Student Exam No:-_____

GANPAT UNIVERSITY
B.TECH SEM-VII (ELECTRICAL)
REGULAR EXAMINATION NOV-DEC-2016
2EE 701: INTERCONNECTED POWER SYSTEM

Time: 3 Hours **Total Marks:-70**

Instructions: (1) This Question paper has two sections. Attempt each section in separate answer book.
(2) Figures on right indicate marks.
(3) Be precise and to the point in answering the descriptive questions.
(4) Make suitable assumptions wherever necessary

SECTION-I

Que-1 **(A)** A synchronous machine is delivering power to an infinite bus through two transmission lines in parallel. Suddenly a fault occurs at the midpoint of one the transmission lines which cause it to trip after some time. After the fault is cleared the synchronous machine delivers power through one of the transmission line. Derive the expression for critical clearing angle. **[06]**

(B) A 50 Hz synchronous generator having an internal voltage 1.2 pu, H = 5.2 MJ/MVA and a reactance of 0.4 pu is connected to an infinite bus through a double circuit line, each line of reactance 0.35 pu. The generator is delivering 0.8pu power and the infinite bus voltage is 1.0 pu. Determine: maximum power transfer, Steady state operating angle and Natural frequency of oscillation if damping is neglected. **[06]**

OR

Que-1 **(A)** Distinguish between steady state, dynamic and transient stability. Derive power angle equation $P=P_m\sin\delta$ for salient pole synchronous machine. State the assumptions made. **[05]**

(B) What is synchronizing coefficient? Prove that synchronizing coefficient of a machine should be positive for system stability. **[05]**

(C) A 4 pole, 50 Hz, 13.2 KV turbo generator has a rating of 100 MW at p.f 0.8 lag. Its rotor has a moment of inertia 36000 Kgm^2.Calculate (a) The kinetic energy in MJ at rotor speed (b) Inertia Constant H (c) Inertia constant M in MJ.sec/ elect degree. **[02]**

Que- 2 **(A)**The load flow data for a 3-bus system depicted in given tables. The maximum and minimum reactive power limits at bus 2 are 0.3 and 0.0 p.u respectively. Determine the voltages at various buses at the end of first iteration by using Guass Siedel method. **[08]**

Bus Code	Impedance	Bus No.	Line Charging Admittance $Y'_{ij}/2$
1-2	0.06+j0.18	1	j0.05
1-3	0.02+j0.06	2	j0.06
2-3	0.04+j0.12	3	J0.06

Bus	P_G	Q_G	P_D	Q_D	Bus Voltage
1	?	?	0	0	1.06+j0.0 (Slack Bus)
2	0.2	?	0	0	$\|V_2\|$=1.04 (PV Bus)
3	0	0	0.6	0.25	V_3=? (PQ Bus)

(B) With the help of the suitable example explain the following operating states of power system. **[03]**
(1) optimal dispatch (2)Post contingency (3) Secure dispatch (4)Secure post contingency

OR

Que- 2 **(A)** Discuss the algorithm of load flow solution using Newton-Raphson method for all type of buses. **[07]**

(B) Compare the Different load flow solution methods of power system. **[04]**

Que-3 **Attempt following questions.**

(A) Derive following relations : $Y_{bus} = A\,[y]\,A^T$, using primitive admittance matrix 'y' and network topology. **[05]**

(B) Derive the static load flow equations of n buses system. Also discuss the different types of buses. **[07]**

SECTION-II

Que-4 **(A)** Derive the transmission loss formula for optimal load dispatch. **[06]**

(B) A system consists of two plants connected by a transmission line. The load is at plant 2. If a load of 125 MW is transmitted from plant 1 to the load, there is a loss of 12.5 MW. Determine the generation schedule and the load demand if the cost of the received power is Rs. 70 per MWh. Assume that the incremental costs of the two plants are given by **[06]**

$$\frac{dC_1}{dP_1} = 0.25\,P_1 + 40 \text{ Rs/MWh}; \qquad \frac{dC_2}{dP_2} = 0.20\,P_2 + 50 \text{ Rs/MWh}.$$

Solve the problem using (a) coordination equation; (b) penalty factor method.

OR

Que-4 **(A)** What do you mean by coordination equation? Discuss in detail the modified coordination equation. **[06]**

(B) A power station has two generating plants and the power is being dispatched economically with P_1=150MW and P_2=275 MW. **[06]**

The loss coefficients are:

$$B_{11}=0.1\times10^{-2}\ MW^{-1},\ B_{12}=-0.01\times10^{-2}\ MW^{-1}\ B_{22}=0.13\times10^{-2}\ MW^{-1}$$

To raise the total load on the system by 1 MW will cost an additional Rs. 200 per hour. Find (a) Penalty factor for plant 1 and (b) the additional cost per hour to increase output of plant 1 by 1 MW.

Que-5 **(A)** Why load frequency control is necessary in power system? Explain it with suitable block diagram. **[06]**

(B) Write a short note on load frequency control with generation rate constraints. **[05]**

OR

Que-5 **(A)** Discuss in detail the two area load frequency control with necessary block diagrams. **[06]**

(B) Write a short note on automatic voltage control with necessary diagrams and equations. **[05]**

Que-6 **Attempt following questions.** **[12]**

(A) Describe the advantages and disadvantages of interconnections of power systems in details.

(B) Discuss various methods to improve steady state stability.

(C) Discuss following question.

1) What is Jacobian matrix? How the elements of Jacobian matrix are computed?

2) What is primitive network? Derive the necessary equation.

END OF PAPER

Best of Luck