*Name* : ...................................................................

*Roll No.* : ...............................................................

*Invigilator's Signature* : ...........................................

## CS/B.TECH(EE-NEW)/SEM-6/EE-602/2011
## 2011
## 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 the following :

$$10 \times 1 = 10$$

   i)  An equipment has per unit reactance of 0.9 pu to a base of 20 MVA, 33 kV. The pu reactance to the base of 50 MVA and 11 kV will be
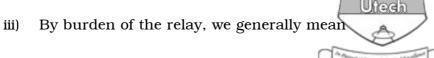
   a)  4.5              b)  20.25

   c)  0.9              d)  2.

   ii)  Buchholz relay is used for

   a)  motor protection       b)  generator protection

   c)  feeder protection       d)  transformer.

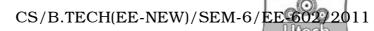iii) By burden of the relay, we generally mean

    a)   volt-ampere rating of relay

    b)   current rating of relay

    c)   voltage rating of relay

    d)   watt rating of relay.

iv) In a load flow study a *PV* bus is treated as a *PQ* bus when

    a)   voltage limit is violated

    b)   active power limit is violated

    c)   phase angle is violated

    d)   none of these.

v) A 3-phase 11/66 kV delta/star transformer, protected by Merz-Price scheme has CT ratio of 400/5 on LT side. Ratio of CT on HT side will be

    a)   23 : 1             b)   $23 : \sqrt{3}$

    c)   23 : 5             d)   none of these.

vi) Load flow study is carried out for

    a)   fault calculation       b)   stability study

    c)   system planning       d)   load frequency control.

vii) If a fault current is 2000 amps, the relay setting 50% and the C.T ratio is 400/5, then plug setting multiplier will be

a) 25 A  b) 15 A

c) 50 A  d) none of these.

viii) The rate of rise of restriking voltage depends upon

a) the type of circuit breaker

b) the inductance of system only

c) the capacitance of system only

d) both capacitance and inductance of system.

ix) 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) 89 kA.

x) The unit of inertia constant H is

a) MJs/MVA  b) MJ/MVA

c) kV/MVA  d) rad/MVA.

## GROUP – B

### ( Short Answer Type Questions )

Answer any *three* of the following.    3 × 5 = 15

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

3. What do you mean by relay ? What are the fundamental requirements of relay ? Define Instantaneous relay, Infinite time relay and PSM.

4. What is a 3-phase unsymmetrical fault ? Discuss the different types of symmetrical fault that can occur on a 3-phase system.

5. What is load flow analysis ? Classify various types of buses in a powder system for load flow studies.

6. Why do we use reactors in power system ? Discuss their advantages and disadvantages.

## GROUP – C

**( Long Answer Type Questions )**

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

7. a) Explain with sketch the construction, use and advantage and disadvantage of $SF_6$ circuit breaker.    7

   b) Why is current interruption easier in an a.c. circuit than in a d.c. circuit ?    3

   c) A 50z, 13.2 kV generator, with reactance of 3.8 $\Omega$ including the generator and connected system, has a distributed capacitance of 0.012 $\mu F$ and negligible resistance. Find (i) the maximum restriking voltage (ii) the natural frequency of oscillation (c) average rate of rise of restriking voltage.    5

8. a) Distinguish between steady state, transient and dynamic stability. What do you mean by critical clearing angle ? Obtain an expression for critical angle with the aid of equal area criterion.    9

   b) A synchronous generator, capable of developing 500 MW, operates at a power angle of 80. By how much can the input shaft power be increased suddenly without loss of stability ?    6
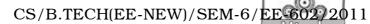
9. a) Draw a schematic diagram of thermal power plant showing all the major components. 7

   b) Explain the working principle of major four components of a thermal plant. 8

10. a) The line to ground voltages on a high voltage side of a step-up Transformer are 100 kV, 33 kV and 38 kV on phases A, B and C respectively. The voltage on phase A leads that of phase B by 100° & lags that of phase C by 176.5°. Determine analytically the symmetrical components of the voltages on each phase. 8

    b) The fuel cost functions in Rs./hour for two 800 MW thermal plants are given by

    $C_1 = 400 + 6.0 \, P_1 + 0.004 \, P_1^2$ and

    $C_2 = 500 + \beta \, P_2 + \gamma P_2^2$ , where $P_1$ and $P_2$ are in MW.

    i) The incremental cost of power $\lambda$ is Rs. 8/MWh when the total demand is 550 MW. Neglecting losses, determine the optimal generation of each plant.

    ii) The incremental cost of power $\lambda$ is Rs. 10/MWh when the total demand is 1300 MW. Neglecting losses, determine the optimal generation of each plant.

    From the results of (i) and (ii) find the fuel-cost coefficients $\beta$ and $\gamma$ of the second plant. 7

11. Write short notes on any *three* of the following :    3 × 5 = 15

    a)    Nuclear Power Planrt

    b)    Non-conventional Energy sources

    c)    Air-Blast Circuit Breaker

    d)    Distance Reley

    e)    Arcing Ground

    f)    Surge tank.

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