Reg.No.: | | | | | | | | | | | | |

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 80030

M.E. / M.Tech. DEGREE END-SEMESTER EXAMINATIONS – JAN. / FEB. 2026
First Semester
Power Systems Engineering
P23PS101 – ADVANCED POWER SYSTEM OPERATION AND CONTROL
(Regulation 2023)

Time : Three Hours | Maximum : 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 – Evaluating
	K2 – Understanding	K4 – Analyzing	K6 – Creating

PART – A

(10 x 2 = 20 Marks)

Q. No	Questions	Marks	KL	CO
1.	Illustrate the significance of load sharing of two (2) parallel units with relevant time response.	2	K2	CO1
2.	Justify why spinning reserve is important for generation control.	2	K2	CO1
3.	State why P-F and Q-V control loops can be treated as non-interactive?	2	K2	CO2
4.	Define Area Frequency Response Characteristics (AFRC).	2	K2	CO2
5.	Show and express time dependent start-up cost of thermal power plant.	2	K2	CO3
6.	Illustrate the expression for total transmission loss in terms of real power generation when n = 2.	2	K2	CO3
7.	Highlight why all the generators have different incremental production costs?	2	K2	CO4
8.	Illustrate physical meaning of $C = 400 + 8.4P_1 + 0.006P_1^2$.	2	K2	CO4
9.	Justify "Newton Raphson AC power flow convergence characteristics are quadratic in nature".	2	K2	CO5
10.	Identify the physical significance of contingency analysis.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)		Develop the mathematical model of Rotating Mass and Load.	13	K2	CO1
			(OR)			
	b)	i.	Highlight the necessity of load forecasting in the modern power system.	3	K2	CO1
		ii.	Describe the factors affecting the load forecasting. In detail mathematically elaborate any two standard load term load forecasting techniques.	10		
12.	a)	i.	Point out the difference between Primary Frequency Control (PFC) and Secondary Frequency Control (SFC).	3	K3	CO2
		ii.	Construct an example to represent how the speed dropping of 20 MW in an isolated power system is taken care in a systematic way to restore equilibrium. Assume 50% loading, R=4%, rated capacity as 2000 MW, frequency as 60 Hz and H = 5 Sec.	10		
			(OR)			
	b)		In detail explain the Primary Frequency Control (PFC) using governing mechanism and hence develop the corresponding mathematical relations.	13	K3	CO2
13.	a)	i.	Draw a neat schematic diagram of pumped storage hydro power plant.	3	K2	CO3
		ii.	In detail explain dynamic programming to solve hydrothermal scheduling problem with pumped storage hydro plant.	10		
			(OR)			
	b)		With neat sketch, describe the technical operation principle of different types of hydro power plants with merits.	13	K2	CO3
14.	a)	i.	Write the steps to solve optimal dispatch considering the generator limits (with losses).	3	K2	CO4
		ii.	Let a power system is supplied by two power plants, both of which operate on economical dispatch. At the bus of power plant-1, IC is 55 Rs/MWh and at plant-2, IC is 50 Rs/MWh. Which plant has the higher penalty factor (PF)? What is the PF of plant-1 if the cost per hour of increasing the load on the system by 1 MW is 75 Rs./hr.	10		
			(OR)			
	b)		Derive the expression for transmission loss as a function of real power generation with relevant diagrams. Also Obtain condition for economical division of load between plants (coordination equation).	13	K2	CO4

			Marks	KL	CO
15.	a)	Describe the systematic procedure to perform N-1 contingency analysis in the power system.	13	K2	CO5
		(OR)			
	b)	In detail explain the mathematical steps to perform security constrained optimal power flow in power system.	13	K2	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	Compute the load flow solution by Newton Raphson method at the end of first iteration of the system with data as given below. The solution is to be achieved for the following cases, (i) All buses except bus 1 are PQ Buses, (ii) Bus 2 is a PV bus whose voltage magnitude is specified as 1.04 pu.	15	K2	CO5

Line Data				Bus Data			
SB	EB	R (pu)	X (pu)	Bus	P_i (pu)	Q_i (pu)	V_i
1	2	0.05	0.15	1	--	--	1.04
1	3	0.10	0.30	2	0.5	-0.2	--
2	3	0.15	0.45	3	-1.0	0.5	--
2	4	0.10	0.30	4	-0.3	-0.1	--
3	4	0.05	0.15	--	--	--	--

(OR)

	b)	Develop a generalized framework for optimal automated load frequency control in multi-area interconnected power system with tie line bias control.	15	K3	CO2