Menoufiya University
Faculty of Engineering
Shebin El-Kom
Second Semester Examination
Max: 100 Marks

Department: Electrical Eng.
Subject: Control of large Power System
Time Allowed: 3 hours
Date:8/ 6/ 2015
Post Grad. (Doctor.)

1- A. Mention the excitation types for synchronous generating units. Draw a schematic diagram for the brushless excitation system , then derive its model equations and draw the block diagram.

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B. For the above excitation system, if:

$K_A = 100$, $T_A = 0.05$sec. , $K_E = 1.0$ , $T_E = 0.5$ sec.
$K_F = 1$ , $T_F = 3$ sec.

1- Construct a carefully drawn root locus plot for:
   i- The system without stabilizing loop.
   ii- The system equipped with a stabilizing transformer across the regulator and has a transfer function of : 0.5 s
2- Calculate $\zeta$ and $\omega_n$ for the upper two cases and comment on the results.
3- If the generator load increased resulting in a decrease in the effective field inductance so the field time constant decreases from 3 s to 1 sec, is the system stability changes.
4- Prove that the static accuracy requirements conflicts with the requirements for stability
5- If the frequency kept constant how we make the generator increase its turbine power by the increased load demand

[25 Marks]

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2- A. Draw a schematic diagram of the speed governing system for a synchronous generating unit and describe its function. Then derive its model equations and draw the block diagram.

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B. If the machine is represented by a simple transfer function $G_P(s)$, to complete the closed loop (ALFC ) and the system has the following data:

(f = 50 hz)

Total rated capacity $P_r$ =2000 MW
Total operating load $P_D$ = 1000 MW
Inertia constant H = 5 sec.
Regulation R = 2 Hz/P.u. MW.

i-Determine the primary ALFC loop parameters.
ii- If the load demand increased by 20 MW, Find the static frequency drop for the two following cases:
   1- Governor operate 2- Governor opened
iii- Explain how we can eliminate the accumulator frequency error.

[25 Marks]

3-A. What is meant by: Free governor action - Regulation due to governor action

B. Two synchronous generators operate in parallel and supply a total load of 300 MW. The capacities of the machines are 150 MW and 200 MW . Assuming free governor action, we found that machine one take 128.6 MW and machine two take the remainder of the load and the difference between the no load speed and the common speed at this setting is 0.034 p.u. Calculate the speed droop characteristics from no-load to full-load.

[20Marks]

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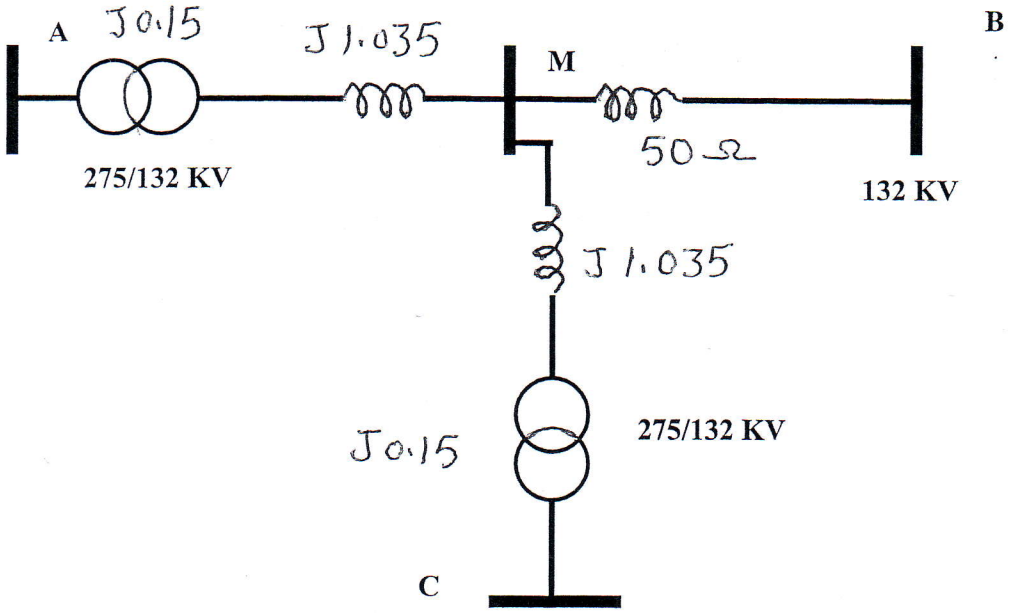
4-A. Discuss breifly the Methods of reactive power control

B-Three power stations A, B and C are connected to a common bus bar M as shown in figure (1). Each of stations A and C is maintained at 275 KV and connected to M through a transformer of reactance 0.15 p.u. and a transmission line of reactance 1.35 pu. Station B is nominally at 132 KV and is connected to M through a 132 KV line of 50 ohm 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 power injection required at M to re-establish the original voltage. The p.u. values are referred to a 500 MVA base and all resistances may be neglected.




[30 Marks]

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*Good luck...* *Prof Dr/ Gamal A. Morsy*