

**FACULTY OF ENGINEERING**  
**B.E. 4/4 (E & EE) I Semester (Main) Examination, December 2010**  
**POWER SYSTEM OPERATION AND CONTROL**

Time : 3 Hours]

[Max. Marks : 75

*Instruction : Answer all questions from Part – A. Answer any five questions from Part – B.*



(25 Marks)

1. Explain the importance of slack bus in load flow studies.
2. What are the unknown at voltage controlled bus ?
3. Why a generator cannot operate above  $P_{\max}$  explain ?
4. What are the assumptions made in deriving  $B_{mn}$  coefficient ?
5. What is coherency ? Explain.
6. What are the advantages of pool operation ?
7. Write two recent methods of improving transient stability.
8. With  $P-\delta$  curves explain how auto recloser helps in improving transient stability.
9. What is the effect of reactive power on voltage magnitude ?
10. Explain how TCSC is used to improve system performance.

## PART – B

(50 Marks)

11. a) Explain FDLF method for n bus system with one slack bus and remaining as PQ buses.
- b) Find  $Y_{\text{bus}}$  for the system shown in fig. 1.

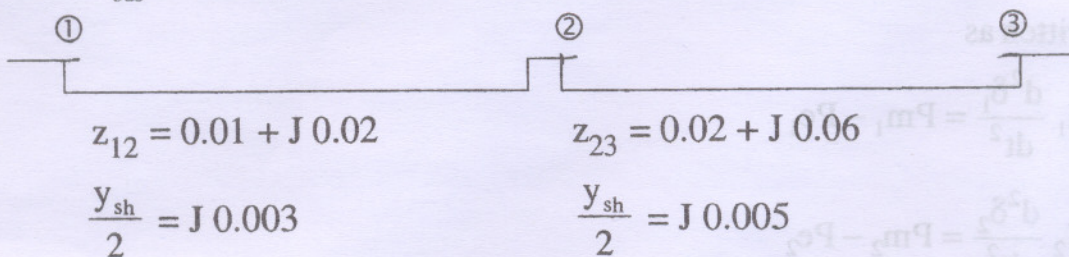


fig. 1

12. a) Derive necessary condition for economic operation of n-plant system considering transmission losses.

b) A constant load of 300 MW is supplied by two 200 MW generators. 1 and 2 for which cost functions are

$$C_1 = 0.005 P_{G1}^2 + 20 P_{G1} + 50 \quad \text{Rs/hr.}$$

$$C_2 = 0.006 P_{G2}^2 + 15 P_{G2} + 30 \quad \text{Rs/hr.}$$

Where  $P_G$ 's are in MW. Find most economical division of load between generators and saving in Rs/hr compared to equal sharing between generators.

13. a) Explain the terms : i) Flat frequency control

ii) Flat tie - line control.

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 they operate at 50 Hz. sharing a load of 600 MW in the ratio of their ratings. If load reduces to 400 MW how will it be shared among the generators and what will be the system frequency.

14. a) Explain step by step method of solution to swing equation.

b) The swing equation of two interconnected synchronous machines are written as

$$M_1 \frac{d^2 \delta_1}{dt^2} = P_{m1} - P_{e1}$$

$$M_2 \frac{d^2 \delta_2}{dt^2} = P_{m2} - P_{e2}$$

If relative angle  $\delta = \delta_1 - \delta_2$  then obtain single equivalent machine in terms of  $\delta$  connected to infinite bus.



15. a) Derive block diagram representation of Automatic Voltage Regulator.

b) With neat diagram explain working of STATCOM.

16. a) Explain Gauss - Seidel method of load flow solution including PV buses.

b) Derive an expression for  $B_{mn}$  coefficient.

17. Write short notes on :

a) Factors affecting Transient stability.

b) Mathematical formulation of Voltage stability problem.

c) Model for speed governing system.

(25 Marks)