Q.P. Code: 20HS0845 **R20**

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

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR

(AUTONOMOUS)

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

MATHEMATICAL AND STATISTICAL METHODS

(Common to CSM, CAD, CCC & CIC)

Time: 3 hours Max. Marks: 60

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

UNIT-I

1 a Prove by the principle of mathematical induction for all n in Z, CO1 L5 6M

$$P(n)=1+\frac{1}{1+2}+\frac{1}{1+2+3}+....+\frac{1}{1+2+3+....n}=\frac{2n}{n+1}$$

b Express 2072 in the binary system and represent15036 in hexadecimal. CO1 L2 6M

OR

2 a Factorize 809009 using Fermat's method of factorization. CO1 L1 6M

b Find the general solution of $63x-23y=-7$ by using Euclidean algorithm. CO1 L3 6M

UNIT-II

3 a Solve system of linear equations $3x+13y\equiv 8(\text{mod } 55)$ $5x+21y\equiv 34\ (\text{mod } 55)$. CO2 L3 6M

b Define Euler phi function and compute the least residue of $2^{340}(\text{mod}\,341)$. CO2 L3 6M

OR

4 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 12M

UNIT-III

5 a Define estimation and statistical inference. CO3 L1 6M

b 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

OR

6 a What is the size of the smallest sample required to estimate an unknown proportion to within a maximum error of 0.06 with at least 95% confidence? CO3 L1 6M

b Define prediction interval and estimating the variance. CO3 L1 6M

UNIT-IV

7	a	Suppose a communication system transmits the digits 0 and 1 through many stages. At each state the probability that the same digit will be received by the next stage as transmitted, is 0.75. What is the probability that a 0 is entered at the first stage is received as a 0 in the 5[th] stage?	CO4	L1	6M
	b	The transition probability matrix of a Markov chain $\{x_n\}$, n = 1, 2, 3, …. having three states, 1, 2 and 3 is $P=\begin{bmatrix}0.1 & 0.5 & 0.4\\ 0.6 & 0.2 & 0.2\\ 0.3 & 0.4 & 0.3\end{bmatrix}$ and the initial distribution is $P^{(0)}=(0.1,\ 0.2,\ 0.1)$. Find $(i)\ P(X_2=3,\ X_1=3,\ X_0=2)$. $(ii)\ P(X_2=3)$. $(iii)\ P(X_2=2,\ X_2=3,\ X_1=3,\ X_0=2)$.	CO4	L3	6M

OR

8	Two boys B1, B2 and two girls G1, G2 are throwing a ball from one to another. Each boy throws the ball to other boy with probability $\frac{1}{2}$ and to each girl with probability $\frac{1}{4}$. On the other hand, each girl throws the ball to each boy with probability $\frac{1}{2}$ and never to the other girl. In the long run, how often does each receive the ball? Draw transition diagram.	CO4	L6	12M

UNIT-V

9	A petrol pump station has 4 pumps. The service times follow the exponential distribution with mean of 4 minutes and car arrive for service in a poison process at the rate of 30 cars per hour. (i) What is the probability that an arrival would have to wait in line? (ii) Find the average waiting time in the queue, average time spent in the system and the average number of cars in the system. (iii) For what % of time would a pump be idle on an average?	CO5	L3	12M

OR

10	A car servicing station has two bays where service can be offered simultaneously. Due to space limitation only four cars are accepted for servicing. The arrival pattern is Poisson with 12 cars per day. The service time in both the bays is exponentially distributed with $\mu = 8$ cars per day per bay. Find the average number of cars in the service station the average number of cars waiting to be serviced and the average time spends in the system.	CO5	L3	12M

*** END ***