state condition of power if negative
   III. fault condition of power if negative
   IV. steady state condition of power system if positive
      (a) I is true II is false
      (b) Both I and II are true
      (c) III is false , IV is true
      (d) Both III and IV are true.
4) With usual notations the conditions Vbb'=Vcc'=0 , Ia=0 refers to
   (a) Two conductor open
   (b) One conductor open

(c) One conductor and two conductor open
(d) One conductor or two conductor open

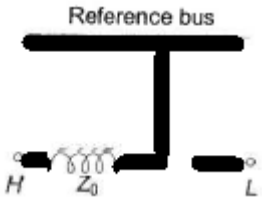
5) Value of current Ib for the following numeral data is _____ .

$$\begin{bmatrix} I_a \\ I_b \\ I_c \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ \alpha^2 & \alpha & 1 \\ \alpha & \alpha^2 & 1 \end{bmatrix} \begin{bmatrix} -j0.136 \\ -j0.136 \\ 0 \end{bmatrix}$$

6) If sequence current Ia1=Ia2=Ia0 then
(a) Sequence network are connected in parallel
(b) Sequence network are same
(c) Sequence network are same but line network conditions are different
(d) None of the above

7) State and explain Fortesque's theorem.

8) If Z = 1/3+j4 find the value of conductance and susceptance.

9) 

The above figure refers to
a) Positive sequence component of star to delta transformer
b) Zero Sequence component of Star-star transformer with neutral of star unconnected on secondary side
c) Zero sequence component of Delta- Star transformer with neutral grounded on secondary side
d) Zero sequence component of Star-Delta transformer with neutral grounded on primary side.

10) A 3 phase balanced network is characterized by a source and a load. The each phase of source is represented by magnitude of rms voltage 100 V shifted away with 120 electrical degree and internal impedance of 0.5+j1.5 ohm. The three phase balanced load is characterized by an impedance of 2.5+j2.5 ohm in each leg. Find the value of current in each phase.

11) The per unit impedance of a transformer on the primary side and secondary side is

(a) A function of transformation ratio.

(b) Depends upon the voltage applied

(c) Different for different types of configuration of transformer with same voltage , current and impedance parameters

(d) Same on both the side.

12) During the three phase short circuit of alternator on no load
   (a) The flux remains constant.
   (b) The voltage remains constant
   (c) The current remains constant
   (d) Power remains constant.
13) Draw the primitive network in impedance and admittance form.

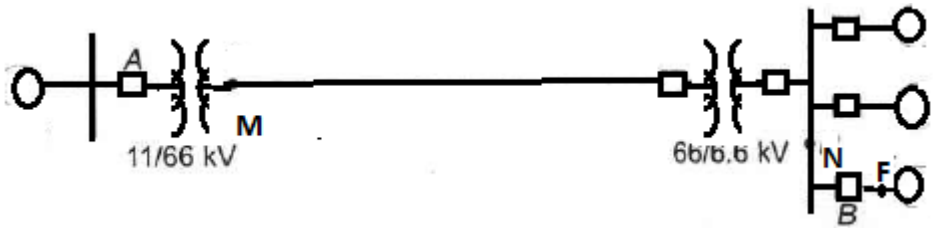
14) Name various types of bus classification for Load Flow Study.

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

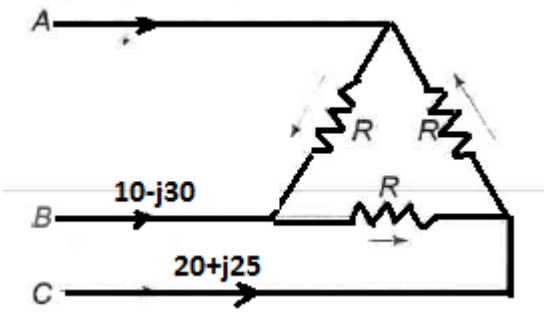
Q-2	**Attempt all questions**	**(14)**
(a)	Define per unit system. State the advantages and disadvantages of the same.	(4)
(b)	Derive the formulae for per unit impedance for single phase and 3 phase case.	(5)
(c)	Derive the per unit model of single phase transformer.	(5)

Q-3	**Attempt all questions**	**(14)**
(a)	Derive the mathematical network model for the four bus structure of power system.	(4)
(b)	Derive the bus incidence matrix for the four bus structure of power system.	(5)
(c)	Derive the value of r+1 iteration of voltages for n bus structure using Gauss-Seidel method when all the buses are PQ buses.	(5)

Q-4	**Attempt all questions**	**(14)**
(a)	Draw the oscillogram of short circuit current on transmission line when subjected to 3 phase symmetrical fault.	(2)
(b)	Discuss the role of symmetrical short circuit current in the selection of circuit breakers.	(4)
(c)	A 25 MVA, 11 kV generator with Xd"=25 %connected through a transformer, line and a transformer to a bus that supplies three identical motors as shown in Fig. below. Each motor has Xd" = 25% and Xd' = 30 % on a base of 5 MVA, 6.6 kV. The three-phase rating of the step-up transformer is 25 MVA, 11/66 kV with a leakage reactance of l0 % and that of the step-down transformer is 25 MVA, 66/6.6 kV with a leakage reactance of l0%..The bus voltage at the motors is 6.6 kV when a three-phase fault occurs at the point F. For the specified fault, calculate (a) the sub transient current in the fault, (b) the sub transient current jn the breaker (c) the momentary current in breaker B, and Given: Reactance of the transmission line = 25% on a base of 25 MVA, 66 kV. Assume that the system is operating on no load when the fault occurs.	(8)



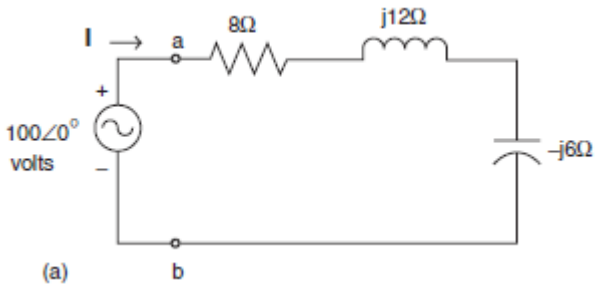
Q-5	**Attempt all questions**	**(14)**
(a)	With usual notations prove that $1+a+a^2=0$	(3)
(b)	State and explain positive sequence network model for alternator.	(3)
(c)	A delta connected balanced resistive load is connected across an unbalanced three-phase supply as shown in Figure below. With currents in lines C and B specified, find the symmetrical components of line currents.	(8)



Q-6	**Attempt all questions**	**(14)**
(a)	Derive the formulae for the current Ia_1 when phase a of the system abc is subjected to ground fault.	(6)
(b)	Derive the formulae for the current Ib and Ic when Line to Line fault occurs between phase b and c of power system consisting of abc phases.	(6)
(c)	*State the percentage occurrence of faults for various types of faults occurring in power system.*	(2)

Q-7	**Attempt all questions**	**(14)**
(a)	What is the meaning of the term stability ? Explain transient stability.	(2)
(b)	Derive the formulae of equal area criterion for the stability of the system.	(4)

(c) (8)



Solve for Z, I, and S at Port ab in the above figure.
(b) Repeat (a) in per-unit on bases of Vbase=100 V and Sbase=1000 VA. Draw the corresponding per unit circuit. S and V refers to the usual notations.

Q-8 **Attempt all questions** **(14)**

(a) Derive swing equation governing the rotor dynamics for rotor of an alternator. (5)

(b) (3)

For the power system whose one-line diagram is shown in the above figure, sketchthe zero sequence network

(c) A 50 Hz, four pole turbo generator rated 100 MVA, 11 kv has an inertia constant of 8 MJ/MVA. (7)
(1)Find the stored energy in the rotor at synchronous speed.

(2)If the mechanical input is suddenly raised to 90 MW for an electrical load of 50 MW, find rotor acceleration, neglecting mechanical and electrical losses.

(3) If the acceleration calculated in part (2) is maintained for 20 cycles, find the change in torque angle and rotor speed in revolutions per minute at the end of this period.