Reg.No.:												

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

Question Paper Code: 8020

M.E. / M.Tech. DEGREE END-SEMESTER EXAMINATIONS – JUNE / JULY 2024

Second Semester

Power Systems Engineering

P23PS206 – POWER SYSTEM TRANSIENTS

(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.	Highlight the effects of lightening stroke currents.	2	K1	CO1
2.	Justify the importance of providing crushed rock in the design of substation grounding grids, especially in areas of low soil resistivity.	2	K2	CO1
3.	Define ferroresonance and highlight its physical significance.	2	K1	CO2
4.	What are the limitations of gap-type arresters for protection of capacitor banks?	2	K3	CO2
5.	Frame the relation between infinite line and surge impedance loading.	2	K3	CO3
6.	Suggest how a practical transmission line can be treated as a lossless line.	2	K3	CO3
7.	Highlight the physical significance of dissipation factor and what should be its value for perfect dielectrics?	2	K2	CO4
8.	List the major factors impacting the breakdown strength of insulators.	2	K1	CO4
9.	Draw the flow chart of computational modules in EMTP.	2	K2	CO5
10.	List the applications of EMTP in power systems.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q. No.			Questions	Marks	KL	CO
11.	a)	i.	Describe the parameters of front of return stroke current wave with neat sketch during first and following strokes.	6	K2	CO1
		ii.	What is backflashover? In detail, explain its mechanism for surge transfer and breakdown with the help of critical breakdown flashover and backflashover rate.	7	K2	
			(OR)			
	b)	i.	Explain the behavior of lightning strikes on power transmission line tower structure with the help of striking distance and attractive radius.	6	K2	CO1
		ii.	What is Shielding? With neat sketch, explain the geometric model for shielding of transmission lines with inclusion of Eriksson's modifications.	7	K3	
12.	a)		Compare resistance switching and point of wave switching. Which is better and why? Show how two sets of resistors for HV circuit breakers, one for closing and the other for interrupting, are used.	13	K3	CO2
			(OR)			
	b)		Explain why the switching overvoltage transients on an OH line are higher at the receiving end as compared to the sending end. Can these be higher at the sending end in any operation?	13	K3	CO2
13.	a)		A long transmission line is energized by a unit step function at the sending end and is open-circuited at the receiving end. Construct Bewely lattice diagram and obtain the value of the voltage at the receiving end after a long time. Consider an attenuation factor of 0.8.	13	K4	CO3
			(OR)			
	b)		Derive the ABCD constants for a line having resistance of 0.1 Ω/mi, reactance 0.86 Ω /mi, and capacitance 0.04 Ω /mi using long line model. What is the electrical length of the line?	13	K5	CO3
14.	a)	i.	During impulse testing of a restorable insulation, a flashover occurs on the tail of test wave, while the insulation has successfully withstood the peak. Explain this phenomenon with respect to breakdown mechanism in insulations.	9	K3	CO4
		ii.	How does the insulation coordination of GIS differ from an air-insulated substation?	4	K2	CO4
			(OR)			

	b)	i. Calculate the leakage distance of an insulator string according to IEEE and IEC methods for a service voltage of 500 kV, medium polluted atmosphere.	8	K3	CO4
		ii. Describe the voltage-time characteristics of SF6 with supporting curves.	5	K2	CO4
15.	a)	In detail, explain the formulation of EMTP network equations for steady-state and time domain solutions.	13	K4	CO5
		(OR)			
	b)	Describe the modeling of transmission lines with supporting mathematical equations suitable for EMTP simulations.	13	K5	CO5

PART – C

(1 x 15 = 15 Marks)

Q. No.		Questions	Marks	KL	CO
16.	a)	Estimate the BIL of a transformer and switchgear in a 230-kV substation, given the following data: Line insulation = 15 discs of standard insulators, conductor diameter = 2.54 cm, average height = 13 m, protected zone = 1.6 km, surge impedance = 400 Ω, transformer capacitance = 1000 pF, earthing factor = 1.35, temporary overvoltage = 1.10 pu for 1 s, distance of surge arrester to transformer = 10 m, distance of surge arrester to line entrance = 60 m, two lines leading in different directions are connected to the substation. Choose appropriate surge arrester rating.	15	K4	CO4
		(OR)			
	b)	Consider a lightning stroke ramp rising at 40 kA/μs, with a wave front of 0.5 μs, and infinite tail. Tower surge impedance Z_t = 100 Ω. The ground wire impedance Z_g = 300 Ω. Tower height = 30 m. Velocity down the tower = 240 m/μs, velocity along the ground (shield) wire = 300 m/μs. The tower footing resistance = 10 Ω. Coupling factor K = 0.3, span = 300 m. Calculate the tower top voltage, insulation stress, voltage at base of the tower for the duration of the lightning wave front, that is, 0.5 μs. Consider a surge channel impedance of 1500 Ω.	15	K5	CO1