

FACULTY OF ENGINEERING

B.E. 4/4 (EEE) I-Semester (Suppl) Examination, May 2013

Subject : **Power System Operation and Control**

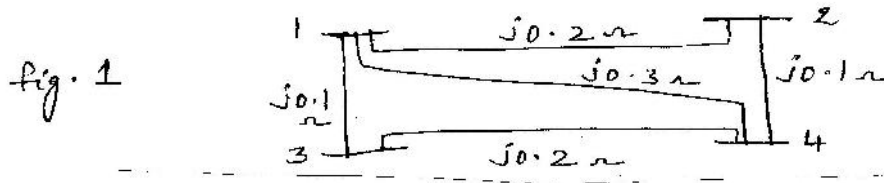
Time : 3 Hours

Max. Marks: 75

Note: Answer all questions of Part - A and answer any five questions from Part-B.

PART – A (25 Marks)

1. List out the assumptions made in FDLF method. (2)
2. For the system show in figure 1 find Y-Bus? (3)



3. The incremental fuel costs in Rs/MWh of two generating plants are given as (3)

$$\frac{dF_1}{dP_1} = 0.008P_1 + 8; \quad \frac{dF_2}{dP_2} = 0.012P_2 + 9$$

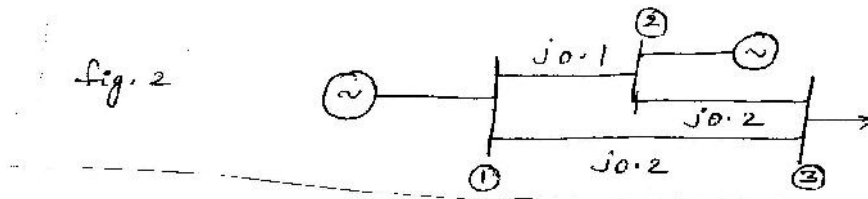
The system is operating on economic dispatch with $P_1 = P_2 = 500$ MW and

$$\frac{\partial P_L}{\partial P_2} = 0.2. \text{ Find the penalty factor of plant 2.}$$

4. Define the following terms : (2)
 - (i) Incremental fuel rate (ii) Incremental efficiency
5. What is flat-frequency control? How is different from flat-tie line frequency control? (3)
6. How PV buses are handled in G-s method? (2)
7. Define : (2)
 - (i) Steady state stability (ii) Transient stability
8. A 50 Hz, four pole turbo generator rated 100 MVA, 11KV has an inertia constant of 10 MJ/MVA. Find the stored energy in the rotor at synchronous speed. (2)
9. Explain the AVR with neat diagram. (3)
10. Draw and explain the operation of STATCOM. (3)

PART – B (5x10=50 Marks)

- 11.(a) List the various data required for the formulation of a load flow problem and hence formulated voltage equations for a general 'n' bus power system. (3)
- (b) For the system shown in figure 2 use Gauss-Seidel method and obtain voltages buses (2) and (3) at the end of the first iteration? (7)



The line impedances marked in the figure are in p.u.

Bus No	Generation		Load		Voltage V	Reactive power limit		Remarks
	P	Q	P	Q		Q _{min}	Q _{max}	
1	-	-	-	-	1.0	-	-	slack
2	5.32	-	-	-	1.1	0	5.32	PV
3	-	-	3.64	0.53	-	-	-	PQ

..2..

12.(a) Derive the necessary condition for economic operation of n-plants considering transmission losses. (5)

(b) The incremental fuel costs of two units are

$$\frac{dC_1}{dP_1} = 0.1P_1 + 22 ; 20 \leq P_1 \leq 100 \text{ Mw}$$

$$\frac{dC_2}{dP_2} = 0.12P_2 + 16 ; 20 \leq P_2 \leq 100 \text{ Mw}$$

Determine the economic load allocation between the units when the total load on the system is

160 Mw. C is in Rs/hr and P is in MW. (5)

13.(a) What is single area system? Deduce dynamic models for a single area system. Show the full block diagram. (6)

(b) Two generators rated 200 MW and 400 MW are operated in parallel. The drop characteristics of their generators are 4% and 5 % respectively from no load to full load. Determine the load shared by each unit for a load of 500 MW. (4)

14.(a) Using equal area criterion, derive an expression for critical clearing angle for a system having a generator feeding a large system through double circuit line. (4)

(b) For the system show in figure 3, the generator has a rating of 50 MVA and $H=2.7 \text{ MJ/MVA}$ at rated speed. $E=1.05$, $V=1$, $X'_d=0.2$, $X_1=X_2=0.4 \text{ pu}$. The generator is supplying 50 MW to the infinite bus when a 3-phase fault occurs at the middle of the line 2. Plot the swing curve for a sustained fault upto a time of 0.5 sec $\Delta t = 0.05 \text{ sec}$.

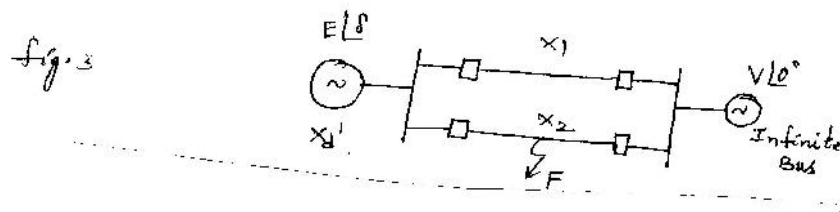


Figure 3

15.(a) Explain the reactive power generation by synchronous generators. (5)

(b) What are the basic FACTS controllers and with neat diagram explain the working of UPFC? (5)

16.(a) Distinguish between rotor angle stability and voltage stability. (4)

(b) A 3-phase over head transmission line in which voltages at both ends are kept fixed at 66 kV has a negligible resistance and an inductive reactance of 20 ohms / conductor. What is the maximum power that could be transmitted over this line. If this line when working at 60% of the above steady state limit suffers a short circuit which is cleared soon after and circuit restored. What are the limits of angular oscillations for transient stability ? (6)

17. Write short notes on the following:

(a) Tie line bias control (3)

(b) Advantages and disadvantages of series compensation (3)

(c) Dynamic response of single area system (4)
