USN | | | | | | | | | | | 10EE82

Eighth Semester B.E. Degree Examination, June/July 2015
Power System Operation and Control

Time: 3 hrs. Max. Marks: 100

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

PART – A

1 a. Explain the function of a typical digital computer control and monitoring of a power system with the help of a block diagram. **(10 Marks)**

b. Two areas are interconnected as shown in Fig.Q.1(b). The generating capacity of area A is 36000 MW and its regulating characteristic is 1.5% of capacity per 0.1 Hz. Area B has a generating capacity of 4000 MW and its regulating characteristics is 1% of capacity per 0.1 Hz. Find each area share of a 400MW disturbance (load increase) occurring in area B and the resulting tie-line flow. **(10 Marks)**

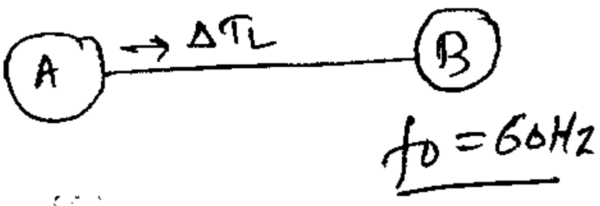

Fig.Q.1(b)

2 a. With a schematic diagram, explain the LFC loop and AVR loop of a generator:
LFC = load frequency control
AVR = automatic voltage regulator. **(08 Marks)**

b. Obtain the complete block diagram representation of load frequency control of an isolated power system. **(12 Marks)**

3 a. Obtain an expression for steady state change in system frequency Δf_{ss} for a step change in the load demand; assume free governor operation. **(12 Marks)**

b. A 100MVA alternator operating on rated load, uPF, at a frequency of 50Hz. The load is suddenly reduced to 50 MW. Due to time lag in the governor system, the steam valve begins to close after 0.4 seconds. Determine the change in frequency that occurs in this time. Take H = 5 kW-sec/kVA of generator capacity. **(08 Marks)**

4 a. Show that the real power flow between two nodes in determined by the transmission angle 'δ' and the reactive power flow is determined by the scalar voltage difference between two nodes. **(08 Marks)**

b. Define voltage stability and voltage collapse. **(04 Marks)**

c. Three supply points A, B and C are connected to a common bus bar M. Supply point A 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 50Ω 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 50Ω reactance. If at a particular system load, the line voltage at M falls below its nominal value by 5kV. 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 500MVA base and resistance may be neglected throughout. Refer Fig.Q.4(c). **(08 Marks)**

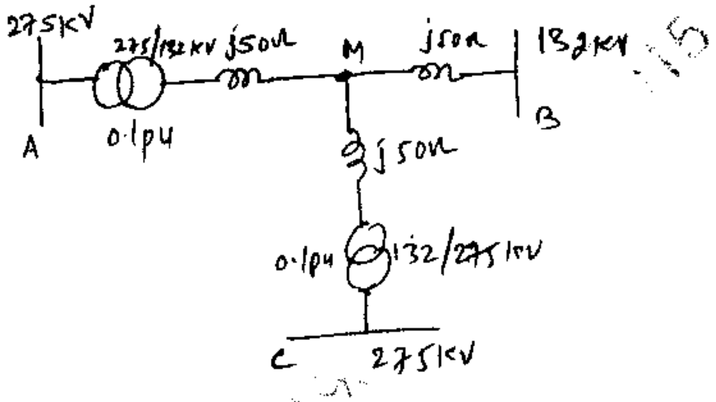

Fig.Q.4(c)

PART – B

5 a. Define unit commitment problem. **(04 Marks)**
b. Explain the dynamic programming (DP) method to solve unit commitment problem in a power system. **(10 Marks)**
c. Discuss the constraints in unit commitment for thermal plants. **(06 Marks)**

6 a. What do you understand by the term 'secured power system' and 'power system blackout'. **(06 Marks)**
b. Explain the security-constrained optimal power flow (SCOPF) function of power system security with an example. **(06 Marks)**
c. Explain contingency analysis using a suitable flow chart. **(08 Marks)**

7 a. Explain the weighted LSE (least squares estimation) method of power system state estimation. **(10 Marks)**
b. Explain: i) Suppression of bad data and ii) Identification of bad data in state estimation problem. **(10 Marks)**

8 a. Define reliability of a system. **(02 Marks)**
b. Explain the three modes of failure of a system. **(08 Marks)**
c. Obtain the expressions for steady-state reliability and general reliability function. **(10 Marks)**

* * * * *