CS/B.TECH/EE/EVEN/SEM-6/EE-602/2015-16

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Paper Code : EE-602

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)   A single line to ground fault occurs on a 3-phase
        isolated neutral system with a line to neutral
        voltage of V kV. The potential of the healthy phases
        rise to a value in kV is

        a) $\sqrt{2}\,V$ b) $\sqrt{3}\,V$

        c) $3\,V$ d) $\frac{1}{\sqrt{3}}\,V$.

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   ii) The voltage of a particular bus can be controlled b
        controlling

        a) phase angle

        b) reactive power injection at the bus

        c) active power injection at the bus

        d) phase angle and reactive power at the bus.

   iii) An equipment has per unit reactance of 0·9 pu to
        base of 20 MVA, 33 kV. The pu reactance to th
        base of 50 MVA and 11 kV will be

        a) 4·5   b) 20·25

        c) 0·9   d) 2.

   iv) The main information obtained from load flo
        studies is

        a) phase angle of load bus voltage

        b) reactive power at generator buses

        c) reactive power flow

        d) all of these.

   v)   A power system is subjected to a fault which makes
        the zero sequence component of current equal to
        zero. The nature of fault is

        a) double line to ground fault

        b) double line fault

        c) line to ground fault

        d) three phase to ground fault.

vi) The torque produced in induction type relay (shaded pole structure) is

a) inversely proportional to current

b) inversely proportional to the square of current

c) proportional to current

d) proportional to square of current.

vii) Equal area criterion is used to study

a) relative stability

b) transient stability

c) dynamic stability

d) steady state stability.

viii) The main criterion for selection of the size of a distributor for a radial distribution system is

a) voltage drop   b) corona loss

c) temperature rise   d) capital cost.

ix) Jacobians refer to matrices having

a) constant elements

b) derivative elements

c) partial derivative elements

d) combination of constant and partial derivative elements.

x) Pole mounted substations are used in

a) primary transmission system

b) secondary transmission system

c) primary distribution system

d) secondary distribution system.

xi) Negative sequence reactance of a transformer is

a) equal to the positive sequence reactance

b) larger than the positive sequence reactance

c) smaller than the positive sequence reactance

d) equal to positive sequence and zero sequen. reactance.

xii) Use of high speed circuit breaker

a) improves steady state stability

b) has no effect on system stability

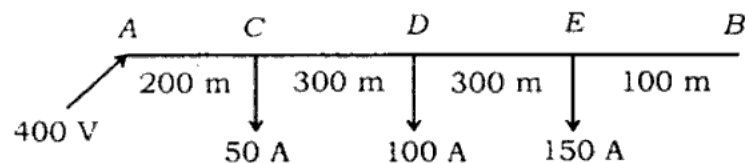c) improves transient stability

d) reduces transient stability.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 1$

2. Explain with proper diagram, the phenomenon o current chopping. What are the measures taken t reduce it ?

3. An 11/0·4 kV, 200 kVA transformer has an equivalent impedance of (2·4 + j 12·4) ohms referred to the HV side. Determine the base values for the PU system, the per unit equivalent impedance for both HV and LV side.

4. Determine the symmetrical components of the three voltages $V_a = 200\angle 0°$, $V_b = 220\angle 245°$ and $V_c = 200\angle 105°$.

5. A 2-wire dc distribution AB, 900 metres long is fed at A with 400 V and loads of 50A, 100A and 150A are tapped off from C, D and E which are at a distance of 200 m, 500 m and 800 m from point A respectively. The distribution is also loaded uniformly at the rate of 0·5 A/m. If the resistance of the distribution per metre (go & return) is 0·0001 Ω, calculate voltage at points B & D.


6. Define steady state stability and transient stability in power system. What is a swing equation ?   4 + 1
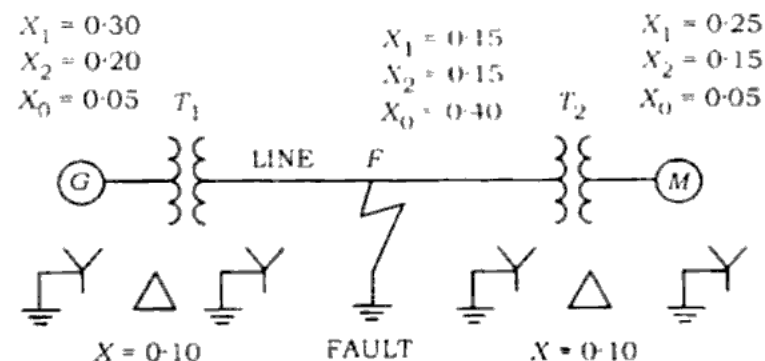
GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 4

7. a) Using equal area criterion, deduce the equation critical clearing angle of a power system having a alternator and connected to an infinite bus throug two parallel feeders.

   b) A 50 Hz generator of reactance 1·00 pu connected to an infinite has through a line reactance 0·50 pu, $E = 1·10$ pu and $V = 1·0$ pu, th inertia constant H is 5 MW-sec/MVA. Th generator is loaded to 50% of the maximum pow limit. Find M and the frequency of natur oscillations.

8. a) Develop load flow equations suitable for solution Newton-Raphson method.

   b) What is the necessity of having slack bus in power system ?

   c) For the following single line diagram determine Y_{B} when shunt admittances are neglected. All the lin impedances are in per unit.
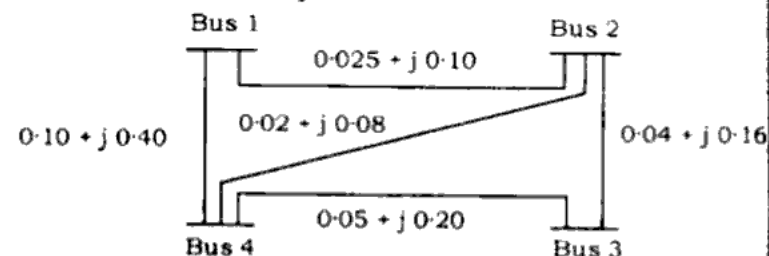
9. a) Explain with a neat diagram the application of Merz-price circulating current principle for the protection of alternator. 5

b) A 50 Hz, 11 kV, 3-phase, neutral earthed alternator is connected to the bus bar through a circuit breaker. The system has inductive reactance of 50 ohm/phase and capacitance of 0·02 μF/phase. A fault occurs just beyond the circuit breaker, which opens when the symmetrical SC current is 7500 A. Assuming the resistance of the generator to be negligible, calculate :

   i) maximum voltage across the contacts of breaker

   ii) frequency of oscillations

   iii) maximum value of RRRV. 10

10. a) Derive the expression for fault current in double line to ground fault on unloaded generator. 7

b) The power system shown in Figure has a dead short circuit at the mid-point of the transmission line. Find the fault current for (a) single line to ground fault, (b) line to line fault, (c) double line to ground fault. Both generators G and motor M are

operating at their rated voltage. Neglect pre-fault current. The reactance are given in p.u. on the same base. 8

$$X_1 = 0.30$$
$$X_2 = 0.20$$
$$X_0 = 0.05 \quad T_1$$

$$X_1 = 0.15$$
$$X_2 = 0.15$$
$$X_0 = 0.40 \quad T_2$$

$$X_1 = 0.25$$
$$X_2 = 0.15$$
$$X_0 = 0.05$$

$X = 0.10$ FAULT $X = 0.10$

11. a) Describe the principle of differential protection applied to a delta/star power transformer. 7

b) i) Define recovery voltage and rate of rise of re-striking voltage.

   ii) Derive an expression for re-striking voltage assuming an infinite resistance across the circuit breaker. 8