C 58372 (Pages : 3) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION JUNE 2009

Electrical Engineering

EE 04 604—POWER SYSTEMS—II

(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

1. (a) **What are the advantages and disadvantages of the de-coupled Power flow over the Newton Power flow ?**

   (b) **Briefly explain the load flow solution by Gauss-Seidel method.**

   (c) **The incremental fuel costs of two plants are :**

$$\lambda_1 = \frac{dt_1}{dPg_1} = 0.012Pg_1 + 8.0$$

$$\lambda_2 = \frac{dt_2}{dPg_2} = 0.008\,Pg_2 + 9.6$$

Where t is in Rs./ hour and Pg is in MW. If both units operate at all times and maximum and minimum loads on each unit are 550 and 100 MW respectively, Plot λ of the plant in Rs. / MWh versus plant output in MW for economic dispatch as total load varies from 200 to 1100 MW.

(d) Explain in detail about automatic load dispatching.

(e) Discuss briefly the concept of shoot circuit capacity of a bus. How does the short circuit capacity affect the circuit-breaker rating ?

(f) Three 10 MVA generators each having a reactance of 0.2 pu are Operating in parallel. They feed a transmission line through a 30 MVA transformer having a per unit reactance of 0.05. Find the fault MVA for a fault at the sending end of the line.

(g) Derive Swing equation and discuss its application is the study and Power system stability.

(h) How the transient stability of a system can be improved ? Discuss the various approaches to the problem.

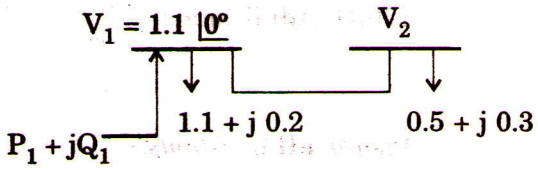
(8 × 5 = 40 marks)

Turn over

2. (a) Explain in detail the algorithm for the formation of Bus Impedance matrix. How can the matrix to be modified for addition or removal of a branch ?

Or

(b) A two bus system in shown in the figure. below. Determine the voltage at the end of third iteration by Gauss-Seidel method. The elements of bus impedance matrix are $Y_{11} = Y_{22} = 1.5 \angle -86$ p.u. and $Y_{21} = Y_{12} = 1.8 \angle 110°$ p.u.



3. (a) What is meant by economic load dispatch ? Derive the condition for optimal load dispatch including transmission lines, what are the assumptions made in deriving the same ?

Or

(b) The fuel cost in Rs./hour of three thermal plants of a power system are :

$$C_1 = 200 + 7.0\,P_1 + 0.008\,P_1^2 \text{ Rs./hr.}$$

$$C_2 = 180 + 6.3\,P_2 + 0.009\,P_2^2 \text{ Rs./hr.}$$

$$C_3 = 140 + 6.8\,P_3 + 0.007\,P_3^2 \text{ Rs./hr.}$$

where P_1, P_2 and P_3 are in MW. Plant outputs are subject to the following limits :

$10 \text{ MW} \le 85 \text{ MW}$

$10 \text{ MW} \le 80 \text{ MW}$

$10 \text{ m} \le 70 \text{ MW}.$

For this problem, assume the real power loss is given by :

$$P_L \text{ (pu)} = 0.0218\,P_1^2 \text{ (pu)} + 0.0228\,P_2^2 \text{ (pu)} + 0.0179\,P_3^2 \text{ (pu)}.$$

where the loss Coefficients are specified in per unit on a 100–MVA base. Determine the optimal dispatch of generation when the total system load is 150 MW.

4. (a) Derive the equation for the total fault current in terms of Symmetrical Components and Phase equation for the line to line fault at a bus.

Or

(b) Explain in brief about the various unsymmetrical faults occurring in Power System.

5. (a) Explain in detail the point by point method method for determining the critical clearing time.

Or

(b) A synchronous generator having a reactance of 1 p.u. is connected to an infinite bus through a transmission system with a reactance of 0.7 p.u. The generator is running on no-load with a voltage of 1.1 p.u. Take H = 4.5. MW–s / MVA.

The voltage of infinite bus is 1 $\underline{|0°}$ p.u. and its frequency is 50 Hz.

Calculate the frequency of natural oscillation if the machine in suddenly loaded to :

(i) 60 % and

(iii) 75 % of its maximum power limit.

Neglect resistance and machine damping.

(4 × 15 = 60 marks)