Registration no: | | | | | | | | | | |

Total Number of Pages:02 **B.TECH**

PCEL4401

7th Semester Regular / Back Examination 2015-16

POWER SYSTEM OPERATION AND CONTROL

BRANCH: Electrical

Time: 3 Hours

Max marks: 70

Q.CODE: T190

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

The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** **(2 x 10)**

a) Why per unit system is used for the studies of power system?

b) What are the different types of buses used for the load flow studies?

c) Why the load flow equations are called static equations?

d) Write the equation used for evaluation of Y_{BUS} considering the incidence matrix of the power network.

e) What are the components used for the automatic load frequency control of a single area system.

f) What is the significance of a voltage control bus in the load flow study?

g) What are typical conditions needed to be taken care of while distributing loads among the plants of a system?

h) Which costs are involved in the startup cost of a generator in a plant?

i) Define the transient stability of a generator.

j) Define the per unit inertia constant of an alternator.

Q2 **a)** Two generators are connected in parallel to a 6.6kV bus. One of the generators has a rating of 20MVA and a reactance of 15% while the second generator is rated at 15MVA and has a reactance of 12%. Calculate the per unit reactance on a50MVA and 6.6kV base. What is the per unit reactance of a single equivalent generator on 50MVA and 6.6kV base? **(5)**

b) Show that the diagonal elements of a Y_{BUS} matrix equals the sum of admittances connected to that bus and an off diagonal element equals the negative of the sum of admittances directly connected between the buses. **(5)**

Q3 The following tables provide line admittance and real and reactive power data of a four bus system. **(10)**

The line admittance of a 4-bus system are as under:

Bus Code	Admittance in Mho
1-2	2-j8.2
1-3	1-j4.1
2-3	0.667-j2.66
2-4	0.95-j4
3-4	2-j7.5

The schedule of active and reactive power is

Bus Code	P	Q	V	Bus Specification
1	-	-	1.058+j0	Slack
2	0.5	0.201	Not Specified	PQ
3	0.4	0.305	Not Specified	PQ
4	0.3	0.1	Not Specified	PQ

Compute the voltage at buses 2,3 and 4 at the end of first iteration using Gauss-Seidel method.

Q4 **a)** Derive a suitable formula for the calculation of transmission loss. **(5)**

b) The incremental fuel costs for two generating units 1 and 2 of a power plant are given by the following equation: **(5)**

$$\frac{dF_1}{dP_1} = 0.065P_1 + 25$$

$$\frac{dF_2}{dP_2} = 0.08P_2 + 20$$

Where, F is the fuel cost in rupees per hour and P is power output in MW. Find:

i. The economic loading of the two units when the total load supplied by the power plants is 160 MW.

ii. The loss in fuel cost per hour if the load 160 MW is equally shared by both units.

Q5 **a)** Explain the details of the development of ALFC loop for automatic control of frequency. **(5)**

b) A 300 MW turbo generator has a speed regulation of 0.045pu on its own rated capacity as base Determine the increase in power output when the frequency drops from normal 50Hz to a steady state value of 49.95 Hz. **(5)**

Q6 **a)** Explain the details of unit commitment problem with an example. **(5)**

b) Find out the dynamic load frequency characteristics of two area system. **(5)**

Q7 A power station A consists of two synchronous consists of two synchronous generators. The generator-1has a rating of 50 MVA, 50 Hz, 1500 rpm and has an inertia constant of 8MJ/MVA. The generator-2 has a rating of 100MVA, 50 Hz, 3000 rpm and has inertia constant of 4 MJ/MVA. **(10)**

i. Find the inertia constant for the equivalent generator on a base of 100MVA

ii. Another power station B has 4 generators two each of the above type. Find the inertia constant for the equivalent generator on a base of 100MVA

iii. If the two power systems are connected through an inter connector, find the inertia constant for the equivalent generator connected to infinite bus bar.

Q8 **Write short notes on any two:** **(5 x 2)**

a) Application of Equal area criterion for stability of power system

b) Automatic Generation Control

c) Fasr Decoupled Metod for load flow studies of power system.