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06EE82

Eighth Semester B.E. Degree Examination, May/June 2010
Power System Operation and Control

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Derive the expression for tie-line power and frequency deviation for two area system. **(10 Marks)**

b. Two areas are interconnected as shown in Fig.1(b). The generating capacity of area 'A' is 36,000 MW and its regulating characteristic is 1.5% of capacity per 0.1 Hz. Area 'D' has a generating capacity of 4000 MW and its regulating characteristic is 1% of capacity per 0.1 Hz. Find each area's share of +400 – MW disturbance (load increase) occurring in area 'D' and the resulting tie-line flow. **(10 Marks)**

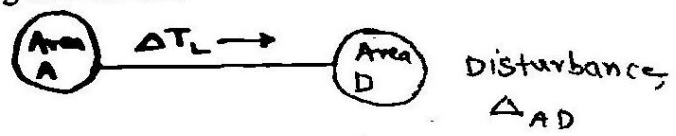

Fig.1(b).

2 a. What is load frequency control? Explain with a block diagram, the model of a load frequency control for an isolated power system. **(10 Marks)**

b. Two synchronous generators operate in parallel and supply a total load of 200 MW. The capacities of the machines are 100 MW and 200 MW and both have governor droop characteristics of 4% from no load to full load. Calculate the load taken by each machine, assuming free governor action. **(06 Marks)**

c. Determine the primary ALFC loop parameters (K_p and T_p) for a control area having the following data :

Total rated area capacity	$P_r = 2000$ MW
Normal operating load	$P_D^O = 1000$ MW
Inertia constant	$= 5.05$
Frequency	$F^O = 60$ c/s
Regulation	R = 2.40 HZ/PU MW (all area generators)

(04 Marks)

3 a. Derive the equations to get the relation between voltage, power and reactive power at a node. **(10 Marks)**

b. Three supply points A, B and C are connected to a common busbar M. Supply point is maintained at a nominal 275 KV and is connected to M through a 275/132 KV transformer (0.1 pu reactance) and a 132 kV line of 50 Ω reactance. Supply point C is nominally at 275 KV and is connected to M by a 275/132 kV transformer (0.1 pu reactance) and a 132 kV line of 50 Ω reactance. Supply point B at 132 kV and connected to M through 132 kV line of 50 Ω reactance.

If at a particular system load, the line voltage at M falls below its nominal value by 5 kV, calculate the magnitude of the reactive volt-ampere injection required at M, to re-establish the original voltage. The per unit values are expressed on 500 MVA base and resistance may be neglected throughout. Refer Fig.3(b). **(10 Marks)**

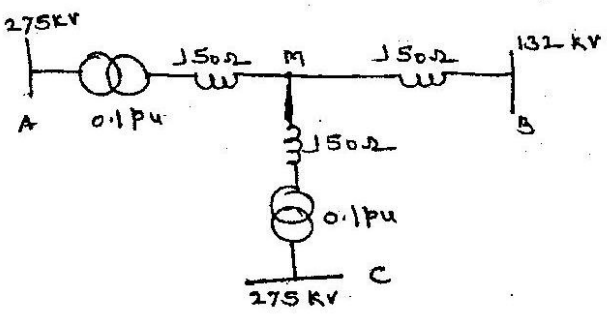

Fig.3(b).

4 Write short notes on:
a. Automatic voltage regulators
b. Control centre of a power system
c. Data collection and state estimator
d. Voltage stability. **(20 Marks)**

PART – B

5 a. Derive the transmission loss formula and state the assumptions made in it. **(10 Marks)**

b. For the system shown in Fig.5(b), with bus 1 as reference bus with a voltage of $1.0\angle 0^\circ$ pu, find the loss formula co-efficient if the branch currents and impedances are :

$I_a = (1.00 + j\ 0.15)$ pu ; $Z_a = 0.02 + j\ 0.15$ pu

$I_b = (0.50 - j\ 0.05)$ pu ; $Z_b = 0.03 + j\ 0.15$ pu

$I_c = (0.20 - j\ 0.05)$ pu ; $Z_c = 0.02 + j\ 0.25$ pu.

If the base is 100 MVA, what will be the magnitudes of B – coefficients in reciprocal MW? **(10 Marks)**

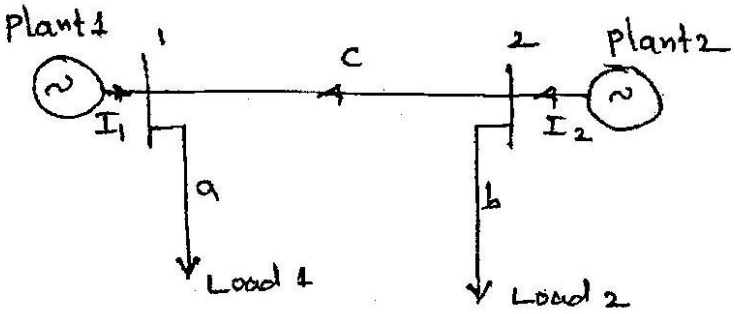

Fig.5(b).

6 a. Explain the need of an optimal unit commitment problem. **(06 Marks)**

b. Using the DP method, how do you find the most economical combination of the units to meet a particular load demand? **(06 Marks)**

c. Draw the flow chart for DP method and explain. **(08 Marks)**

7 a. Discuss the factors affecting power system security. **(10 Marks)**

b. Explain the contingency analysis for detection of network problems. **(10 Marks)**

8 a. Explain the calculation of network sensitivity factors. **(10 Marks)**

b. Describe the AC load flow methods of sensitivity analysis. **(10 Marks)**

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