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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech Degree Examination June 2022 (2019 Scheme)

Course Code: EET304

Course Name: POWER SYSTEMS II

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1	A 50MVA, 11 kV, three phase synchronous generator was subjected to different types of faults. The fault currents are as follows: LG fault: 4130 A, LL fault 2590 A, 3 Phase fault: 1870 A. The generator neutral is solidly grounded. Find the p.u values of sequence reactances of the generator.	(3)
2	Draw the zero sequence networks for a) Y-Y b) Y-Δ connected transformers.	(3)
3	Explain the terms with respect to Gauss Siedel method a) Acceleration factor b) Convergence criteria c) Handling of PV buses.	(3)
4	State the static load flow problem.	(3)
5	Differentiate between steady state and transient stability?	(3)
6	What is critical clearance time and critical clearance angle? What is their significance in stability studies?	(3)
7	What is SCADA? Give its purpose.	(3)
8	What is control area and ACE?	(3)
9	Examine the following: 1) Reasons for maintaining spinning reserve 2) Significance of start-up cost	(3)
10	Derive the condition for economic dispatch when losses are considered.	(3)

PART B

Answer one full question from each module, each carries 14 marks.

Module I

11	a)	Derive the expression for fault current in a line to line fault on unloaded generator. Draw an equivalent network showing the inter connection of networks to simulate a line to line fault.	(10)
	b)	What are current limiting reactors? Give its function and location.	(4)

OR

12 a) Give reasons a) The neutral grounding impedance Z_n appears as $3Z_n$ in the zero sequence equivalent circuit. (4)

b) Zero sequence currents cannot flow in the line currents of a delta connected system.

b) A synchronous generator and a synchronous motor are rated 25 MVA, 11kV and having sub transient reactance of 15% are connected through transformers and a transmission line. The transformers are rated 25MVA, 11/66 kV and 66/11kV respectively with leakage reactance of 10%. The line connecting them has a reactance of 10% on the base of 25MVA, 66kV. The motor is drawing 15 MW at 0.8pf lead and a terminal voltage of 10.6kV when a symmetrical 3phase fault occurs at the motor terminals. Find the sub transient current in the motor, generator and fault by using the internal voltages of the machines. (10)

Module II

13 a) Consider the one line diagram of a power system as shown in Fig.1.Line impedances are marked in per unit on a 100MVA base. Obtain the load flow solution using Gauss Siedel technique. (10)

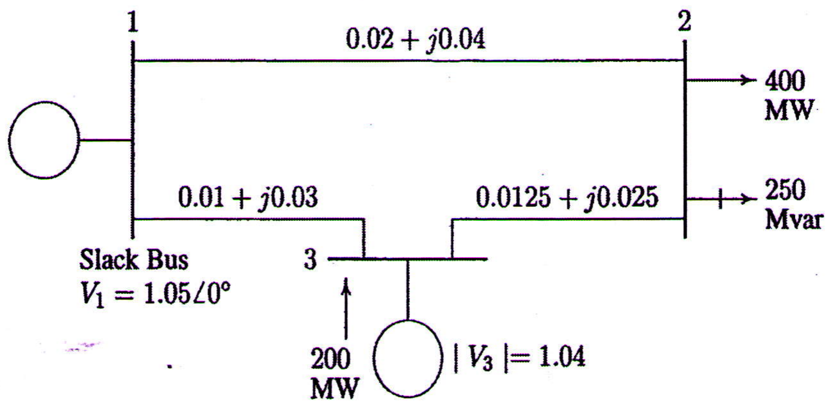

Fig.1

b) Write a brief note on fast decoupled load flow. (4)

OR

14 a) Derive the Newton Raphson power flow analysis algorithm and gives steps for implementation of the algorithm. (10)

b) What are the operating constraints in load flow analysis? (4)

Module III

15 a) Explain the method of solving swing equation by point-by-point method. (8)

b) A generator having H=6.0 MJ/MVA is delivering power of 1p.u. to an infinite (6) bus through a purely reactive network when the occurrence of a fault reduces the generator output power to zero. The maximum power that could be delivered is 2.5per unit. When the fault is cleared the original network conditions again exist. Determine the critical clearance angle and time.

OR

16 a) Write all methods to improve steady state stability limit of power system. (4)

b) A three phase fault is applied at the point P as shown in Fig.2. Find the critical clearing angle for clearing the fault with simultaneous opening of the breakers 1 and 2. The reactance values of various components are indicated in the diagram. The generator is delivering 1.0 p.u. power at the instant preceding the fault. (10)

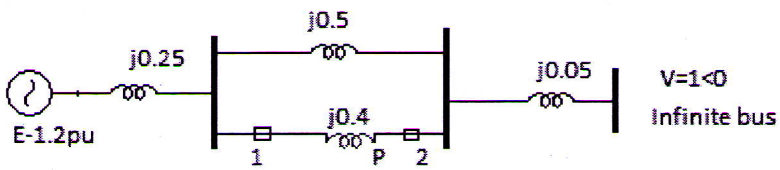

Fig.2

Module IV

17 a) Explain the P-f and Q-V control loops of a power system. (4)

b) Draw the block diagram representation of Load Frequency Control (LFC) of a single area system & explain the steady state stability for free governor operation. (10)

OR

18 a) Two generators of rating 100 and 200 MW are operated with a droop characteristic of 6% from no load to full load. Determine the load shared by each generator, if a load of 270 MW is connected across the parallel combination of those generators. (6)

b) Analyse the dynamic response of frequency for step load change for an isolated power system. (8)

Module V

19 a) The cost curves of two plants of a generating system are (10)

$\frac{dF_1}{dP_1} = 0.012P_1 + 6.6$ and $\frac{dF_2}{dP_2} = 0.0096P_2 + 6$

The loss coefficient for the above system is given as

$B_{11} = 5x10\text{-}3$, $B_{12} = B_{21} = -0.03x10^{-3}$ and $B_{22} = 8x10^{-3}$ on a base of 100MVA. If plant 1 supplies 200MW and plant 2 supplies 300MW, find the penalty factors of each plant. Is the present dispatch economical? If not, which plant output must be increased and which one decreased? Give reasons also for the same.

b) Distinguish between economic dispatch and unit commitment (4)

OR

20 a) Define penalty factors and loss coefficients in economic operation of power system. (4)

b) The fuel inputs per hour of plants 1 & 2 are as given: (10)

$$F1=0.2P_1^2+40P_1+120 \text{ Rs/hr}$$

$$F2=0.25P_2^2+30P_2+150 \text{ Rs/hr.}$$

Determine the economic operating schedule and the corresponding cost of generation if the maximum and minimum loading on each unit are 100MW and 25MW and the demand is 180MW and transmission loses are neglected. If the load is equally shared by both the units, determine the savings obtained by loading the units as per the equal incremental production cost.

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