Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S,FE) (FT/WP/S4 PT) Examination December 2025 (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 symmetrical components of the three phase system.	(3)
2	A three phase generator with rating 1000kVA, 33kV has its armature resistance and synchronous reactance as 30Ω/phase and 85Ω/phase. Calculate p.u impedance of the generator.	(3)
3	Classify various types of buses in power system for load flow studies.	(3)
4	Write four ways of adding an impedance to an existing system so as to modify bus impedance matrix.	(3)
5	What are the methods of improving transient stability of the power system?	(3)
6	Draw and explain power angle curve of a synchronous machine.	(3)
7	A 100MVA, 50Hz alternator is operating at rated speed. The H constant of the machine is 4kW-sec per kVA. The load suddenly increases by 40MW. Due to delay in governor action there is a delay of 0.5 second in opening of steam valve. Find the frequency deviation.	(3)
8	With schematic diagram explain automatic voltage regulator.	(3)
9	Discuss about constraint in Unit Commitment problem.	(3)
10	Define penalty factor. Explain incremental cost in terms of penalty factor.	(3)

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

Module I

11	a)	Show that positive and negative sequence currents are equal in magnitude but out of phase 180 ° in a line to line fault on unloaded generator. Derive the fault current and draw diagram showing interconnection of sequence networks for this type of fault.	(10)
	b)	Define per unit value. What are the advantages of per unit system?	(4)

OR

12 a) A synchronous generator and motor are rated for 30000kVA, 13.2kV and both have sub transient reactance of 20%. The line connecting them has a reactance of 10% on the base of machine ratings. The motor is drawing 20000kW at 0.8pf leading. The terminal voltage of the motor is 12.8kV. When a symmetrical three phase fault occurs at motor terminals, find the sub transient current in generator, motor and at the fault point. (10)

b) Write the condition for single line to ground and Double line to ground fault on an unloaded generator and draw the sequence network. (4)

Module II

13 a) The following is the system data for load flow solution. The line admittances are given in the following table. (10)

Bus code	Admittance
1-2	0.05+j0.15 p.u
1-3	0.10+j0.30 p.u
1-4	0.20+0.40 p.u
2-4	0.10+j0.30 p.u
3-4	0.05+j0.15 p.u

The schedule of active and reactive powers are:

Bus Code	P	Q	V	Remarks
1	-	-	$1.05<0^0$	Slack bus
2	0.5	- 0.2	-	PQ bus
3	-1.0	0.5	-	PQ bus
4	0.3	-0.1	-	PQ bus

Determine the voltages at the end of first iteration by Gauss Seidel method.

b) Derive equation for elements of Jacobian using rectangular coordinates. (4)

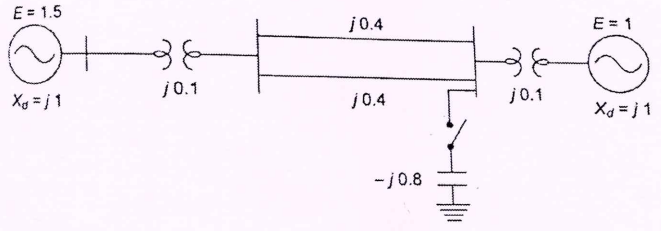
OR

14 a) Explain Fast Decoupled method of load flow solution with flow chart. (10)

b) Compare Gauss Seidel and Newton-Raphson methods of load flow analysis. (4)

Module III

15 a) Find the maximum steady state power transfer a) when capacitor is connected b) when capacitor is replaced by an inductor of the same value. All the reactance are to a common base. (9)



b) Derive the swing equation of a synchronous machine. (5)

OR

16 a) Two power station A and B are located close together, Station A has 5 identical generator sets each rated 100MVA and having an inertia constant of 8MJ/MVA whereas the station B has 4 sets each rated 200MVA, 4MJ/MVA. Calculate the inertia constant of a single equivalent machine on a base of 100MVA. (8)

b) Explain the point by point method for solving the swing equation. (6)

Module IV

17 Develop and explain the block diagram of load frequency control of a single area system. (14)

OR

18 a) A control area has a total rated capacity of 10000MW. The regulation R for all the units in the area is 2 Hz/pu MW. A one per cent change in frequency causes a one per cent change in load. If the system is operating at half of rated capacity and the load increases by 2% (i) find the static frequency drop (ii) If the speed governor loop were open, what would be the frequency drop. (7)

b) Explain the basic generator control loops. (7)

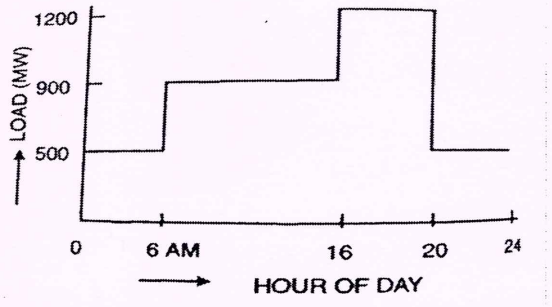
Module V

19 a) The fuel cost characteristic of two thermal plants are as under: (10)

$C_1=5200+52.8P_1+0.0055P_1^2$ Rs/hour

$C_2=3400+15P_2+0.05P_2^2$ Rs/hour

The limits of generation for the two units $200 \leq P \leq 800$MW. The load curve is shown in Fig. Find the daily operating schedule to minimize the operating cost.

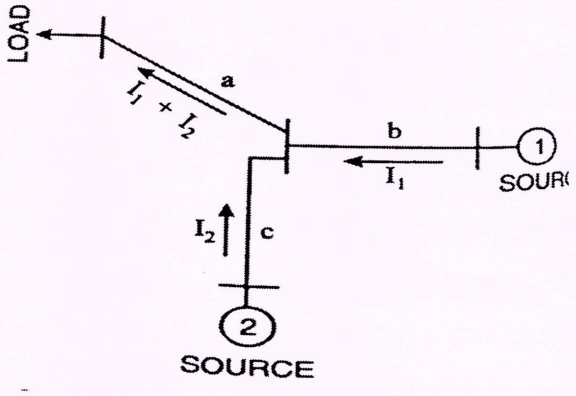


The cost of taking a unit off and then putting it on is Rs.1500/-.

b) Define input –output characteristic, heat rate and incremental cost. (4)

OR

20 a) Find the loss coefficients and the transmission loss as shown in fig, $I_1 = 0.8\angle 0^\circ$ p.u. and $I_2 = 1.0\angle 0^\circ$ p.u. Line impedance are 0.04+j0.12p.u, 0.03+j0.1p.u and 0.03+j0.12 p.u. for the section a, b and c respectively. The voltage at load bus is $1\angle 0^\circ$ p.u. (9)



b) Derive an expression for the transmission loss and express it as a function of plant loading. (5)

***