Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (EE-O)/SEM-8/EE-801A/2010

2010

COMPUTER AIDED POWER SYSTEM STUDIES

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) At a slack-bus, the quantities specified are

   a) P & Q b) P & $|V|$

   c) $|V|$ and δ d) P & δ.

   ii) Which one of the following is *not* correct ?

   a) $P_i - J Q_i = V_i^* \sum_{j=1}^{n} Y_{ij} V_j$

   b) $V_i = |V_i| (\cos \delta_i + j \sin \delta_i)$

   c) Real power loss = $\sum_{i=1}^{n} P_i = \sum_{i=1}^{N} P_{gi} - \sum_{i=1}^{N} P_{di}$

   d) $Q_i = \sum_{j=1}^{N} |Y_{ij} V_i V_j| \cos (\delta_i - \delta_j - \theta_{ij})$.

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iii) The operator 'a' is given by

a) e^{j120° b) e^{-j120°

c) e^{j60° d) e^{-j60°.

iv) With usual notation, which of the following is true for a decoupled model ?

a) $\Delta P = [\ H\ ]\ \Delta\ \delta$

b) $\Delta Q = [\ L\ ]\ \Delta\ \delta$

c) $\Delta P = [\ M\ ]\ \Delta\ |V|$

d) $\Delta P = [\ M\ ] \frac{\Delta |V|}{|V|}$.

v) The speed of fast decoupled load flow method when compared to Newton-Raphson method is

a) very slow

b) almost the same

c) double the N-R method speed per iteration

d) five times the N-R method speed per iteration.

vi) The number of iterations required for an n-bus system in Gauss-Seidel method is approximately

a) n b) n^2

c) 3 d) $\frac{n(n+1)}{2}$.

vii) In load flow studies, the state variables are

a) P & Q b) $|V|$ & δ

c) P & $|V|$ d) P & δ.

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viii) For the solution of 3-phase star connected unbalanced load problem, which method is more suitable ?

a) Symmetrical component

b) Direct analysis

c) Thevenin's theorem

d) Milman's theorem.

ix) Which of the following is *true* ?

a) Gauss-Seidel method is a direct solution method for power flow

b) All iterative methods ensure convergence

c) A generator bus is also called a swing bus

d) If the reactive generation exceeds the limit, then the P, $|V|$ bus will become a P, Q bus.

x) All generators in a coherent group in load frequency control

a) speed up individually

b) slow down individually

c) speed up & slow down together

d) none of these.

xi) The rank of a graph (n is the no. of nodes in the graph) is

a) n b) $n - 1$

c) $n + 1$ d) 0.

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GROUP – B

(Short Answer Type Questions)

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

2. Discuss briefly the bus classification.

3. Compare the Gauss-Seidel & Newton-Raphson methods for power flow solution.

4. Which method of load forecasting would you suggest for long term & why ?

5. Write a note on treatment of bad data in power system.

6. What is meant by optimal unit commitment ? Explain.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. A power system consists of 4 buses. Generators are connected at buses 1 2 3, reactances of which are *j* 0·2 & *j* 0·1 respectively. The transmission lines are connected between buses 1-2, 1-4, 2-3 & 3-4 & have reactances *j* 0·25, *j* 0·5, *j* 0·4 & *j* 0·1 respectively.

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Find the bus admittance matrix —

i) by direct inspection

ii) using bus incidence matrix & admittance matrix.

8. a) Discuss Newton-Raphson method in general & explain its applicability for power flow solution.

b) Explain the principle of load frequency control (single area case) in power system. 7 + 8

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9. In the following figure, assume that

$S_{D1} = 1 \cdot 0,\ V_1 = 1 < 0,\ S_{D2} = 1 \cdot 0 - j0 \cdot 8$

$Q_{G2} = -0 \cdot 3,\ S_{D3} = 1 \cdot 0 + j0 \cdot 6,\ P_{G2} = 0 \cdot 8$

$Z_2 = j0 \cdot 4$ all lines

Use Gauss iteration to find V_2 & V_3. Start with V_2° & $V_3^{\circ} = 1 \angle 0^{\circ}$. Do one iteration only. Bus 2 is a P, Q bus.

10. a) What is meant by economic despatch in power system ?

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b) A constant load of 300 MW is supplied by two 200 MW generators, 1 & 2 for which the respective incremental fuel costs are

$$\frac{dC_1}{dP_{G_1}} = 0 \cdot 1 P_{G_1} + 20$$

$$\frac{dC_2}{dP_{G_2}} = 0 \cdot 12 P_{G_2} + 15$$

with powers P_G in MW & costs C in Rs./hr. Determine –

i) the most economical division of load between the generators

ii) the saving in Rs./day thereby obtained to equal load sharing between machines. 5 + 10

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

a) Data acquisition system

b) Hydrothermal scheduling

c) Static state estimation

d) Active & reactive power optimization.

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