

CS/B.TECH/EE/NEW/SEM-6/EE-602/2013

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2013

POWER SYSTEM – II

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following :

10 × 1 = 10

- i) The rate of rise of restriking voltage depends upon
 - a) the type of CB
 - b) the inductance of the system only
 - c) the capacitance of the system only
 - d) both inductance and capacitance.
- ii) The stability of arc in vacuum depends on
 - a) the contact material only
 - b) the contact material and the vapour pressure
 - c) the circuit parameters only
 - d) the combination of (a) and (c).

- iii) Equal area criterion is used to study
 - a) Relative stability
 - b) Transient stability
 - c) Dynamic stability
 - d) Steady state stability.
- iv) A 3-phase breaker is rated at 2000 MVA, 33 kV; its making current will be
 - a) 35 kA
 - b) 49 kA
 - c) 70 kA
 - d) 90 kA.
- v) When a line to ground fault occurs, the current in a faulted phase is 100 A. The zero sequence current in this case will be
 - a) zero
 - b) 33.3 A
 - c) 300 A
 - d) 100 A.
- vi) Use of high speed circuit breakers
 - a) improves steady state stability
 - b) has no effect on system stability
 - c) improves transient stability
 - d) reduces transient stability.
- vii) Buchholz Relay is used for
 - a) motor protection
 - b) transformer protection
 - c) feeder protection
 - d) generator protection.
- viii) In a balanced 3-phase system, there will be
 - a) 0 sequence and + ve sequence only
 - b) + ve and -ve sequences
 - c) + ve sequence only
 - d) -ve sequence only.

- ix) In a 3-phase line, positive sequence components are present in
- $L-L-G$ fault
 - $L-G$ fault
 - 3-phases to ground fault
 - all types of fault.
- x) The +ve, -ve and 0 sequence impedances of a solidly grounded system under steady state condition always follow the relation
- $Z_0 > Z_1 > Z_2$
 - $Z_1 < Z_2 < Z_0$
 - $Z_1 > Z_2 > Z_0$
 - $Z_0 < Z_1 < Z_2$
- xi) An equipment has per unit reactance of 0.9 /m to a base of 20 MVA, 33 kV. The p.u. reactance to a base of 50 MVA and 11 kV, will be
- 4.5
 - 2
 - 0.9
 - 20.25.
- xii) For a stable operation of interconnected system, the passive element that can be used as interconnecting element is
- resistor
 - capacitor
 - inductor
 - capacitor-resistor.
- xiii) $a - a^2 =$
- $j\sqrt{3}$
 - $-j\sqrt{3}$
 - $\sqrt{3}$
 - 0.

- xiv) An acceleration factor is used in Load Flow study by
- Newton-Raphson method
 - Gauss-Seidel method
 - Decoupled method
 - Fast Decoupled method.
- xv) The zero sequence current of a generator for $L-G$ fault is 2.4 p.u. Then the current through the neutral during the fault is
- 2.4 p.u.
 - 0.8 p.u.
 - 7.2 p.u.
 - 0.24 p.u.
- xvi) The unit of inertia constant H is
- MJS/MVA
 - MJ/MVA
 - kV/MVA
 - rad/MVA.
- xvii) A Mho relay is a
- voltage restrained directional relay
 - voltage controlled overcurrent relay
 - directional restrained overcurrent relay
 - directional restrained overvoltage relay.
- xviii) The voltage of a particular bus can be controlled by controlling
- phase angle
 - relative power injection of the bus
 - active power injection at the bus
 - phase angle and reactive power at the bus.

xix) To keep RRRV within the rating of a circuit breaker for resistance switching, the critical value of resistance R is

- a) $\frac{1}{3}\sqrt{L/C}$ b) $\frac{1}{2}\sqrt{L/C}$
c) $\sqrt{L/C}$ d) $\frac{1}{2}\sqrt{C/L}$

xx) In a short transmission line, the maximum power transfer condition requires

- a) $R = \sqrt{3}X$ b) $X = \sqrt{3}R$
c) $R = \sqrt{5}X$ d) $X = 2R$

GROUP - B

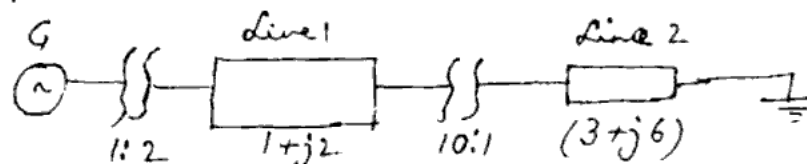
(Short Answer Type Questions)

Answer any *three* of the following $3 \times 5 = 15$

2. What is a substation ? Discuss about the function and location of instrument transformers in a substation. $2 + 3$
3. Derive the equation for Gauss-Seidel method for Load Flow study. How is the convergence rate of such a study improved ? $4 + 1$
4. A 200 MVA, 2-pole, 50 Hz alternator has a moment of inertia of $50 \times 10^3 \text{ kg-m}^2$.
a) What is the energy stored in the rotor at the rated speed ?
b) What are the values of H and the angular momentum ?

$1 + 2 + 2$

5. The figure shows a one-line diagram of a single-phase power system. Assuming the transformer to be ideal, calculate the p.u. current.



6. Explain with a neat sketch the operation of an induction type over-current relay. What are the functions of current and time multiplier setting associated with such a relay ? $3 + 2$
7. Derive a relation for the phase to phase fault and show the connection of the sequence networks.
8. Explain the principle of operation of a Buchholz Relay.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

9. a) Define the terms 'steady state stability', 'transient stability' and 'dynamic stability'.
b) Derive an equation for the rotor angle when a change in load takes place in a generator in a power system.
 $3 + 3 + 3 + 6$
10. a) Draw the positive, negative and zero sequence networks of the power system shown by one-line diagram.



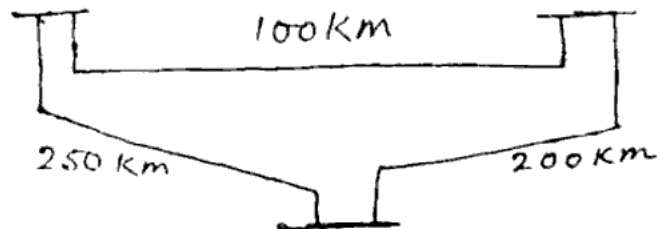
- b) Determine the symmetrical components of the three voltages $V_a = 220 \angle 0^\circ$, $V_b = 200 \angle 245^\circ$, $V_c = 200 \angle 105^\circ$.

$7 + 8$

11. a) Derive the equation for Load-Flow by N-R method. What is a Jacobian ? Which property of a Jacobian is exploited to reduce the computational burden and develop a decoupled version ?

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- b) For the following single line diagram of a network, determine the Y_{bus} matrix :



Given, line series reactance is 0.001 pu/km, shunt susceptance is 0.0016 pu/km. 5 + 2 + 2 + 6

12. a) Explain why directional relays are preferred over simple overcurrent relays in case of parallel feeders and ring mains protection.
- b) Determine the time of operation of a relay of rating 5A and having a relay setting of 125%. TMS = 0.6. It is connected to a supply circuit through a C.T. of 400/5 ratio. The fault current is 4000 A.

PSM	2	4	5	8	10	20
Operating time (sec)	10	5	4	3	2.8	2.4

6 + 9

13. Write short notes on any three of the following : 3 × 5

- Definite distance relay
- SF_6 Circuit Breaker and its advantage
- Breaking capacity and Making capacity of a Circuit Breaker
- Current chopping phenomenon
- Effects of negative sequence current on alternator and transformers.

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