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: 20001

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2024
Fifth Semester
Computer Science and Technology
U19MA509 – PROBABILITY, QUEUEING THEORY & GAME THEORY
(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.	When 12 coins are tossed 256 times, how many times may one expect 8 heads and 4 tails?	2	K1	CO1
2.	State the axiomatic definition of probability.	2	K1	CO1
3.	It has been claimed that in 60% of all solar heat installations, the utility bill is reduced by at least one-third. What are the probabilities that the utility bill will be reduced by at least one-third in at least four of the first installations?	2	K2	CO2
4.	Buses arrive at a specified stop at 15-minute intervals starting from 7 am, ie. they arrive at 7, 7.15, 7.30, 7.45, and so on. If a passenger arrives at a stop at a random time that is uniformly distributed between 7 and 7.30, find the probability that he waits for less than 5 minutes for a bus.	2	K2	CO2
5.	Messages arrive at a telegraph office according to a Poisson process with λ = 3/hour. What is the probability that no messages arrive between 8 am and 12 noon?	2	K3	CO3
6.	A supermarket has two girls attending sales at the counters. If the service time for each customer is exponential with mean 4 minutes and if people arrive in a Poisson fashion at the rate of 10 per hour, what is the probability that a customer have to wait for service?	2	K3	CO3

7.	What is the critical path in Pert/CPM Explain its importance?	2	K2	CO4
8.	What are the two main costs for a project? Illustrate with examples.	2	K2	CO4
9.	Define two-person zero sum game and saddle point.	2	K3	CO5
10.	Solve the game by the method of matrices	2	K3	CO5

$$\begin{matrix} & B \\ A & \begin{pmatrix} 1 & -1 & -1 \\ -1 & -1 & 3 \\ -1 & 2 & -1 \end{pmatrix}. \end{matrix}$$

PART – B

(5 x 16 = 80 Marks)

Q.No.		Questions	Marks	KL	CO
11. a)	i.	Sixty percent of the employees of the XYZ. Corporations are college graduates. Of these, ten percent are in sales. Of the employees who did not graduate from college, eighty percent are in sales. What is the probability that an employee selected at random is in sales? An employee selected at random is neither in sales nor a college graduate.	8	K1	CO1
	ii.	Four cards are drawn at random from a pack of 52 cards. Find the probability that they are a kind, a queen, a jack, and an ace. Two are kings, two are queens, two are black and two are red. There are two cards of hearts and two cards of diamonds.	8	K3	CO1
		(OR)			
b)	i.	From a city population, the probability of selecting a male or a smoker is 7/10. A male smoker is 2/5 and a male if a smoker is already elected is 2/3. Find the probability of selecting a non-smoker a male and a smoker if a male is first selected.	8	K1	CO1
	ii.	If A and B are independent events then prove that A and $\bar{B}$, $\bar{A}$ and B, $\bar{A}$ and $\bar{B}$ are also independent.	8	K3	CO1
12. a)	i.	The length of time (in minutes) that a certain lady speaks on the telephone is a random variable specified by the probability density function $f(x)=\begin{cases} Ae^{\frac{-x}{5}} & ; x > 0. \\ 0\,; otherwise \end{cases}$ Find the probability that she talks i. more than 10 minutes ii. less than 5 minutes iii. between 5 and 10 minutes over phone.	8	K2	CO2

	ii.	A and B shot independently until each hit his own target. The probabilities of A and B hitting the target is 3/5, 5/7 respectively. Find the probability that B will require more shots than A.	8	K3	CO2
		(OR)			
b)	i.	The probability of an individual suffering a bad reaction to an injection of a certain antibiotic is 0.001. Out of 2000 individuals, find the probability that a) exactly 3 suffer b) more than 2 suffer from bad reaction.	8	K2	CO2
	ii.	A random variable X has uniform distribution over (-3,3) Compute $P(x < 2), P(\|x\| < 2)$ and $P(\|x-2\| < 2$. Also find k, where $P(x > k) = \frac{1}{3}$.	8	K3	CO2
13. a)		Customers arrive at a watch repair shop according to a Poisson process at a rate of one per every 10 minutes and the service time is an exponential random variable with a mean of 8 minutes. Find the average number of customer (Ls) in the shop. Find the average time a customer spends in the shop (Ws). Find the average number of customers in the queue (Lq). Also what is the probability that the server is idle?	16	K5	CO3
		(OR)			
b)		A port there are 6 unloading berths and 4 unloading crews. When all the berths are full, arriving ships are diverted to an overflow facility 20 km down the sea. Tankers arrive according to a Poisson process with a mean of 1 every 2 hours. It takes an unloading crew an average of 10 hours to unload a tanker where the unloading time following an exponential distribution. How many tankers are at the port on average and how long does a tanker spend at the port on average. Also find the average arrival rate at the overflow facility.	16	K5	CO3
14. a)		Consider the following data of project.	16	K5	CO4

Activity	Normal time (weeks)	Normal cost (Rs.)	Crash time (weeks)	Crash cost (Rs.)
1-2	7	600	4	840
1-3	11	200	9	First week: Rs. 70 Second week : Rs. 80
2-3	10	800	8	1000
2-4	6	500	4	760
2-5	16	100	9	380
3-4	6	200	4	360
3-5	9	500	4	960
4-5	8	300	5	50

(OR)

b) Calculate the earliest start, earliest finish, latest start and latest finish for each activity of the project given below and determine the critical path of the project. 16 K5 CO4

Activity	1-2	1-3	1-5	2-3	2-4	3-4	3-5	3-6	4-6	5-6
duration in weeks	8	7	12	4	10	3	5	10	7	4

15. a) i. Solve the following game by using simplex method 8 K3 CO5

Player B

$$\text{Player A}\begin{pmatrix} 1 & -1 & 3 \\ 3 & 5 & -3 \\ 6 & 2 & -2 \end{pmatrix}$$

ii. Using graphical method to solve the rectangle game whose payoff matrix for player A is 8 K4 CO5

$$\begin{bmatrix} 2 & -1 & 5 & -2 & 6 \\ -2 & 4 & -3 & 1 & 0 \end{bmatrix}$$

(OR)

b) i. In a game of matching coins with two players suppose A wins one-unit value when there are two heads, wins nothing when there are two tails and loses ½ units' value when there are one head and one tail. Determine the payoff matrix, the best strategy for each player and the value of the game. 8 K3 CO5

ii. Using Dominance property solve 8 K4 CO5

		Player B			
		I	II	III	IV
Player A	1	-5	3	1	20
	2	5	5	4	6
	3	-4	-2	0	-5