ME - PSE (3)

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:2013

M.E. / M.Tech. DEGREE END-SEMESTER EXAMINATIONS – FEB. 2023

First Semester

Power System Engineering

P19MA103 – OPTIMIZATION TECHNIQUES

(Regulation 2019)

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.	Identify the whether the random variable in the following situation is discrete or continuous: i. In an acid base titration, the millimeters of base that are needed to reach equivalence are measured to the nearest millimeter between 0.1 and 0.15 millimeter. ii. In a voice communication system, with 50 lines the random variable is the number of lines in use at a particular time.	2	K1	CO1
2.	The probability that a wafer contains a large particle of contamination is 0.01. If it is assumed that wafers are independent, what is the probability that exactly 125 wafers need to be analyzed before a large particle is detected?	2	K2	CO1
3.	The joint pdf of X and Y is given by $f(x,y) = \begin{cases} kxy, 1 \le x \le y \le 2 \\ 0, otherwise \end{cases}$. Find the value of k?	2	K1	CO2
4.	If the correlation between the variables X and Y is ± 1 then what type of correlation exists between the variables? What would be the angle between the regression lines?	2	K2	CO2
5.	What is Type –I and Type –II error in testing of hypothesis?	2	K1	CO3

6.	When do we use the F-distribution?	2	K1	CO3
7.	What is an infeasible solution, and how does it occur linear programming problem?	2	K1	CO4
8.	Mention any two limitations of using graphical method to solve a LP problem?	2	K1	CO4
9.	Define principle of optimality.	2	K1	CO5
10.	How does a dynamic programming problem differ from the linear programming problem?	2	K1	CO5

PART – B

(5 x 16 = 80 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Derive the mean, variance and moment generating function of a binomial distribution.	10	K2	CO1
		ii.	The number of monthly breakdowns of a computer is a random variable with mean equal to 1.8. Find the probability that this computer will function for a month 1) without a breakdown 2) with only one breakdown 3) with at least one breakdown.	6	K3	CO1
			(OR)			
	b)	i.	State and prove memory less property of exponential distribution. If the time required repairing a machine is exponentially distributed with $\lambda = \frac{1}{2}$, use the property to find the conditional probability that a repair takes at least 10 hours given that its duration exceeds 9 hours?	10	K3	CO1
		ii.	If X has a uniform distribution in$(-3,3)$, find the $P(\lvert X-2\rvert) < 2$.	6	K3	CO1
12.	a)	i.	The joint probability function (X,Y) is given by $P(x,y) = k(2x+3y), x = 0,1,2 \; and \; y = 1,2,3$. Find the marginal distributions. Also find the value of $P(Y=1\lvert X=0)$ and $P(Y=3\lvert X=1)$	8	K3	CO2
		ii.	The joint pdf of two dimensional random variables (X,Y) is and $f(x,y) = \begin{cases} 2-x-y, 0 \le x \le 1, \; 0 \le y \le 1 \\ 0, \; otherwise \end{cases}$ Find the correlation coefficient between X and Y	8	K3	CO2
			(OR)			

b) i. The joint pdf of the two dimensional random variable (X,Y) is given by $f(x,y) = \begin{cases} e^{-(x+y)}, x \geq 0, y \geq 0 \\ 0, otherwise \end{cases}$. Find the marginal densities of X and Y. Also find the value of $P(X < 1)$ and $P(X + Y < 1)$. 8 K3 CO2

ii. Find the correlation coefficient and the equation of regression lines for the following values of X and Y. 8 K3 CO2

X	1	2	3	4	5
Y	20	50	30	80	70

13. a) i. A time study engineer developed a new sequence of operation elements that he hopes will reduce the mean cycle time of a certain procedure process. The results of a time study of 20 cycles are 12.1395. If the present mean cycle time is 12.5 minutes, shall we adopt the new sequence? Use appropriate hypothesis testing to support your answer. 8 K4 CO3

ii. Two random samples gave the following results: 8 K4 CO3

Sample	Size	Sample mean	Sum of squares of deviation from mean.
1	10	15	90
2	12	14	108

Test whether the samples are from the same normal population at 5% level of significance.

(OR)

b) i. Samples of two types of electric light bulbs were tested for length of life and following data were obtained: 8 K3 CO3

	Type I	Type II
Sample size	18	7
Sample mean	1.234hrs	1.036hrs
Sample SD	36hrs	40hrs

Is the difference in means sufficient to warrant that type I is superior to type II regarding length of life at 5 % level of significance?

ii. 1072 college students were classified according to their intelligence and economic conditions. Test whether there is any association between intelligence and economic conditions. 8 K3 CO3

		Intelligence			
Economic conditions		Excellent	Good	Mediocre	Dull
	Good	48	199	181	82
	Not good	81	185	190	106

14. a) A diary firm has three plants located in a state. The daily milk production of: Plant 1 is 6 million litres, Plant 2 is 1 million litres, and Plant 3 is 10 million litres. Each day the firm must fulfil the need of its four distribution centers. The minimum requirement of Distribution center 1 is 7 million litres, Distribution centre 2 is 5 million litres, Distribution centre 3 is 3 million litres and Distribution centre 4 is 2 million litres. Cost of shipping one million litre from each plant to each distribution centre is given in the following table: 16 K3 CO4

		Distribution			
		D1	D2	D3	D4
Plant	P1	2	3	11	7
	P2	1	0	6	1
	P3	5	8	15	9

Find the initial basic feasible solution using Vogel's approximation method.

(OR)

b) i. Use Graphical method to solve the LPP Minimize $Z = x + y$ subject to the constraints 8 K3 CO4

$$2x + y \geq 4; x + 2y \geq 7 \text{ and } x, y \geq 0.$$

ii. A computer center has three expert programmers. The centre wants three application programmes to be developed. The head of the computer centre, after carefully studying the programmes to be developed, estimates the computer time in minutes required by the experts for the application programmes as follows: 8 K3 CO4

	Programmers			
Programmes	1	120	100	80
	2	80	90	110
	3	110	140	120

Assign the programmers to the programmes in such a way that the total computer time is minimum.

15. a) i. Determine the value of u_1, u_2, u_3 so as to Maximize $Z = u_1 \cdot u_2 \cdot u_3$ subject to the constraint $u_1 + u_2 + u_3 = 10$ and $u_1, u_2, u_3 \geq 0$. 8 K3 CO5

ii. Use dynamic programming to solve the problem: Minimize $Z = {y_1}^2 + {y_2}^2 + {y_3}^2$ subject to the constraint $y_1 + y_2 + y_3 = 10$ and $y_1, y_2, y_3 \geq 0$. 8 K3 CO5

(OR)

b) In a cargo loading problem, there are 4 items of different weights per unit and different value unit as given below. The maximum cargo load is restricted to 17. How many units of each item be loaded to maximize the value? 16 K3 CO5

Item	Weight per unit (kg/unit)	Value per unit (Rs/unit)
1	1	1
2	3	5
3	4	7
4	6	11

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Question Paper Code: 8033

M.E./M.Tech. DEGREE END-SEMESTER EXAMINATIONS – FEB. 2023

First Semester

Power System Engineering

P19PS101 – POWER SYSTEM OPERATION AND CONTROL

(Regulation 2019)

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.	What is the role of shunt reactor in reactive power control?	2	K2	CO1
2.	State the role of a shunt capacitor in power system.	2	K2	CO1
3.	List any two advantages of Dynamic programming method.	2	K2	CO2
4.	What is spring reserve?	2	K1	CO2
5.	Compare the unit commitment problem with economic load dispatch.	2	K4	CO3
6.	State the significance of penalty factor.	2	K2	CO3
7.	What are the functions of energy control center?	2	K2	CO4
8.	List out the major components of SCADA.	2	K2	CO4
9.	What are Pseudo measurements?	2	K1	CO5
10.	List any two drawbacks of weighted least square state estimation.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Illustrate how reactive power compensation and voltage control is performed using static VAR compensator and synchronous condenser.	13	K2	CO1
		(OR)			
	b)	In a single-phase circuit assume the voltage rating is 5 kV, which feeds a load of 450 kW and operates at a lagging power factor of	13	K5	CO1

0.8. if it is desired to improve the power factor, determine the following:

i. The reactive power consumption.

ii. The new corrected power factor after installing a shunt capapcitor bank with a rating of 420 kVAR.

12.	a)	Explain brief about Forward DP approach also discuss how it is different from Dynamic Programming approach.	13	K4	CO2
		(OR)			
	b)	What are different constraints in unit commitment approach discuss them in detail? Explain in brief about priority list method.	13	K4	CO2
13.	a)	The incremental for two plants are given below $\frac{dC_1}{dP_{G1}} = 0.078P_{G1} + 18Rs/MWh$ $\frac{dC_2}{dP_{G2}} = 0.085P_{G2} + 16Rs/MWh$ The loss coefficients are given as B_{11} =0.0018/MW, B_{12} = - 0.0004/MW and B_{22} = 0.0035/MW for λ=30 Rs./MWh. Find the real-power generations, total load demand and the transmission power loss.	13	K5	CO3
		(OR)			
	b)	Explain in detail the gradient method of economic dispatch.	13	K2	CO3
14.	a)	Explain in brief about different functions of SCADA. Discuss in brief about monitoring data acquisition and controls.	13	K2	CO4
		(OR)			
	b)	Discuss in brief about reactive power control system operating states by security control functions.	13	K1	CO4
15.	a)	i. Discuss in brief about – States estimation by orthogonal decomposition algorithm.	7	K3	CO5
		ii. Discuss how state estimation is performed in AC network.	6	K3	CO5
		(OR)			
	b)	i. Discuss in brief about network observability.	5	K3	CO5
		ii. Explain how estimation of quantities not being measured is performed.	8	K3	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	Why is it important to do reactive power control? Explain different methods of voltage control?	15	K3	CO1
		(OR)			
	b)	Discuss in brief about energy management system software structure and its working.	15	K1	CO4

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Question Paper Code: 8034

M.E./ M.Tech. DEGREE END-SEMESTER EXAMINATIONS – FEB. 2023

First Semester

Power System Engineering

P19PS102 – DIGITAL POWER SYSTEM PROTECTION

(Regulation 2019)

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.	State the characteristics of good protective relaying.	2	K2	CO1
2.	What is the significance of digital filtering? List the merits and de-merits.	2	K2	CO1
3.	List the faults in a transmission line, Provide list of available protection schemes for transmission line.	2	K1	CO2
4.	What are Volt-Time Curves? Explain their significance in power system studies?	2	K2	CO2
5.	What factors cause difficulty in applying Merz-price protection to a power transformer?	2	K3	CO3
6.	List the faults in synchronous generator, Provide list of available protection schemes for synchronous generator	2	K2	CO3
7.	In a 3-step distance protection, the reach of the three zones of the relay at the beginning of the first line typically extends into what percentage of first line, second line and third line.	2	K1	CO4
8.	What is the significance of Co-ordination of over current relays? List the merits and de-merits.	2	K2	CO4
9.	What is the significance of Surge Absorber and Surge Diverter? List few comparisons.	2	K2	CO5
10.	List the softwares used for simulation of Short Circuits studies.	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	List the benefits and limitations of any two numerical relays with a neat block diagram	7	K3	CO1
		ii.	What are the advantages of using digital techniques in power system protection?	6	K2	
			(OR)			
	b)	i.	Discuss the significance of the below listed techniques in Digital Power System Protection? Derive necessary Equations. • Sampling theorem • Least Error Squared (LES) technique	6	K3	CO1
		ii.	With neat schematic diagrams, explain the operation of any two over- current protection schemes.	7	K3	
12.	a)	i.	With neat schematic diagrams, explain the operation of the following relay circuits during fault conditions • Distance relays • Travelling wave relays	6	K3	CO2
		ii.	How to design a Digital protection scheme based upon fundamental signal. Explain it by considering any one application.	7	K4	
			(OR)			
	b)	i.	What is travelling wave phenomenon, Explain in detail. Also discuss how it can be used in digital protection of EHV/UHV transmission line	8	K3	CO2
		ii.	With a neat schematic diagram, explain the new relaying schemes of amplitude comparison.	5	K2	
13.	a)	i.	With neat schematic diagrams and necessary equations, explain the operation of any two Digital Protection schemes of a transformer during • Earth-Fault, • Restricted Earth Fault and • Phase-Phase Fault conditions.	7	K3	CO3
		ii.	A 100 kVA, 66/11 kV, Y-Δ, three-phase transformer is protected by percentage differential relays. If the current transformers (CTs) located on LV side have a transformer ratio of 420/5. What will be CTs ratio on HV side? Also find ratios of CT's on HV side for Δ-Y, Δ-Δ and Y-Y configurations.	6	K4	
			(OR)			

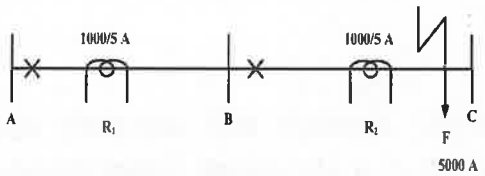
	b)	i.	With neat schematic diagrams and necessary equations, explain the operation of any two Digital Protection schemes of synchronous generator during fault conditions	7	K3	CO3
		ii.	A 3-ph, 11 KV, 20 MVA star connected alternator is protected by the Merz-Price protection. If the ratio of the current transformer is 1200/5, the minimum operating current of the relay is 0.75 Amps and the neutral point earthing resistance is 6 Ω, calculate the percentage of each phase of the stator winding which is unprotected against earth faults when the machine is operating at normal voltage. Show quantitatively, the effect of varying the neutral earthing resistance (consider min. two values).	6	K4	
14.	a)	i.	With neat schematic diagrams and necessary equations, explain the operation of a Directional multi-Zone distance relay	5	K3	CO4
		ii.	Define and Determine • The Pick-up current, • Fault current in relay coil, • Plug setting multiplier (PSM) and • Actual relay operating time of a 10 A, 5-second over current relay having a current setting of 175% and a time setting multiplier of 0.7 connected to supply circuit through a 450/5 current transformer when the circuit carries a fault current of 5,500A. (Corresponding to the PSM of 2, 3, 4, 5 and 6, the time of operation are 11, 9.5, 7, 5.5 and 3 seconds respectively)	8	K3	
			(OR)			
	b)	i.	With neat schematic diagrams and necessary equations, explain the operation of a Directional Instantaneous IDMT over current relay	7	K3	
		ii.	Elucidate the significance of a Computer graphics display in power system protection. With neat schematic diagrams explain the Man-machine interface subsystem. List the Application of computer graphics	6	K3	CO4
15.	a)	i.	List the assumptions made to develop the algorithms for Short Circuit studies	7	K2	CO5
		ii.	With a neat flowcharts, explain any two algorithms which were developed in your course for SC studies	6	K3	
			(OR)			
	b)	i.	With a neat flowcharts, explain any two algorithms which were developed in your course for SC studies of multiphase systems	6	K3	CO5
		ii.	With neat schematic diagrams and necessary equations, explain the operation of any two Ultra high speed protective relays for high voltage long transmission lines.	7	K3	

PART – C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16. a)	i.	With a neat single line diagram, explain the steps involved to simulate the Short Circuit studies. Design a Power System and provide the code/Simulink Model to analyse SC studies	7	K3	CO5
	ii.	A 50 MVA, 132/66 KV, Δ-Y, three-phase transformer is protected by percentage differential relays. If the current transformers (CTs) located on Δ and Y sides of the power transformer are 300/5 A and 1200/5 A respectively, determine • The output current at full load • The relay current at full load • The minimum relay current setting to permit 25% of overload.	8	K4	CO3
		(OR)			
b)	i.	Explain the procedure to transform the Software Model to Hardware Model. On What basis the component quantities are selected. Explain in detail, how to Design a Hardware Model from Software Model for SC studies	7	K3	CO5
	ii.	Two relays, R_1 and R_2 are connected in two sections of a feeder as shown in below figure. CTs are of 1000/5 A. The plug setting of relay R_1 is 100% and R_2 is 125%. The operating characteristics are given in table.	8	K4	CO4

PSM	2	4	5	8	10	20
Operating time in sec	10	5	4	3	2.8	2.4



The time multiplier setting of the relay R_2 is 0.3. The time grading scheme has a discriminative time margin of 0.5 sec between the relays. A 3-phase short circuit fault F results in a fault current of 5000A. Find the actual operating times of R_1 and R_2. What is the TMS of R_2.

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Question Paper Code: 8034

M.E./ M.Tech. DEGREE END-SEMESTER EXAMINATIONS – FEB. 2023

First Semester

Power System Engineering

P19PS102 – DIGITAL POWER SYSTEM PROTECTION

(Regulation 2019)

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.	State the characteristics of good protective relaying.	2	K2	CO1
2.	What is the significance of digital filtering? List the merits and de-merits.	2	K2	CO1
3.	List the faults in a transmission line, Provide list of available protection schemes for transmission line.	2	K1	CO2
4.	What are Volt-Time Curves? Explain their significance in power system studies?	2	K2	CO2
5.	What factors cause difficulty in applying Merz-price protection to a power transformer?	2	K3	CO3
6.	List the faults in synchronous generator, Provide list of available protection schemes for synchronous generator	2	K2	CO3
7.	In a 3-step distance protection, the reach of the three zones of the relay at the beginning of the first line typically extends into what percentage of first line, second line and third line.	2	K1	CO4
8.	What is the significance of Co-ordination of over current relays? List the merits and de-merits.	2	K2	CO4
9.	What is the significance of Surge Absorber and Surge Diverter? List few comparisons.	2	K2	CO5
10.	List the softwares used for simulation of Short Circuits studies.	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	List the benefits and limitations of any two numerical relays with a neat block diagram	7	K3	CO1
		ii.	What are the advantages of using digital techniques in power system protection?	6	K2	
			(OR)			
	b)	i.	Discuss the significance of the below listed techniques in Digital Power System Protection? Derive necessary Equations. • Sampling theorem • Least Error Squared (LES) technique	6	K3	CO1
		ii.	With neat schematic diagrams, explain the operation of any two over- current protection schemes.	7	K3	
12.	a)	i.	With neat schematic diagrams, explain the operation of the following relay circuits during fault conditions • Distance relays • Travelling wave relays	6	K3	CO2
		ii.	How to design a Digital protection scheme based upon fundamental signal. Explain it by considering any one application.	7	K4	
			(OR)			
	b)	i.	What is travelling wave phenomenon, Explain in detail. Also discuss how it can be used in digital protection of EHV/UHV transmission line	8	K3	CO2
		ii.	With a neat schematic diagram, explain the new relaying schemes of amplitude comparison.	5	K2	
13.	a)	i.	With neat schematic diagrams and necessary equations, explain the operation of any two Digital Protection schemes of a transformer during • Earth-Fault, • Restricted Earth Fault and • Phase-Phase Fault conditions.	7	K3	CO3
		ii.	A 100 kVA, 66/11 kV, Y-Δ, three-phase transformer is protected by percentage differential relays. If the current transformers (CTs) located on LV side have a transformer ratio of 420/5. What will be CTs ratio on HV side? Also find ratios of CT's on HV side for Δ-Y, Δ-Δ and Y-Y configurations.	6	K4	
			(OR)			

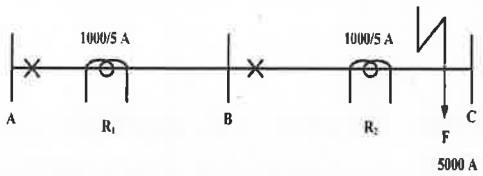
	b)	i.	With neat schematic diagrams and necessary equations, explain the operation of any two Digital Protection schemes of synchronous generator during fault conditions	7	K3	CO3
		ii.	A 3-ph, 11 KV, 20 MVA star connected alternator is protected by the Merz-Price protection. If the ratio of the current transformer is 1200/5, the minimum operating current of the relay is 0.75 Amps and the neutral point earthing resistance is 6 Ω, calculate the percentage of each phase of the stator winding which is unprotected against earth faults when the machine is operating at normal voltage. Show quantitatively, the effect of varying the neutral earthing resistance (consider min. two values).	6	K4	
14.	a)	i.	With neat schematic diagrams and necessary equations, explain the operation of a Directional multi-Zone distance relay	5	K3	CO4
		ii.	Define and Determine • The Pick-up current, • Fault current in relay coil, • Plug setting multiplier (PSM) and • Actual relay operating time of a 10 A, 5-second over current relay having a current setting of 175% and a time setting multiplier of 0.7 connected to supply circuit through a 450/5 current transformer when the circuit carries a fault current of 5,500A. (Corresponding to the PSM of 2, 3, 4, 5 and 6, the time of operation are 11, 9.5, 7, 5.5 and 3 seconds respectively)	8	K3	
			(OR)			
	b)	i.	With neat schematic diagrams and necessary equations, explain the operation of a Directional Instantaneous IDMT over current relay	7	K3	
		ii.	Elucidate the significance of a Computer graphics display in power system protection. With neat schematic diagrams explain the Man-machine interface subsystem. List the Application of computer graphics	6	K3	CO4
15.	a)	i.	List the assumptions made to develop the algorithms for Short Circuit studies	7	K2	CO5
		ii.	With a neat flowcharts, explain any two algorithms which were developed in your course for SC studies	6	K3	
			(OR)			
	b)	i.	With a neat flowcharts, explain any two algorithms which were developed in your course for SC studies of multiphase systems	6	K3	CO5
		ii.	With neat schematic diagrams and necessary equations, explain the operation of any two Ultra high speed protective relays for high voltage long transmission lines.	7	K3	

PART – C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16. a)	i.	With a neat single line diagram, explain the steps involved to simulate the Short Circuit studies. Design a Power System and provide the code/Simulink Model to analyse SC studies	7	K3	CO5
	ii.	A 50 MVA, 132/66 KV, Δ-Y, three-phase transformer is protected by percentage differential relays. If the current transformers (CTs) located on Δ and Y sides of the power transformer are 300/5 A and 1200/5 A respectively, determine • The output current at full load • The relay current at full load • The minimum relay current setting to permit 25% of overload.	8	K4	CO3
		(OR)			
b)	i.	Explain the procedure to transform the Software Model to Hardware Model. On What basis the component quantities are selected. Explain in detail, how to Design a Hardware Model from Software Model for SC studies	7	K3	CO5
	ii.	Two relays, R_1 and R_2 are connected in two sections of a feeder as shown in below figure. CTs are of 1000/5 A. The plug setting of relay R_1 is 100% and R_2 is 125%. The operating characteristics are given in table.	8	K4	CO4

PSM	2	4	5	8	10	20
Operating time in sec	10	5	4	3	2.8	2.4



The time multiplier setting of the relay R_2 is 0.3. The time grading scheme has a discriminative time margin of 0.5 sec between the relays. A 3-phase short circuit fault F results in a fault current of 5000A. Find the actual operating times of R_1 and R_2. What is the TMS of R_2.

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Question Paper Code: 8035

M.E. / M.Tech. DEGREE END-SEMESTER EXAMINATIONS – FEB. 2023

First Semester

Power System Engineering

P19PS103 – ADVANCED POWER SYSTEM ANALYSIS

(Regulation 2019)

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.	Form the Y_{bus} for the off-nominal turns ratio transformer?	2	K2	CO1
2.	Explain modeling of three phase alternator?	2	K1	CO1
3.	What is the need of Slack bus in Load Flow Analysis?	2	K1	CO2
4.	How Generator bus (or P-V bus) is handled in Newton Raphson (Polar Form) Loaf Flow method?	2	K1	CO2
5.	Distinguish between Short Circuit faults and Open Circuit faults?	2	K2	CO3
6.	What are the advantages of using Z_{bus} compared to Y_{bus} in short-circuit studies?	2	K2	CO3
7.	Define Optimal Power Flow (OPF)? Write equations pertaining to Problem formulation of OPF.	2	K1	CO4
8.	Distinguish between Unit Commitment and Economic Load Dispatch?	2	K3	CO4
9.	What is the need of Power system State Estimation?	2	K3	CO5
10.	What do you understand by Observability of a network and Bad Data Detection?	2	K4	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	By singular transformation prove that $Z_{loop} = C^t [z] C$ where, C is the basic loop incidence matrix and z is primitive impedance matrix.	13	K2	CO1
		(OR)			
	b)	Explain.			
		i. Successive Elimination Method and	6	K2	CO1
		ii. Triangular Factorization method? Discuss their merits?	7		
12.	a)	What is the need of AC-DC load flow? Write the algorithm for the AC-DC Load Flow for single phase balanced power system?	13	K3	CO2
		(OR)			
	b)	i. Write assumptions made in Fast Decoupled Load Flow study?	6	K1	CO2
		ii. Compare			
		1) Newton-Raphson (Polar) and	7		
		2) Fast Decoupled Load Flow Methods?			
13.	a)	Using three-phase representation, obtain the expressions for fault current and fault voltages for a fault at p^{th} bus for three-phase to ground fault?	13	K3	CO3
		(OR)			
	b)	i. Mention assumptions made in Short Circuit study? What is their significance?	5	K3	CO3
		ii. Derive the expressions for fault currents and voltages during fault for single line to ground (SLG) fault at p^{th} bus in a power system?	8		
14.	a)	Explain formulation of Optimal Power Flow (OPF) solution using Gradient method?	13	K2	CO4
		(OR)			
	b)	A system consists of two plants connected by a transmission line and a load is at power plant-2. Data for the loss equation consists of the information that 200 MW transmitted from plant-1 to the load results in a transmission loss of 20 MW. Find the optimum generation schedule considering transmission losses to supply a load of 204.41 MW. Also evaluate the amount of financial loss that may be incurred if at the time of scheduling transmission losses are not co-ordinated. Assume that the incremental fuel cost characteristics of plant-1 and plant-2 are given by $df_1/dP_{G1} = 0.025\ P_{G1} + 14$ Rs/MWh $df_2/dP_{G2} = 0.050\ P_{G2} + 16$ Rs/MWh	13	K5	CO4

15.	a)	Write the step by step algorithm for the Weighted Least Squares (WLS) state estimation method?	13	K3	CO5
		(OR)			
	b)	Explain bad data detection identification methods for the power system state estimation and discuss test for bad data?	13	K6	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	Write step-by-step algorithm for the three phase AC-DC load flow considering multi-terminal DC system?	15	K3	CO2
		(OR)			
	b)	What is Hessian Matrix? For n-bus power system how hessian matrix is formed for the state estimation problem? What is its advantage instead of Jacobian Matrix?	15	K4	CO5

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: 8036

M.E./M.Tech. DEGREE END-SEMESTER EXAMINATIONS – FEB. 2023

First Semester

Power System Engineering

P19PSE05 – POWER QUALITY

(Regulation 2019)

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.	Define the power quality as per IEEE standard. What are the main components of power quality?	02	K1	CO1
2.	List out the major power quality issues and classify the types of available power quality solutions.	02	K2	CO2
3.	Point out the causes of voltage sag and suggest the three levels of possible solutions to voltage sag and momentary interruption problems.	02	K2	CO2
4.	How to estimate voltage sag performance? What is the importance of voltage sag estimation?	02	K2	CO2
5.	What are the various causes of over voltages in power system?	02	K2	CO2
6.	Summarize the devices used for protection of over voltages?	02	K4	CO4
7.	State the difference between harmonics and transients.	02	K3	CO3
8.	Why even harmonics are normally absent in the power converters?	02	K3	CO3
9.	What is the function of dynamic voltage restorer?	02	K5	CO5
10.	What are the devices that can be used to reduce THD?	02	K4	CO4

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Name and explain different types of power quality issues that affect the power systems depending upon the severity?	13	K1	CO1

(OR)

	b)	Explain the various types of power quality disturbances in power system and also explain the characteristics of each disturbance.	13	K1	CO1
12.	a)	Discuss the following characteristics of power quality issue			
		i. Short duration variations	7	K1	CO1
		ii. Long duration variations	6		
		(OR)			
	b)	With a waveform sketch, explain the terms			
		i. Voltage sag and Voltage swells	6	K2	CO2
		ii. Voltage interruption and Voltage Sag with harmonics	7		
13.	a)	Describe in detail about transients and waveform distortion related to the power quality.	13	K2	CO2
		(OR)			
	b)	Discuss the source of overvoltage due to following phenomena			
		i. Capacitor switching.	6	K3	CO3
		ii. Magnification of Capacitor switching transients	7		
14.	a)	i. Define Total Harmonic Distortion (THD).	5	K3	CO3
		ii. Explain the procedure for calculation of the THD due to disturbance in the power system.	8		
		(OR)			
	b)	Explain briefly how the phenomenon of current distortion affects the voltage distortion under the presence of harmonics.	13	K3	CO3
15.	a)	Distinguish between the operation of DVR and DSTATCOM.	13	K5	CO5
		(OR)			
	b)	i. What is UPQC?	3	K5	CO5
		ii. Explain the control strategies applicable to UPQC.	10		

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	i. What are custom power devices and custom power parks?	5	K5	CO5
		ii. Discuss the importance of custom power devices used in mitigating power quality issues.	10		
		(OR)			
	b)	i. How to identify the polluting load causing power quality problems.	7	K3	CO3
		ii. Discuss various devices used for mitigating power quality issues.	8	K4	CO4

Reg.No.:								

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Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 8032

M.E./M.Tech. DEGREE END-SEMESTER EXAMINATIONS – FEB. 2023

First Semester

Power System Engineering

P19PSE07 – ELECTRICAL POWER DISTRIBUTION SYSTEMS

(Regulation 2019)

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.	What are the essential requirements of a good distribution system?	2	K1	CO1
2.	Why conventional power flow algorithm applied to transmission system is not applicable distribution system?	2	K3	CO1
3.	Determine the following for a parallel connection of three components. The reliability and the availability.	2	K3	CO2
4.	Determine the following for a parallel connection of three components. The MTTF and the Hazard rate.	2	K3	CO2
5.	Define short term and long term forecasting.	2	K2	CO3
6.	What is the need for feeder reconfiguration in distribution system?	2	K2	CO3
7.	What is meant by voltage drop and voltage regulation?	2	K2	CO4
8.	List the causes for overvoltage in distribution system.	2	K1	CO4
9.	What is meant by fault? Classify types fault occurred in distribution system.	2	K2	CO5
10.	What is the principle of sectionalizer?	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Explain the different methods for reduction of distribution system losses.	6	K2	CO1
		ii.	How do you classify the Loads and give its characteristics?	7		
			(OR)			
	b)		Derive the power loss equation for Radial feeders with uniformly distributed Load.	13	K1	CO1
12.	a)		Consider a Markov chain, with two states, having the one-step transition matrix of $P = \begin{bmatrix} 0.6 & 0.4 \\ 0.3 & 0.7 \end{bmatrix}$ and the initial state probability vector of $P^{(0)} = [0.8 \ \ 0.2]$ Determine the following: • The vector of state probabilities at time t_1 • The vector of state probabilities at time t_4 • The vector of state probabilities at time t_8	13	K3	CO2
			(OR)			
	b)		Assume that a substation transformer has a constant hazard rate of 0.005 per day. • What is the probability that it will fail during the next 5 years? • What is the probability that it will not fail. • Determine the probability that it will fail during year 6, given that it survives 5 years without any failure.	4+4+5	K5	CO2
13.	a)	i.	What are the various factors that influence the voltage levels in the design and operation of the distribution system?	6	K4	CO3
		ii.	Compare the four and six feeder patterns in substation location?	7		
			(OR)			
	b)	i.	Draw the single line diagram of 33-kV / 11-kV substation and explain the purpose of each component.	6	K3	CO3
		ii.	Explain the different factors to be considered to decide the ideal location for a substation.	7		
14.	a)	i.	Write down the procedure to determine the best capacitor location.	6	K3	CO4
		ii.	A 3 phase overhead line has resistance and reactance per phase of 5 ohm and 20 ohm respectively. The load at the receiving end is 25MW at 33 kV and a power factor of 0.8 lagging. Find the capacity of the synchronous condenser required for this load condition if it is connected at the receiving end and the line voltages at both ends are maintained at 33kV.	7		

(OR)

	b)	i.	Describe different types of equipment for voltage control with neat diagrams.	6	K2	CO4
		ii.	Explain the line drop compensation on voltage control.	7		
15.	a)	i.	Discuss the co-ordination procedure between fuse and a circuit breaker.	6	K2	CO5
		ii.	Discuss about the objectives of distribution system protection.	7		

(OR)

	b)	i.	Derive the expression for fault current of line to ground fault.	6	K4	CO5
		ii.	An earth fault occurs on one conductor of a three conductor are supplied by a 10MVA, 6.6kV, three phase source with neutral earthed. The source has positive, negative and zero sequence impedances of (0.5+j4.7), (0.2 + j0.5) and j0.43 ohms per phase. The corresponding impedance values for the cable up to the fault point are (0.36+j0.25), (0.36+j0.25),(2.8+j0.9) ohms per phase. Find the fault current.	7		

PART – C

(1 x 15 = 15 Marks)

Q.No.			Questions	Marks	KL	CO
16.	a)		Assume that a three-phase 500-hp 60 Hz 4160V wye-connected induction motor has a full-load efficiency of 88%, a lagging power factor of 0,75, and is connected to a feeder. If it is desired to correct the power factor of the load to a lagging power factor of 0.9 by connecting three capacitors at the load, determine the following:			
		i.	The rating of the capacitor bank, in kilovars.	5		
		ii.	The capacitance of each unit if the capacitors are connected in delta, in microfarads.	5	K4	CO4
		iii.	The capacitance of each unit if the capacitors are connected in wye, in microfarads.	5		

(OR)

	b)		The annual peak load of the feeder is 3000 kWh. Total copper loss at peak load is 300 kW. If the total annual energy supplied to the sending end of the feeder is 9000 MWh, determine the following:			
		i.	The annual loss factor for an urban area	5	K4	CO1
		ii.	The annual loss factor for a rural area	5		
		iii.	The total amount of energy lost due to copper losses per year in (a) and its value at $0.06/kWh	5		