Name : ....

Roll No. : ....

Invigilator's Signature : ....

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

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 :

　　　　　　　　　　　　　　　　$10 \times 1 = 10$

　　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

a) *L-L-G* fault

b) *L-G* fault

c) 3-phases to ground fault

d) 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

a) $Z_0 > Z_1 > Z_2$ b) $Z_1 < Z_2 < Z_0$

c) $Z_1 > Z_2 > Z_0$ d) $Z_0 < Z_1 < Z_2$.

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

a) 4·5   b) 2

c) 0·9   d) 20·25.

xii) For a stable operation of interconnected system, the passive element that can be used as interconnecting element is

a) resistor   b) capacitor

c) inductor   d) capacitor-resistor.

xiii) $a - a^2 =$

a) $j\sqrt{3}$ b) $-j\sqrt{3}$

c) $\sqrt{3}$ d) 0.
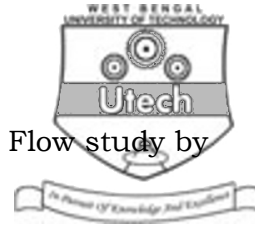
xiv) An acceleration factor is used in Load Flow study by

    a) Newton-Raphson method

    b) Gauss-Seidel method

    c) Decoupled method

    d) 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

    a) 2·4 p.u.   b) 0·8 p.u.

    c) 7·2 p.u.   d) 0·24 p.u.

xvi) The unit of inertia constant *H* is

    a) MJS/MVA   b) MJ/MVA

    c) kV/MVA   d) rad/MVA.

xvii) A Mho relay is a

    a) voltage restrained directional relay

    b) voltage controlled overcurrent relay

    c) directional restrained overcurrent relay

    d) directional restrained overvoltage relay.

xviii) The voltage of a particular bus can be controlled by controlling

    a) phase angle

    b) relative power injection of the bus

    c) active power injection at the bus

    d) phase angle and reactive power at the bus.
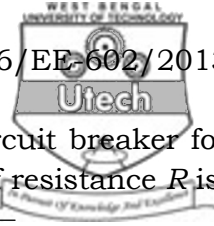
xix) To keep RRRV within the rating of a circuit breaker for resistance switching, the critical value of resistance R is

    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 × 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 50×10^{3} kg-m².

   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.
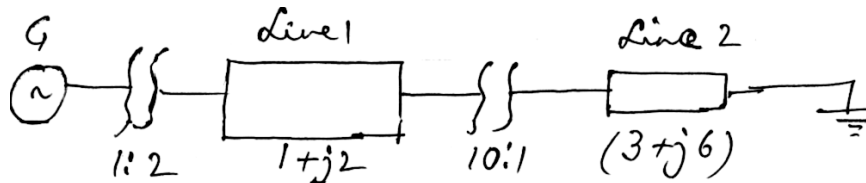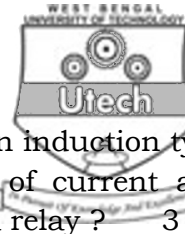
6. Explain with a neat sketch the operation of an induction type over-current relay. What are the functions of current and time multiplier setting associated with such a relay ?   3 + 2

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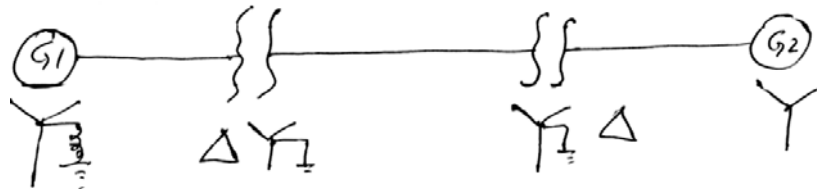
   b) Determine the symmetrical components of the three voltages $V_a = 220\angle 0°$, $V_b = 200\angle 245°$, $V_c = 200\angle 105°$.

   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 ?

b) For the following single line diagram of a network, determine the Y_{bus} matrix :
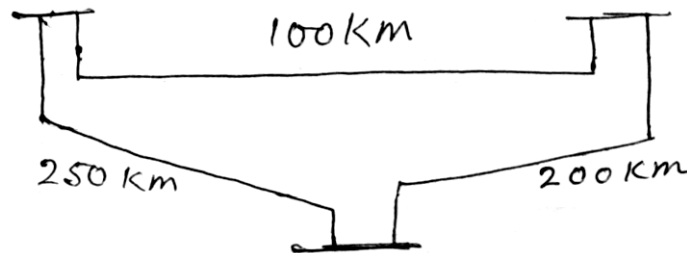
Given, line series reactance is 0·001 pu/km, shunt susceptance is 0·0016 pu/km.   5 + 2 + 2 + 6

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

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