[Total No. of Questions - 9] **[Total No. of Printed Pages - 4]**
(2125)

15309

B. Tech 7th Semester Examination

Power System Operation and Control (NS)

EE-414

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt ALL sections. Sections A, B, C and D have choices, and E is compulsory. Each carries equal marks.

SECTION - A
(Attempt questions 1 and 2, both)

1. (a) What are the characteristics of Power Generation (steam) unit and also describe the system Variables? (10)

OR

(b) What are the techniques for the solution of Unit Commitment problems? Write a short note on dynamic programming. (10)

2. (a) Describe the cost function formulation and cost consideration. (10)

OR

(b) Define incremental efficiency and explain non-smooth cost function with multivalve effect. (10)

SECTION - B
(Attempt one out of following questions with its parts)

3. (a) The fuel cost of two units are given by:

$C1 = 1.0 + 25\ P_{G1} + 0.2\ P^2_{G1}$ Rs./hr

$C2 = 1.5 + 35\ P_{G2} + 0.2\ P^2_{G2}$ Rs./hr

If the total demand on the generator is 200 mW, find the economical load scheduling of the two units. (10)

(b) Explain economic dispatch of thermal plant coordinating the system transmission line losses. Derive the relevant equation and state the significance and role of penalty factor. (10)

OR **[P.T.O.]**

4. (a) Provide a comparison between Gauss-Siedel, Newton -Raphson, and Fast Decoupled load flow methods. Discuss optimal power flow problems without inequality constraints. (10)

(b) Consider the following three IC characteristics:

$P_{G1} = -110 + 40\ (IC_1) + 2\ (IC_1)^2$

$P_{G2} = -160 + 50\ (IC_2) - 3.5\ (IC_2)^2$

$P_{G3} = -90 + 30(IC_3) - 1.8\ (IC_3)^2$

Where IC's are in Rs./mWh and P_G 's are in mW.

The total load at a certain hour of the day is 500 mW. Determine the most economical load sharing between the generators. (10)

SECTION - C
(Attempt one out of following questions with its parts)

5. (a) Explain the hydro thermal coordination and its importance with neat schematic diagram. (10)

(b) A two-plant system having a steam plant near the load centre and a hydro-plant at a remote location is shown in Fig. 1. The load is 500 mW for 16 hr a day and 350 mW, for 8 hr a day.

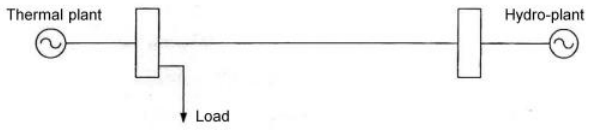

Fig. 1 A typical two plant hydro-thermal plant

The characteristics of the units are:

$C_T = 120P_{GT} + 45P^2_{GT}$ Rs./hr

$w_2 = 0.6\ P_{GH} + 0.00283\ P^2_{GH}\ m^3/s$

Loss coefficient, $B_{22} = 0.001\ mW^{-1}$.

Find the generation schedule, daily water used by the hydro-plant, and daily operating cost of the thermal plant for $\gamma_j = 85.5$ Rs./m^3 - hr. (10)

OR

6. (a) Derive the condition for optimality of short-term hydro-thermal scheduling problem. (10)

(b) A thermal station and a hydro-station supply an area jointly. The hydro-station is run 12 hr daily and the thermal station is run through 24 hr. The incremental fuel cost characteristics of the thermal plant are

$C_T = 5 + 15\ P_{GT} + 0.05\ P^2_{GT}$ Rs./hr

If the load on the thermal station, when both plants are in operation, is 380 mW, the incremental water of a hydro power plant $\frac{d\omega}{dP_{GH}} = 38 + 0.02\ P_{GH}$ m^3/mW -s. The total quantity of water utilized during a 16- hr operation of the hydro-plant is 450 million m^3. Find the generation of the hydro - plant and cost of water use. Assume that the total load on the hydro-plant is constant for the 16-hr period. (10)

SECTION - D

(Attempt one out of following questions with its parts)

7. (a) Why is voltage control required in power system? Mention the different methods of voltage control employed in power system. Explain one method of voltage control in detail giving a neat connection diagram. (10)

(b) Explain the basic requirements needed for control strategy. Describe integral control in detail. (10)

OR

8. (a) A 150 mVA turbo-alternator operator on full load operates at 50 Hz. A load of 50 mW is suddenly reduced on the machine. The steam valves to the turbine commence to close after 0.8 s due to the time lag in the governor system. Assuming the inertia to be constant, H=6 kW-s per kVA of generator, calculate the change in frequency that occurs in this time. (10)

(b) Explain why it is necessary to maintain the frequency of the system constant. What do you mean by LFC (load flow control)? (10)

SECTION - E

(Attempt all of the following)

9 (a) Fill in the blanks for (i)-(vii) of following.

(i) Lagrangian multiplier method converts a non linear constrained optimization problem into_____ non-linear optimization problem.

(ii) Power balance equation is_____constraint.

[P.T.O.]

(iii) Optimization problems with only objective function and without constraints is a_____function.

(iv) In a hydro thermal system, the optimization problem is stated as determining_____so as to minimize the cost of thermal generation.

(v) The optimization scheduling problem of a hydro thermal system can be conveniently solved by_____principle.

(vi) The load flow control system_____in the system.

(vii) _____ controls the excitation voltage and modifies the excitation. (7)

(b) Give short answers for the following:

(viii) Give the expression for the objective function used for optimization of power system operation.

(ix) What is an incremental fuel cost and what are its units?

(x) Write the condition for optimality in allocating the total load demand among the various units.

(xi) How do you get incremental cost curve?

(xii) Define the incremental efficiency.

(xiii) Fast changing loads can be effectively met by which type of plants.

(xiv) Whole or part of the base load can be supplied by which type of hydro plants.

(xv) The peak load or remaining base load is met by which type of plants.

(xvi) Write the objective function expression of hydro thermal scheduling problem.

(xvii) What is the effect of speed of a generator on its frequency?

(xviii) What is the nature of the generator load frequency characteristics?

(xix) What is meant by dynamic response in load flow control (LFC)?

(xx) What is meant by area control error? (13)