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Code No.: 7123 M

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

M.E. I Year (EEE) I-Semester (Make Up) Examinations, March-2016

(Power Systems & Power Electronics)

Power System Stability

Time: 3 hours Max. Marks: **70**

*Note: Answer ALL questions in **Part-A** and any FIVE questions from **Part-B***

Part-A (10 X 2=20 Marks)

1. Define stiffness of synchronous machine and write its significance.
2. Mention at least five counter measures used to avoid voltage instability of power system.
3. Write the typical inertia constants of the following synchronous machines
   i) Turbine generator (condensing) with 1,800 rpm rating
   ii) Turbine generator (condensing) with 3,000 rpm rating
   iii) Turbine generator (non-condensing) with 30,000 rpm rating
   iv) Water wheel generator with less than 200 rpm rating
   v) Water wheel generator with more than 200 rpm rating
   vi) Large synchronous condenser
4. Is transient stability limit more than steady state stability limit? Justify your answer.
5. Draw the block diagram of general electric hydraulic governor model for steam turbine.
6. Mention and write the values of different parameters of mechanical-hydraulic governor for steam turbine.
7. Why dampet windings completely ignored in modelling of power system used for low frequency oscillation studies?
8. What is the role of supplementary excitation circuit in the operation of power system network?
9. What is the reason for sub synchronous resonance phenomenon in power systems?
10. Name at least four SSR countermeasures.

Part-B (5 X 10=50 Marks)

11. a) Define (i) dynamic stability (ii) steady state stability of power system network and also mention the different methods used to improve these stabilities. [5]

    b) Name any two different analysis of voltage stability study and explain about any one analysis. [5]

12. a) A 50 Hz, 500 MVA, 400 kV generator (with transformer) is connected to a 400 k v infinite bus bar through an interconnector. The generator has H=2.5 MJ/MVA, voltage behind transient reactance of 450 kV and is loaded to 460 MW. The transfer reactances between the generator and busbar under prefault, during fault and postfault are 0.5 pu,1.0 pu and 0.75 pu respectively. Draw the swing curve using intervals of 0.05 sec and assuming that the fault is cleared at 0.15 sec, for a period of 0.3sec. [7]

    b) Define and derive steady state stability limit. [3]

13. a) Derive transfer function of all the components of Hovey's hydraulic power and governor system. [7]

    b) Obtain the potential energy function for a Static Var Compensator. [3]

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14. a) From the fundamentals obtain values of constants K_1,K_2,K_3 and K_4 of transfer function of a power system model for low frequency oscillation studies. [7]

    b) Explain any two historical developments of Supplementary Excitation Control. [3]

15. a) Explain in detail about turbine generator torsional characteristics. [5]

    b) Explain characteristics of Series Capacitor Compensated Transmission Systems. [5]

16. a) How generator and loads are modelled for the study of voltage stability of a power system network? [3]

    b) Write an algorithm of Runge-Gutta method used to solve the swing equation. [7]

17. Write short notes on any **two** of the following:

    a) Natural oscillating frequencies in power system network. [5]

    b) Effect of governor of a hydroplant on system damping [5]

    c) Power system stabilizer [5]

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