Registration No. : | | | | | | | | | | |

Total number of printed pages – 3

B. Tech

PCEL 4401

Seventh Semester Examination – 2011

POWER SYSTEM OPERATION AND CONTROL

Full Marks – 70

Time : 3 - Hours

Answer Question No. ***1*** *which is compulsory and any* ***five*** *from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) A single phase ac voltage of 250V is supplied to a series circuit whose impedance is 5 + j8. Find R, X, P, Q and the power factor of the circuit.

   (b) Why the nodal admittance matrix of a typical power system is sparse?

   (c) Define the power balance equation of a power system.

   (d) What are the typical conditions needed to be taken care of while distributing loads within the units of a plant and the same among plants?

   (e) Define unit commitment.

   (f) Draw the static response characteristics of the primary ALFC loop.

   (g) What is the role of tie-line in multi-control area systems ?

   (h) Define dynamic stability of a system.

   (i) What are the factors affecting transient stability ?

   (j) Why is it necessary to analyze power flow in a power system ?

2. (a) A single phase inductive load draws 9 MW at 0.65 power factor lagging. Draw the power triangle and determine the reactive power of a capacitor to be connected in parallel with the load to raise the power factor to 0.8.

5

P.T.O.

(b) A four bus power system is shown on Figure-1. Find out the Y_{BUS} matrix of the system. 5

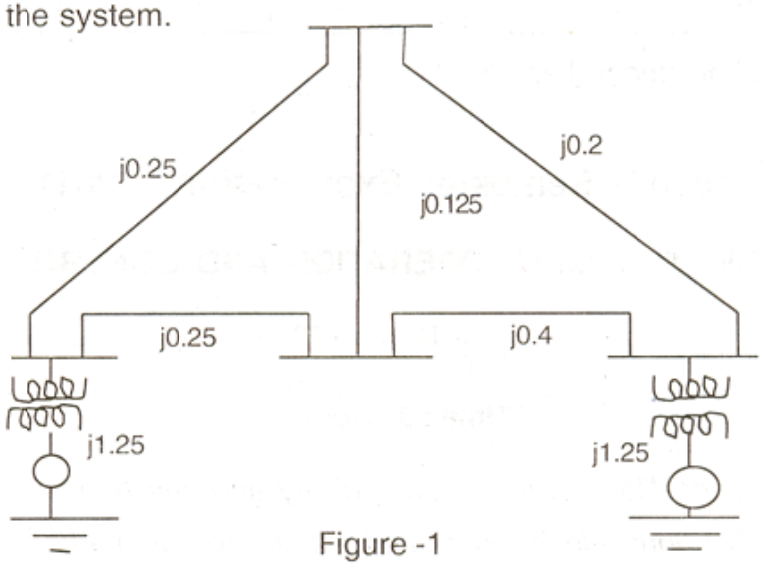

Figure -1

3 The following table provides data of a two bus system where the subscript 1 and 2 represents bus 1 and bus 2 respectively : 10

S_{G1} = Unknown, S_{D1} = Unknown

V1=1+j0.0

$S_1 = 0.35+jQ_{G2}$ $S_{D2} = 1+j0.45$

The buses are interconnected by a transmission line of p.u. reactance 0.6 p.u. Find Q_2 and V_2. Neglect susceptance of the tie line.

4. The incremental fuel costs in dollars per megawatt hour for a plant consisting of two units are given by 10

$$\lambda_1 = \frac{df_1}{dP_{g1}} = 0.0075\ P_{g1} + 8.3$$

$$\lambda_2 = \frac{df_{12}}{dP_{g2}} = 0.009\ P_{g2} + 7.1$$

Assume that both units operating at all times, that the total load demand varies from 375 MW to 1200 MW, and that maximum and minimum loads on each unit are to be 600 MW and 110 MW, respectively. Find the incremental fuel cost of the plant and the allocation of load between units for the minimum cost

of various total loads. Also determine the saving in fuel cost in dollars per hour for economic distribution of a total load of 850 MW between the two units of the plant as compared with equal distribution of the same total load.

5. (a) Draw the dynamic response characteristics of a single area automatic load frequency control (ALFC) loop. 5

(b) The speed regulation of two 950 MW alternators A and B running in parallel is 100 to 104 % and 100 to 105% for full load to no load respectively. Find how these machines will share a total load of 1500 MW. 5

6. (a) Draw the automatic load frequency control (ALFC) block diagram model of two area system. 5

GIET GUNUPUR

(b) (i) A 100 MW generator is operating onto an infinite network. How would you make this generator increase its turbine power by 5MW ? 3

(ii) Consider a generator having 100 MW capacity and has a regulation parameter R of four percent. By how much the increase if the frequency drops by 0.1 Hz with the reference unchanged ? 2

7. (a) Explain how the equal area criterion used for the stability study of a single system under transient conditions. 5

(b) Two 60 Hz generating units operate in parallel within the same power plant and have the following ratings : 5

Units - 1: 450MVA, 0.85 power factor, 13.5 kv, 3600 r/min

H_1 = 5MJ/MVA

Units - 2: 1250 MVA, 0.91power factor, 15kv, 1800 r/min

H_2 = 3.3 MJ/MVA

Calculate the equivalent H constant for the two units on a 100 MVA base.

8. Write short notes on any *two* of the following : 5×2

(a) Unit commitment

(b) Regulating transformer

(c) Control area concept

(d) Automatic Generation Control (AGC)
