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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S, FE) / S4 (PT) (S, FE) Examination December 2024 (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	How will you draw the reactance diagram when the single line diagram of a power system is given?	(3)
2	What are the different types of faults in a power system and effects of fault?	(3)
3	Classify the various types of buses in a power system for load flow studies.	(3)
4	Compare Gauss Seidel method with Newton Raphson method in load flow analysis.	(3)
5	What are the factors affecting transient stability of the system?	(3)
6	Define synchronizing coefficient. For what value of synchronizing coefficient, the system remains stable.	(3)
7	Explain the elements in the excitation system.	(3)
8	Enumerate the reasons for keeping strict limits on the system frequency variations.	(3)
9	Discuss about Economic Dispatch in power system. What are its objectives?	(3)
10	Enlighten upon the Hydro constraints of Unit Commitment problem.	(3)

PART B

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

Module I

11	a)	Derive the expression for fault current and draw the interconnection of sequence networks for line to ground fault on the terminals of unloaded generator.	(8)
	b)	The unbalanced voltage phasors of a system is $V_a = 4\,V, V_b = -3j\,V$ and $V_c = 8\angle 143.1\,V$. Find all voltage components for the positive, negative, zero sequence system.	(6)

OR

12	a)	A 400 MVA, 27 kV, three phase generator has a sub transient reactance of 15 %. The generator supplies two motors through a step-up transformer – transmission	(9)

line – step down transformer arrangement. Length of transmission line is 70 km with both transformers on two ends The motors have rated inputs of 350 MVA and 200 MVA at 32.8 kV with 35% sub transient reactance each. The three phase transformer T_1 kept near to generator end is rated at 450 MVA, 30 kV/240 kV with 25 % leakage reactance. Transformer T_2 is kept to load end is made of three single phase transformers of rating 250 MVA, 130kV/32.8 kV with 20% reactance. The line reactance is 80 Ohms. And reactance is j 1.8 per km. Draw the equivalent per unit reactance diagram by selecting the generator rating as base value.

b) Explain short circuit MVA and its significance in analysing faults in power systems. (5)

Module II

13 a) Write down the steps involved in solving load flow equation using Gauss Seidel method when voltage-controlled buses are absent. (10)

b) What is voltage controlled bus? (4)

OR

14 a) Explain the algorithm for load analysis using Fast decoupled load flow method. (8)

b) Write short notes on: (a) Acceleration factor (b) Need for slack bus (c) Flat voltage start. (6)

Module III

15 a) Using equal area criterion, derive an expression for critical clearing angle for a system having a generator feeding an infinite bus through a single circuit line. (8)

b) Explain the terms (i) steady state stability (ii) dynamic stability and (iii) transient stability. (6)

OR

16 a) Derive swing equation representing the rotor dynamics of synchronous machine. Explain its solution by point- by- point method. (10)

b) A 2 pole, 50 Hz, 11kV turbo generator has a rating of 50 MW at 0.75 power factor lagging. The rotor has a moment of inertia of 7500 kg- m^2. Calculate its inertia constant in MJ/MVA and its angular momentum in MJ-s/elect. degree. (4)

Module IV

17 a) Explain the dynamic response of frequency for step load change for an isolated power system. (8)

b) Draw the block diagram of automatic voltage regulator and describe its operation. (6)

OR

18 a) Explain the main components of speed governor system. Also write the equation governing the system. (10)

b) Enumerate the objectives of AGC. (4)

Module V

19 a) A power plant has three units with the following incremental cost curves: (8)

$dF_1/dP_{g1} = 30 + 0.15\ P_{g1}$

$dF_2/dP_{g2} = 40 + 0.20 P_{g2}$

$dF_3/dP_{g3} = 15 + 0.18\ P_{g3}$

where dF_i/dP_{gi} is in Rs/MW hr.

Total generating capacity is 425 MW. Total system load 300MW. Find the optimum scheduling.

b) Explain the thermal constraints in unit commitment problem. (6)

OR

20 a) Assume that the fuel input BTU/ Hr for unit 1 and unit 2 are given by (10)

$F_1 = (8\ P_1 + 0.024\ P_1^2 + 80)\ 10^6$

$F_2 = (6\ P_2 + 0.04\ P_2^2 + 120)\ 10^6$

The minimum and maximum loads on the units are 100MW and 10MW respectively. The cost of fuel is Rs. 2 million BTU. Determine the minimum cost of generation when the load variation is given in table.

Time	Load
0 – 6 A.M	60 MW
6 A.M – 6 PM	100 MW
6 P.M – 12.00 midnight	60 MW

b) Justify the need for spinning reserve in power system. (4)

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