O.P.Code: 20HS0845	R20	H.T.No.										

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR

(AUTONOMOUS)

B.Tech II Year I Semester Regular & Supplementary Examinations December-2023

MATHEMATICAL AND STATISTICAL METHODS

(Common to CSM, CAD, CAI, CCC & CIC)

Time: 3 Hours **Max. Marks: 60**

(Answer all Five Units **5 x 12** = **60** Marks)

UNIT-I

1	a	Add $(ABAB)_{16}$ and $(BABA)_{16}$ and Subtract $(434421)_5$ from $(4434201)_5$.	CO1	L1	4M
	b	Multiply $(11101)_2$ and $(110001)_2$ and also convert $(11111010111100)_2$ as a hexadecimal.	CO1	L2	8M

OR

2	a	Solve the Fibonacci series Linear Diophantine equation (LDE) $34x+21y=17$	CO1	L3	6M
	b	Find the general solution of Linear Diophantine equation 6x+8y+12z=10.	CO1	L3	6M

UNIT-II

3	a	Solve the system of congruence $x\equiv 3\,(\text{mod }10)$, $x\equiv 8\,(\text{mod }15)$, $x\equiv 5\,(\text{mod }84)$ using Chinese remainder theorem.	CO2	L3	6M
	b	Find $\sigma(500)$ and $\tau(500)$, where $\sigma(n)$ denotes the sum of the divisors and $\tau(n)$ denotes number of divisors.	CO2	L3	6M

OR

4	a	Find the remainder when 15^{1976} is divided by 23.	CO2	L3	6M
	b	Define Euler phi function and Compute the least residue of $2^{340}(\text{mod }341)$.	CO2	L3	6M

UNIT-III

5	a	Prove that for a random sample of size n, $x_1, x_2, x_3, ---x_n$ taken from a finite population $S^2=\frac{1}{n}\sum_{i=1}^{n}\left(x_i-\bar{x}\right)^2$ is not unbiased estimator of the parameter σ^2 but $\frac{1}{n-1}\sum_{i=1}^{n}\left(x_i-\bar{x}\right)^2$ is unbiased.	CO3	L5	6M
	b	Find 95% confidence limits for the mean of a normality distributed population from which the following sample was taken 15, 17, 10, 18, 16, 9,7,11,13 ,14. The value of t for 9 degrees of freedom at 5% level of significance is 2.262.	CO4	L3	6M

OR

6	The mean of a random sample is an unbiased estimate of the mean of population 3, 6, 9, 15, 27. (i) List of all possible samples of size 3 that can be taken without replacement from the finite population. (ii) Calculate the mean of each of the sample listed in (a) and assigning each sample a probability of 1/10. Verify that the mean of these X isequal to 12, which is the mean of the population parameter θ. Prove that $\bar{x}$ is an unbiased estimate of θ.	CO3	L3	12M

UNIT-IV

7	a	The transition probability matrix of a Markov chain $\{x_n\}$, n=1, 2,3... having three states, 1,2 and 3is $P=\begin{bmatrix}0.1 & 0.5 & 0.4\\ 0.6 & 0.2 & 0.2\\ 0.3 & 0.4 & 0.3\end{bmatrix}$ and the initial distribution is $P^{(0)}=(0.7,\ 0.2,\ 0.1)$. Find (i) $P(X_2=3,\ X_1=3,\ X_0=2)$ (ii) $P(X_2=3)$ (iii) $P(X_3=2,\ X_2=3,\ X_1=3,\ X_0=2)$	CO5 L3	6M
	b	A man either drives a car or catches a train to go the office each day. He never goes 2 days in a row by train but if he drives one day, then the next day he is just as likely to drive again as he is to travel by train. Now suppose that on the first day of the week, the man tossed a fair die and drove to work if and only if 6 appeared. Find (i) the probability that he takes a train on the third day and (ii) the probability that he drives to work in the long run.	CO4 L3	6M
		OR		
8		There are two boxes, box I contains 2 white balls and box II contains 3 red balls. A each step of the process, a ball is selected from each box and the 2 balls are Interchanged. Thus box 1 always contains 2 balls and box II always contains 3 balls. The states of the system represent the number of red balls in box I after the interchange. Find (i) the transition matrix of the system (ii) the probability that there are 2 red balls in the box I after 3 steps and (iii) the probability that, in the long run there are 2 red balls in box I.	CO5 L3	12M

UNIT-V

9	The stenographic is attached to 5 officers or whom she performs stenographic work. She gets call from the officers at the rate of 4 per hour and takes on the average 10 min to attend to each call. If arrival rate is Poisson and service time exponential find (i) the average number of waiting calls (ii) the average waiting time for an arriving call and(iii) the average time an arriving call spends in the system.	CO6 L3	12M
	OR		
10	A tollgate is operated on a freeway where cars arrive according to a Poisson distribution with mean frequency of 1.2 cars per minute. The time of completing payments follows an exponential distribution with payment follows an exponential distribution with mean of 20 seconds. Find (i) The idle time of the counter (ii) Average number of cars in the system (iii) Average number of cars in the queue (iv) Average time that a car spends in the system (v) Average time, that a car spends in the queue.(vi) The probability that a car spends more than 30 seconds in the system.	CO6 L3	12M

*** END ***