



Attempt to solve the following problems

1

(30 marks)

a) What are the meant by:

Power system instability, swing equation, equal area criteria, security levels, power system basic requiriments and blackouts.

b) In the system shown in Figure 1, a three phase static capacitor of 0.05 per unit, at a base MVA equals 100, is connected through a switch S. Negeclt the effects of static load.

Calculate the steady state limit, with suitable techically and economical comments for two positions for the capacitor placment which are at the mid point of the upper line only and at the motor bus.

- 1) If the switch is open.
- 2) When the switch is closed.
- 3) If the primiairy voltages of the motor transformers equal 1.3 p.u.
- 4) If the static capacitor is replaced by an inductor with the same reactance.
- 5) If the capacitor is inserted inseies with the generator.
- 6) If a three phase fault occurred at point F when case 2 is considered.

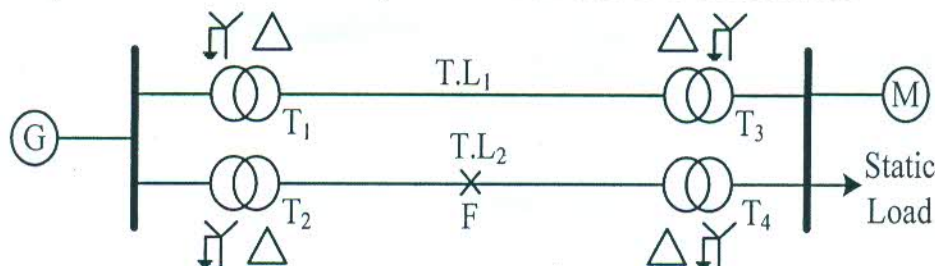


Figure (1)

Generator	15MVA, 11 kV, $x_1=0.14$ p.u., $x_2=0.15$ p.u., $x_0=0.04$, $x_n=0.1$ p.u.
Motor	15 MVA, 11 kV, $x_1=0.18$, $x_2=0.20$ p.u., $x_0=0.1$ p.u., $x_n=0.2$ p.u.
T ₁ , T ₂	5 MVA, 11/66 kV, $x=0.12$ p.u.
T ₃ , T ₄	5 MVA, 66/11 kV, $x=0.12$ p.u.
T.L ₁ , T.L ₂	5 MVA, $x_1=x_2=0.2$ p.u. , $x_0=0.6$ p.u.

2

(20 marks)

- a) Discuss the recent trends that used to enhance steady state and transient stability.
- b) Consider a three phase symmetrical fault at point F, deduce the formula critical clearing angle in terms of the stability limits for pre- during and post fault.
- c) Obtain the critical clearing angle for the system shown in Figure 1 for a three phase fault at the point F. The generator is delivering 1.25 per unit power under pre-fault condition.

3	(25 marks)
	<p>a) Check the errors for the following:</p> <ol style="list-style-type: none"> 1) The interconnected power systems have self-ability to remain normal or stable operation during the occurrence of different disturbances. 2) Power angle curve gives a complete capture of the system behavior after certain harmful disturbance events, 3) Transient operation of power systems is accomplished with measurable voltage variations at the normal frequency. 4) If a sudden increase in the input mechanical power to a synchronous generator then, it is needed to reduce the output generated power as fast as possible to mitigate stability problems. <p>b) Discuss the following:</p> <ol style="list-style-type: none"> 1) The concepts, sources and effects of transient on power systems operation. 2) Switching instant on the transient current. <p>c) Find the steady state power limit of a system consisting of a generator equivalent reactance of 0.60 pu connected to an infinite bus through a series reactance of 1.1 pu the terminal voltage of the generator is held at 1.25 pu and the voltage of the infinite bus is 1.0 pu. What is happen for the steady state limit if the generator emf is held constant at 1.25 pu instead of the terminal voltage? Comment on the results.</p>
4	(25 marks)
	<p>a) Define the following factors:</p> <p>1- Load factor. 2- Utilization factor. 3- Capacity factor.</p> <p>Illustrate your answer with drawing these factors on a typical load curve</p> <p>b) A hydro-electric plant costs 3000 £/kW of the installed capacity. The total annual charges consist of 5 % as interest, 2 % as operation & maintenance and 1.5 % as insurance. Determine a suitable two parts tariff if the losses in the transmission and distribution system are 12.5 %, the diversity factors of the load is 1.25. Assume that the maximum demand on the plant equals 0.80 of the capacity and the annual load factor is 0.4. What is the overall cost of the generated kWh.</p>

Best wishes
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