Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (R,S) / S4 (PT) (R,S) Examination May 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		Explain per unit representation. List out merits of per unit.	(3)
2		What is the significance of current limiting reactors in power system? Where are they located?	(3)
3		Justify the necessity of slack bus in power system.	(3)
4		Explain DC Load flow.	(3)
5		Define critical clearing angle. Comment on its significance in the stability of power system.	(3)
6		What is wide area monitoring system? What is its purpose?	(3)
7		Explain the necessity of automatic voltage control in power system.	(3)
8		Explain P-f and Q-V control loops of a power system.	(3)
9		Compare economic dispatch and unit commitment.	(3)
10		What is Penalty factor? Derive the equation for penalty factor for optimal system operation.	(3)

PART B

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

Module I

11	a)	A 120 MVA, 19.5 kV generator with reactance = 1.55 and is connected to a transmission lie by star – delta transformer rated 150 MVA, 230/18 kV with X= 10 % .if the base to be used in the calculations is 100 MVA, 230 kV for the transmission line, find the per unit values to be used for the transformer and generator reactance.	(7)
	b)	Derive the expression for fault current and draw the interconnection of sequence for the Line- line fault on the terminals of an unloaded generator.	(7)

OR

12	a)	A synchronous generator and a synchronous motor each rated 25 MVA, 11kV having 15% sub transient reactance are connected through transformers and a	(8)

transmission line. The transformers are rated 25MVA, 11 / 66 kV with leakage reactance 10 % each. The transmission line has a reactance of 10 % on a base of 25 MVA, 66 kV. The motor is drawing 15 MW at 0.8 power factor leading and a terminal voltage of 10.6 kV when a symmetrical three phase fault occurs at the motor terminals find the sub transient current in the generator, motor and fault.

b) Prove that three phase power is invariant using symmetrical component analysis. (6)

Module II

13 a) The following is the system data for a load flow solution. (9)

Determine the voltages at the end of first iteration using Gauss-Seidel method. Take acceleration factor = 1.6

The line admittance table is.

Bus Code	Admittance
1-2	2- j6
1-3	1- j3
2-3	0.667-j2.0
2-4	1- j3
3-4	2-j6

The schedule of active and reactive powers :

Bus	P	Q	V	Remarks
1	.....	.....	1.06	Slack
2	0.5	0.2	1+j0	PQ
3	0.4	0.3	1+j0	PQ
4	0.3	0.1	1+j0	PQ

b) What are the static load flow equations for a power system? (5)

OR

14 a) Discuss the Fast Decoupled method of load flow analysis. (4)

b) Write down the algorithm for load flow analysis using Newton – Raphson method. (10)

Module III

15 a) A generator operating at 50 Hz delivers 1 p.u. power to an infinite bus through a transmission circuit which has negligible resistance. A fault takes place reducing the maximum power transferable to 0.5 p. u. whereas before the fault, this power (7)

was 2.0 p.u. and after the clearance of fault, it is 1.5 p.u. By using equal area criterion, determine critical clearing angle.

b) Explain equal area criterion to determine the stability of a power system. (7)

OR

16 a) Derive swing equation. (9)

b) Elucidate upon the steady state stability limit of power system. Describe the methods to improve it. (5)

Module IV

17 a) Derive from fundamentals, the complete block diagram of load frequency control of an isolated power system. (10)

b) Explain SCADA. Give its purpose. (4)

OR

18 a) Explain the working of turbine speed governing system with a neat diagram (8)

b) What is a control area? Discuss in detail about ACE. (6)

Module V

19 a) A two-bus system consist of two power plants connected by a transmission line. If a load of 130 MW is transmitted from plant 1 to the load, a loss of 16 MW is incurred. Load is placed near to plant 2. Determine the generation schedule and load demand Solve the problem using penalty factor method. The incremental production costs of the plants are: (8)

$dF_1/dP_1 = 0.035P1 + 20$

$dF_2/dP_2 = 0.05P2 + 12$

if the cost of received power are λ= Rs 25 / MW hr and λ= Rs 22 / MW hr

b) Enlist the constraints on unit commitment. (6)

OR

20 a) The fuel inputs per hour of plant 1 and plant 2 are given as (10)

$F_1 = 0.2\ P_1^2 + 50\ P_1 + 120$ Rs/hr

$F_2 = 0.25\ P_2^2 + 30\ P_2 + 150$ Rs/hr

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

b) Derive the coordination equation neglecting the transmission losses (4)

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