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Question Paper Code : 50507

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Sixth Semester

Electrical and Electronics Engineering

EE 8003 — POWER SYSTEMS STABILITY

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the two types of disturbances?
2. What are the assumptions made for stability studies?
3. Define small signal stability.
4. What is mode shape?
5. List the advantages of modified Euler method of transient stability analysis.
6. What are the applications of SMIB system?
7. Define voltage stability.
8. What are the reactive power compensating devices?
9. What is high speed fault clearing?
10. Define fast-valving.

PART B — (5 × 13 = 65 marks)

11. (a) A 60 Hz, 4 pole turbo-generator rated 100 MVA, 13.8 KV has inertia constant of 10 MJ/MVA. (i) Find stored energy in the rotor at synchronous speed. (ii) If the input to the generator is suddenly raised to 60 MW for an electrical load of 50 MW, find rotor acceleration. (iii) If the

rotor acceleration calculated in part (iv) is maintained for 12 cycles, find the change in torque angle and rotor speed in rpm at the end of this period. (v) Another generator 150 MVA, having inertia constant 4 MJ/MVA is put in parallel with above generator. Find the inertia constant for the equivalent generator on a base 50 MVA.

Or

(b) Derive the expression for Swing equation.

12. (a) Explain the small signal stability analysis of a single machine infinite bus (SMIB).

Or

(b) A 50Hz,4 pole turbo alternator rated 100 MVA. 11KV has an inertia constant of 8 MJ/MVA. Find (i) the energy stored in the rotor at synchronous speed. (ii) the rotor acceleration if the mechanical input is suddenly raised to 80 MW for an electric load 50 MW.

13. (a) Explain the Runge-Kutta method of analyzing multi machine power system for stability, with neat flow chart.

Or

(b) Consider a system having the following parameters:

$P_m = 3.0$ p.u.; $r_1P_m = 1.2$ p.u.; $r_2P_m = 2.0$ p.u.;

$H = 3.0$; $f = 50$ Hz; $\Delta t = 0.02$ sec; $Pe = 1.5$ p.u.

Determine the rotor angle and angular frequency at the end of 0.02 sec using Runge-Kutta method.

14. (a) Discuss the various factors affecting the voltage stability of the system.

Or

(b) Discuss concept of mechanism of voltage collapse.

15. (a) Explain the role of power system stabilizer in stability enhancement.

Or

(b) Explain the methods of transient stability enhancement.

PART C — (1 × 15 = 15 marks)

16. (a) 50 Hz, 4-pole turbo generator rated 20 MVA, 13.2 KV has an inertia constant of H = 9.0 KWSec/KVA. Determine the K.E. stored in the rotor at synchronous speed. Determine the acceleration if the input less the rotational losses is 25000 HP and electric power developed is 15000 KW. If the acceleration computed for the generator is constant period of

15 cycles, determine the change in torque angle in that period and the rpm at the end of 15 cycles. Assume that the generator is synchronized with a large power system and has no accelerating torque before the 15 cycle period begins.

Or

(b) Discuss in detail, various types of voltage stability and explain about the transmission system characteristics.
