7E4175

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B.Tech. (Sem. VII) (Main) Examination, January - 2010
Electrical Engineering
(7EE5 Power System Engineering)

Time : 3 Hours] [Total Marks : 30
[Min. Passing Marks : 24

Attempt overall five questions. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.)

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. Nil 2. Nil

1 (a) Explain what type of system constraints needs to be satisfied for the economic operation of the power system. 8

(b) The Incremental Fuel Cost (IFC) for two plants are

$$\frac{dC_1}{dP_1} = 0.075\ P_1 + 18\ Rs/MWh$$

$$\frac{dC_2}{dP_2} = 0.08\ P_2 + 16\ Rs/MWh$$

The loss coefficients are given as $B_{11} = 0.0015$ / MW, $B_{12} = -0.0004$ / MW and $B_{22} = 0.0032$ / MW for $\lambda = 25$ Rs/MWh. Find the real power generations, total load demand and the transmission power loss. 8

OR

1 (a) Determine the formula / equation of Incremental Transmission Loss and Penalty Factor. 8

(b) Prepare the unit commitment table with the application of dynamic programming approach for the system having 3 thermal generating units. Determine most economic unit commitment for load demand of 6 MW, changes in steps of 1 MW starting from min. to max. load. The min. and max. capacities and cost curve parameters are given in table below :

Unit No.	*Capacity (MW)*		*Cost curve Parameters*		
	Min.	*Max.*	*a*	*b*	*d*
1	1.0	12.0	0.74	22.9	0
2	1.0	12.0	1.56	25.9	0
3	1.0	12.0	1.87	28.0	0

8

2 (a) Find out the power angle equation and power angle curve under steady state and transient conditions for a salient pole machine and compare.

8

(b) For the system given in **Fig. 1**, a resistive load of R = 0.9 p.u. is connected through a switch at the mid point of the line. Various reactances are marked on the **Fig. 1**. Compare the maximum steady state power transfer with switch open and closed. Discuss the result.

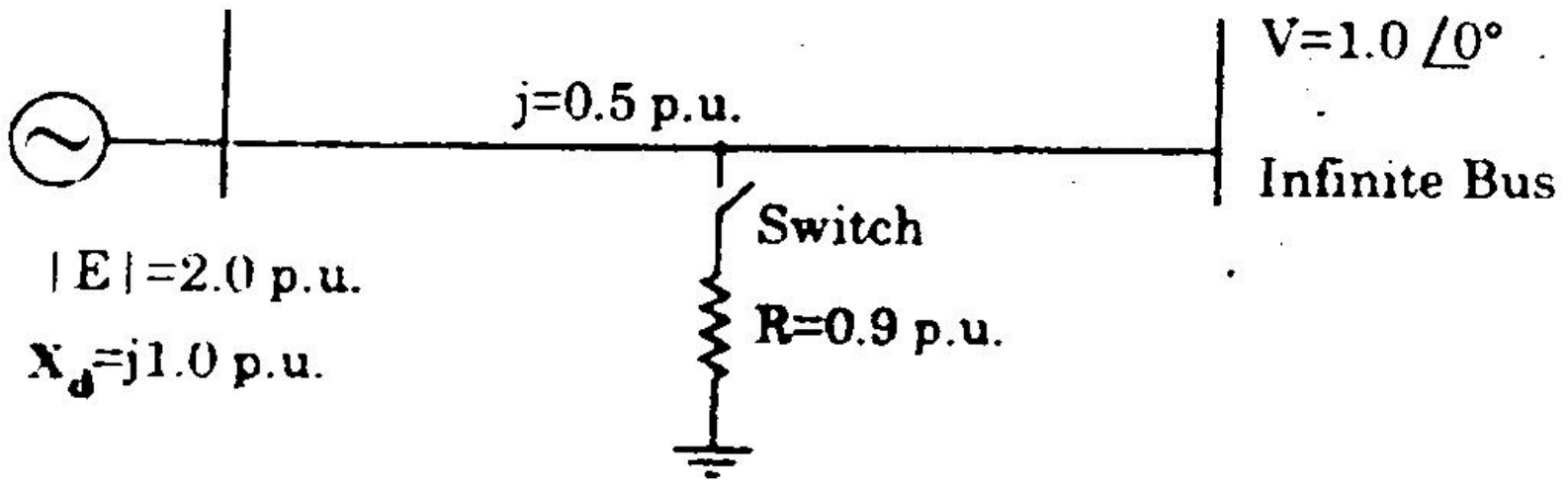

Fig. 1

8

OR

2 (a) Find out the linearised swing equation for small incremental changes in output power and power angle.

8

(b) A 50 Hz, 4-pole, Turbo generator of rating 20 MVA, 13.2 kV has an H = 9 MW-sec/MVA. Determine :

(i) Kinetic energy stored at synchronous speed.

(ii) Acceleration if the input less the losses = 25000 HP and electric power developed is 15 MW.

If the acceleration (α) computed for the generator is constant for a period of 15 cycles. Determine the change in torque angle (δ) in that period and r.p.m. at the end of 15 cycles. Assume that the generator is synchronised with large system and has no acceleration before the 15 cycle begins.

8

3 (a) A generator is connected to the infinite bus through two parallel transmission lines. If a $3-\phi$ fault ($3-\phi$ short ckt.) occurs at the mid point of one of the transmission line, then find out critical clearing angle and critical clearing time if possible using equal area criteria.

10

(b) If auto reclose circuit breaker is used in the system of Q-3(a) above, then how the system transient stability is improved ? Show by equation and graphically, using equal area criteria.

6

OR

3 (a) Write the design methods of improving transient stability. Explain briefly how these methods helps in improvement of stability.

8

(b) In the Fig. 2 given below a generator is connected through parallel transmission line to infinite bus. The machine is delivering 1.0 p.u. power, and the terminal voltage and infinite bus voltage are 1.0 p.u. The reactances shown in the diagram. H = 5 MJ / MVA, f = 60 Hz. Calculate the δ_{cr} and t_{cr} when the system is subjected to a $3-\phi$ fault at point.

(i) P_1 and (ii) P_2 in the diagram

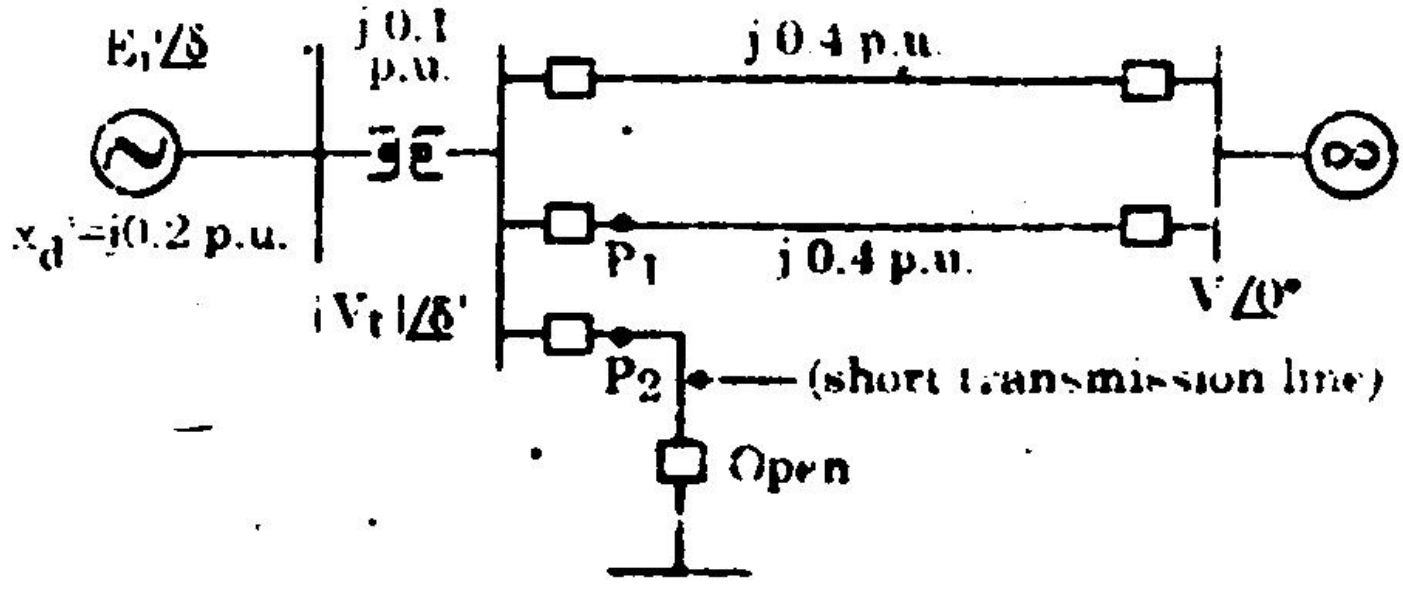

Fig. 2

4 (a) Draw the block diagram and explain the 'Excitation system control and Protective circuits'. 8

(b) Explain with block diagram the brushless excitation system of synchronous generators. 8

OR

4 (a) Write the advantages and problems of Isolated and Interconnected power systems. 8

(b) What are spinning and maintenance reserve capacities ? Explain. How the reserve capacity of power stations decided ? 8

5 (a) Explain working and uses of phase shifting transformer. 8

(b) What are the problems associated with series capacitive compensation ? Explain in detail. 8

OR

5 Write short notes on :

(i) Power system security 8

(ii) Voltage stability. 8