

B.E. / B.Tech. Electrical (Electronics & Power) Engineering (Model Curriculum) Semester-VI  
**TE205 / SYSMSSD1 - Power Systems-II - Operations and Control**

P. Pages : 3

Time : Three Hours



**GUG/S/25/13879**

Max. Marks : 80

- Notes :
1. All questions carry equal marks.
  2. Due credit will be given to neatness and adequate dimensions.
  3. Assume suitable data wherever necessary.
  4. Illustrate your answers wherever necessary with the help of neat sketches.
  5. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
  6. Read the question paper carefully (Branch Semester, Scheme) before attempting the question.
  7. Every question has equal weightage.
  8. Use of programmable calculator is prohibited.
  9. Draw neat and proper diagram/sketches
  10. Don't use red pen for writing the answers.
  11. Don't write any other comments except answers of questions

1. a) Explain the formulation of Bus admittance matrix ( $Y_{Bus}$ ) by singular transformation method with example. 8
- b) Give the algorithm for load flow solution for NR method without PV buses presents. 8

**OR**

2. a) Give the algorithm for load flow solution for Gauss-Seidel method with PQ buses presents. 8
- b) For the following data from the bus admittance matrix by using By Direct inspection Method, if the line series impedances are as given. 8

Bus code	Impedances
1-2	$0.15+j0.6 \text{ p.u}$
1-3	$0.1+j0.4 \text{ p.u}$
1-4	$0.15+j0.6 \text{ p.u}$
2-3	$0.05+j0.2 \text{ p.u}$
3-4	$0.05+j0.2 \text{ p.u}$

3. a) Derive the relationship between the inertia constants G & H of the Synchronous machine. 8

**OR**

Derive for a synchronous machine

$$M = \frac{GH}{180f}$$

- b) A 50 Hz, four pole turbo generator rated 100 MVA, 11 kV has an inertia constant of 8.0 MVA. 8
- i) Find the stored energy in the rotor at synchronous speed.
- ii) If the mechanical input is suddenly raised to 80 MW for an electrical load of 50 MW, find rotor acceleration, neglecting mechanical and electrical losses.
- iii) If the acceleration calculated in part (b) is maintained for 10 cycles, find the change in torque angle and rotor speed in revolutions per minute at the end of this period.

**OR**

4. a) Derive the power angle equation of synchronous machine connected to infinite bus. State its importance from stability point of view 8
- b) A 4 pole, 60 MVA, 33 kV synchronous machine running at 1500 rpm, delivers 55 MW power to an infinite bus via transmission system.  $H=4.4$  MJ/MVA,  $X_d' = 0.4$  pu. The voltage behind transient reactance  $|E| = 1.05$  pu,  $E_\infty = 1.0$  pu. Find  $\delta(t)$  versus  $t$ ,  $\omega(t)$  versus  $t$ . Assume pre-fault transmission system reactance = 0.15 pu and post-fault transmission reactance is 0.55 pu.  $\Delta t = 0.05$  s. Fault is cleared at 0.13 s. Carry out three iterations using Euler's modified method. 8
5. a) Derive the relationship between  $\Delta f$  (Change in frequency) and  $\Delta P_c$  (change in speed changer). 8
- b) Two generators rated 200 MW and 400 MW are operating in parallel. The droop characteristics of their governors are 4 % and 5% respectively from no load to full load. The speed changers are so set that the generators operate at 50 Hz sharing the full load of 600 MW in the ratio of their ratings. If the load reduces to 400 MW, how will it be shared among the generators and what will the system frequency be? Assume free governor operation. The speed changers of the governors are reset so that the load of 400 MW is shared among the generators at 50 Hz in the ratio of their ratings. What are the no load frequencies of the generators. 8

**OR**

6. a) With necessary diagrams, briefly describe DC excitation systems, AC excitation systems and Brushless AC excitation systems. 8
- b) Discuss about the various methods of voltage control 8
7. a) Explain different functions of State load dispatch centre and Regional load dispatch centre. 8
- b) Explain the Contingency Analysis. Preventive Control and Emergency Control of power system. 8

**OR**

8. a) Explain the Components of Energy Control Centre with block diagram. 8
- b) Explain the System Security Assessment of a Power System in detail. 8

9. a) Explain the generation operating cost curve related to thermal power plant. 8
- b) Explain the Contract Path Method of transmission line pricing along with its key features. 8

**OR**

10. a) Explain wholesale competition market model along block diagram. State advantage and disadvantage of same. 8
- b) What is the Ancillary Services? Describe the main function of ancillary services as per Electric Power Research Institute (EPRI). 8

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