Group - A (Short Answer Questions)

S. No	Question	Blooms Taxonomy Level	Course Outcome
UNIT-I SINGLE RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS			
1	If X & Y is a random variable then Prove E[X+K]= E[X]+K ,where 'K' constant	Understand	2
2	Prove that $\sigma^2 = E(X^2) - \mu^2$	Understand	2
3	**Explain** probability distribution for discrete and continuous?	Understand	3
4	If X is Discrete Random variable then Prove that Var (a X +b) = a^2 var(X)?	Understand	3
5	**Write** the properties of the Normal Distribution?	Understand	5
6	**Write** the importance and applications of Normal Distribution?	Apply	5
7	**Define** different types of random variables with example?	Knowledge	3
8	**Derive** variance of binomial distribution?	Apply	4
9	**Derive** mean of Poisson distribution?	Apply	4
10	**Explain** about Moment generating function?	Understand	5
UNIT-II MULTIPLE RANDOM VARIABLES, CORRELATION &REGRESSION			
1	**State** the properties of joint distribution function of two random variable?	Understand	5
2	**Explain** about random vector concepts?	Understand	6
3	If a random variable W=X+Y where X and Y are two independent random variables, What is the density function of W?	Understand	6
4	**Explain** types of correlations?	Knowledge	7
5	**Write** the properties of rank correlation coefficient?	Understand	7

S. No	Question	Blooms Taxonomy Level	Course Outcome
6	**Write** the properties of regression lines?	Understand	7
7	**Write** the difference between correlation and regression?	Knowledge	7
8	The rank correlation coefficient between the marks in two subjects is 0.8. The sum of the squares of the difference between the ranks is 33. **Find** the number of students?	Apply	7
9	**Find** the angle between the regression lines if S.D of Y is twice the S.D of X and r=0.25?	Apply	7
10	**Derive** the angle between the two regression lines?	Apply	7
	UNIT-III **SAMPLING DISTRIBUTIONS AND TESTING OF HYPOTHESIS**		
1	**Explain** different Types and Classification of sampling?	Understand	8
2	**Write** about Point Estimation, Interval Estimation?	understand	9
3	**Write** a short note on Hypothesis, Null and Alternative with suitable examples?	understand	9
4	**Write** a short Note on Type I & Type II error in sampling theory?	understand	9
5	**Prove** that Sample Variance is not an Unbiased Estimation of Population Variance	understand	9
6	**Write** Properties of t-distribution?	Understand	10
7	**Explain** about Chi-Square?	Understand	10
8	**Write** a short note on Distinguish between t, F, Chi square test?	understand	10
9	**Explain** about Bayesian estimation?	Understand	9
10	**Compare** Large Samples and Small sample tests?	Create	10
	UNIT-IV **QUEUING THEORY**		
1	**Explain** queue discipline?	Understand	11
2	**Explain** pure birth process?	Understand	11
3	**Explain** pure death process?	Understand	11
4	**Derive** expected number of customers?	Apply	11
5	**Derive** average waiting time in queue?	Apply	12
6	**Apply** P(n>1) ?	Apply	12
7	**Define** transient state and steady state?	Knowledge	12
8	**Explain** M/M/1 model?	Understand	12
9	**Explain** M/M/1 with infinite population?	Understand	12
10	**Derive** probability of having n customers P_n in a queue M/M/1, having poisson arrival?	Apply	12
	UNIT-V **STOCHASTIC PROCESSES**		
1	**Define** stochastic process	Knowledge	13
2	**Explain** different types of stochastic process	Understand	13
3	**Give** examples of stochastic process	Create	13
4	**Find** the expected duration of the game for double stakes	Apply	13
5	**Define** Markov's chain	Understand	13
6	**Explain** Markov's property	Understand	13
7	**Explain** transition probabilities	Understand	13
8	**Explain** stationary distribution	Understand	13
9	**Explain** limiting distribution	Understand	13
10	**Explain** irreducible and reducible	Understand	13

Group - B (Long Answer Questions)

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT-I **SINGLE RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS**		
1	A random variable x has the following probability function: x 0 1 3 4 5 6 7 P(x) 0 k 2k 2k 3k k^2 $7k^2$+k **Find** the value of k (ii) evaluate p(x<6), p(x>6)	Apply	3
2	Let X denotes the minimum of the two numbers that appear when a pair of fair dice is thrown once. **Determine** the (i) Discrete probability distribution (ii) Expectation (iii) Variance	Understand	3
3	A random variable X has the following probability function: X: -2, -1, 0, 1, 2, 3 P(x): 0.1, K, 0.2, 2K, 0.3, K Then **find** (i) k (ii) mean (iii) variance (iv) P(0 < x < 3)	Apply	3
4	A continuous random variable has the probability density function $f(x)=\begin{cases} kxe^{-\lambda x}, \ for\ x\geq 0, \lambda>0 \\ 0, otherwise \end{cases}$ **Determine** (i) k (ii) Mean (iii) Variance	Apply	3
5	If the PDF of Random variable f(x) = $k(1-x^2), 0<x<1$ then **find** (i) k (ii) p[0.1<x<0.2] (iii) P[x>0.5]	Apply	3
6	If the masses of 300 students are normally distributed with mean 68 kg and standard deviation 3 kg how many students have masses:greater than 72 kg (ii) less than or equal to 64 kg (iii) between 65 and 71 kg inclusive	Understand	5
7	Out of 800 families with 5 children each, how many would you expect to have (i)3 boys (ii)5 girls (iii)either 2 or 3 boys ? Assume equal probabilities for boys and girls.	Apply	4
8	If a Poisson distribution is such that $P(X=1).\frac{3}{2}P(X=3)$, **Find** (i) $P(X\geq 1)$ (ii) $P(X\leq 3)$ (iii) $P(2\leq X\leq 5)$.	Apply	4
9	Average number of accidents on any day on a national highway is 1.8. **Determine** the probability that the number of accidents is (i) at least one (ii) at most one	Apply	4
10	In a Normal distribution, 7% of the item are under 35 and 89% are under 63. **Find** the mean and standard deviation of the distribution.	Apply	5
	UNIT-II **MULTIPLE RANDOM VARIABLES, CORRELATION &REGRESSION**		
1	Consider the joint probability density function f(x,y) = xy, 0 < x < 1, 0 < y < 2. **Find** marginal density function	Apply	6
2	Two independent variable X and Y have means 5 and 10 and variances 4 and 9 respectively. **Find** the coefficient of correlation between U and V where U=3x+4y, V=3x-y	Apply	7
3	The probability density function of a random variable x is $f(x)=\frac{1}{2}\exp\left[-\frac{x}{2}\right], \quad x>0$ **Find** the probability of 1 < x < 2.	Apply	6
4	Let X and Y random variables have the joint density function f(x,y)=2,0<x<y<1then **find** marginal density function	Apply	6

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<tr><th>S. No</th><th>Question</th><th>Blooms Taxonomy Level</th><th>Course Outcome</th></tr>
<tr><td>5</td><td>Find the rank correlation coefficient for the following ranks of 16 students (1,1),(2,10),(3,3),(4,4),(5,5),(6,7),(7,2),(8,6),(9,8),(10,11),(11,15),(12,9),(13,14),(14,12),(15,16) (16,13)</td><td>Apply</td><td>7</td></tr>
<tr><td>6</td><td>Calculate the coefficient of correlation between age of cars and annual maintain cost and comment:
<table>
<tr><td>Years</td><td>2</td><td>4</td><td>6</td><td>7</td><td>8</td><td>10</td><td>12</td></tr>
<tr><td>Rupees</td><td>1600</td><td>1500</td><td>1800</td><td>1900</td><td>1700</td><td>2100</td><td>2000</td></tr>
</table></td><td>Apply</td><td>7</td></tr>
<tr><td>7</td><td>If $\sigma_x = \sigma_y = \sigma$ and the angle between the regression lines is $Tan^{-1}(4/3)$. Find r.</td><td>Apply</td><td>7</td></tr>
<tr><td>8</td><td>For 20 army personal the regression of weight of kidneys (Y) on weight of heart (X) is Y=3.99X+6.394 and the regression of weight of heart on weight of kidneys is X=1.212Y+2.461. Find the correlation coefficient between the two variable and also their means</td><td>Apply</td><td>7</td></tr>
<tr><td>9</td><td>From 10 observations on price X and supply Y the following data was obtained $\sum X = 130, \sum Y = 220, \sum X^2 = 2288, \sum Y^2 = 5506, \sum XY = 3467$
Find coefficient of correlation, line of regression of Yon X and X on Y</td><td>Apply</td><td>7</td></tr>
<tr><td>10</td><td>If the variance of X is 9.The two regression equations are 8X-10Y+66=0 and 40X-18Y-214=0. Find correlation coefficient between X and Y and standard deviation of Y</td><td>Apply</td><td>7</td></tr>
<tr><td colspan="4">UNIT-III
SAMPLING DISTRIBUTIONS AND TESTING OF HYPOTHESIS</td></tr>
<tr><td>1</td><td>The mean of a random sample is an unbiased estimate of the mean of the 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 the each of the samples listed in (iii) And assigning each sample a probability of 1/10.</td><td>Apply</td><td>8</td></tr>
<tr><td>2</td><td>An ambulance service claims that it takes on the average 8.9 minutes to reach its destination In emergency calls. To check on this claim the agency which issues license to Ambulance service has then timed on fifty emergency calls getting a mean of 9.2 minutes with 1.6 minutes. What can they conclude at 5% level of significance?</td><td>Apply</td><td>9</td></tr>
<tr><td>3</td><td>A sample of 400 items is taken from a population whose standard deviation is 10.The mean of sample is 40.Test whether the sample has come from a population with mean 38 also calculate 95% confidence interval for the population</td><td>Apply</td><td>9</td></tr>
<tr><td>4</td><td>The means of two large samples of sizes 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from the same population of S.D 2.5 inches?</td><td>Apply</td><td>9</td></tr>
<tr><td>5</td><td>Experience had shown that 20% of a manufactured product is of the top quality. In one day’s production of 400 articles only 50 are of top quality .Test the hypothesis at 0.05 level?</td><td>Apply</td><td>9</td></tr>
<tr><td>6</td><td>A sample of 26 bulbs gives a mean life of 990 hrs. With S.D. of 20 hours. The manufacture claims that the mean life bulb is 1000 hrs. is the sample not up to the standard?</td><td>Apply</td><td>10</td></tr>
<tr><td>7</td><td>In a one sample of 10 observations the sum of squares of deviations from mean was 90 and other sample of 12 observations it was 108. Test whether the difference is significant at 5% level of significance?</td><td>Apply</td><td>10</td></tr>
<tr><td>8</td><td>The no. of automobile accidents per week in a certain area as follows: 12,8,20,2,14,10,15,6,9,4 . are these frequencies in agreement with the belief that accidents were same in the during last 10 weeks.</td><td>Apply</td><td>10</td></tr>
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<tr><th>S. No</th><th>Question</th><th>Blooms Taxonomy Level</th><th>Course Outcome</th></tr>
<tr><td>9</td><td><table><tr><td>Sample I</td><td>11</td><td>11</td><td>13</td><td>11</td><td>12</td><td>9</td><td>12</td><td>14</td></tr><tr><td>Sample II</td><td>9</td><td>11</td><td>10</td><td>13</td><td>9</td><td>8</td><td>10</td><td>-</td></tr></table>
Two independent samples of 7 items respectively had the following values</td><td>Apply</td><td>10</td></tr>
<tr><td>10</td><td>A die is thrown 264 times with the following results .show that the die is unbiased<table><tr><td>No appeared on die</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>Frequency</td><td>40</td><td>32</td><td>28</td><td>58</td><td>54</td><td>52</td></tr></table></td><td>Understand</td><td>10</td></tr>
<tr><td colspan="4">UNIT-IV
QUEUING THEORY</td></tr>
<tr><td>1</td><td>Consider a box office ticket window being managed by a single server. Customer arrive to purchase ticket according to poisson input process with a mean rate of 30 per hour. The time required to serve a customer has an exponential distribution with a mean of 910 sec. Determine the following: a)Fraction of the time the server is busy b)The average number of customers queueing for service?</td><td>Apply</td><td>11</td></tr>
<tr><td>2</td><td>Patients arrive at a clinic in a Poisson manner at an average rate of 6 per hour. The doctor on average can attend to 8 patients per hour. Assuming that the service time distribution is exponential, find average number of patients waiting in the queue, Average time spent by a patient in the clinic?</td><td>Apply</td><td>12</td></tr>
<tr><td>3</td><td>A bank plans to open a single server drive in banking facilities at a particular centre. It is estimated that 20 customers will arrive each hour on an average. If on an average, it required 2 minutes to process a customer’s transaction, deter mine 1. The proportion of time that the system will be idle 2. On the average how long a customer will have to wait before reaching the server? 3. Traffic intensity of Bank? 4. The fraction of customers who will have to wait?</td><td>Understand</td><td>12</td></tr>
<tr><td>4</td><td>A car park contains five cars .The arrival of cars in Poisson with a mean rate of 10 per/hour. The length of time each car spends in the car park has negative exponential distribution with mean of two hours. how many cars are in the car park on average and what is the probability of newly arriving costumer finding the car parkful and having to park his car elsewhere?</td><td>Apply</td><td>12</td></tr>
<tr><td>5</td><td>Consider a self service store with one cashier. Assume Poisson arrivals and exponential service time. Suppose that 9 customers arrive on the average of every 5 minutes and the cashier can serve 19 in 5 minutes. Find (i) the average number of customers queing for service. (ii)the probability of having more than 10 customers in the system. (iii) the probability that the customer has to queue for more than 2 minutes?</td><td>Apply</td><td>12</td></tr>
<tr><td>6</td><td>A self service canteen employs one cashier at its counter. 8 customers arrive per every 10 minutes on an average. The cashier can serve on average one per minute. Assuming that the arrivals are Poisson and the service time distribution is exponential, determine: (i)the average number of customers in the system; (ii) the average queue length; (iii) average time a customer spends in the system; (iv) average waiting time of each customer</td><td>Apply</td><td>12</td></tr>
<tr><td>7</td><td>Customers arrive at a one window drive in bank according to a Poisson distribution with mean 10 per hour.Service time per customer is exponential with mean 5 minutes The car space in front of the window including that</td><td>Apply</td><td>12</td></tr>
</table>

S. No	Question	Blooms Taxonomy Level	Course Outcome
	for the serviced can accommodate a maximum of 3 cars . Other cars can wait outside the space.i) what is the probability that an arriving customer can drive directly to the space in front of the windom? i) What is the probability that an arriving customer will have to wait outside the indicated space? ii) How long is an arriving customer expected to wait before starting service?		
8	A fast food restaurant has one drive window. Cars arrive according to a poisson process. Cars arrive at the rate of 2 per 5 minutes. The service time per customer is 1.5 minutes. **Determine** i) The Expected number of customers waiting to be served. ii) The probability that the waiting line exceeds 10 iii) Average waiting time until a customer reaches the window to place an order. iv) The probability that the facility is idle	Apply	12
9	At a railway station , only one train is handled at a time. The railway yard is sufficient only for two trains to wait while other is given signal to leave the station.Trains arrive at an avg rate of 6 per hour and the railway station can handle them on an avg of 12 per hour. Assuming poisson arrivals and exponential service distribution , **find** the steady state probabilities for the various number of trains in the system. Find also the avg waiting time of a new train coming into the yard?	Apply	12
10	Consider a single server queuing system with Poisson input and exponential service time.Suppose the mean rate is 3 calling units per hour with the expected service time as 0.25 hours and the maximum permissible number of calling units in the system is two. **Obtain** the steady state probability distribution of the number of calling units in the system and then calculate the expected number in the system?	Apply	12
	UNIT-V **STOCHASTIC PROCESSES**		
1	The transition probability matrix is given by $P = \begin{bmatrix} 0.1 & 0.4 & 0.5 \\ 0.2 & 0.2 & 0.6 \\ 0.7 & 0.2 & 0.1 \end{bmatrix}$ and $P_0 = [0.4 \quad 0.4 \quad 0.2]$ (a) Find the distribution after three transitions. (b) Find the limiting probabilities.	Apply	13
2	If the transition probability matrix of market shares of three brands A,B, and C is $\begin{bmatrix} 0.4 & 0.3 & 0.3 \\ 0.8 & 0.1 & 0.1 \\ 0.35 & 0.25 & 0.4 \end{bmatrix}$ and the initial market shares are 50%,25% and 25%, Find (a) The market shares in second and third periods (b) The limiting probabilities.	Apply	13
3	Define the stochastic matrixes which of the following stochastic matrices are regular. (a) $\begin{bmatrix} 1/2 & 1/4 & 1/4 \\ 0 & 1 & 0 \\ 1/2 & 0 & 1/2 \end{bmatrix}$ (b) $\begin{bmatrix} 2 & 1/2 & 0 \\ 1/2 & 1/2 & 0 \\ 1/4 & 1/4 & 1/2 \end{bmatrix}$	Apply	13
4	Three boys A, B, C are throwing a ball to each other. A always throws the ball to B; B always throws the ball to C; but C is just as likely to throw the ball to B as to A. Show that the process is Markovian. Find the transition matrix and classify the states. Do all the states are ergodic	Apply	13
5	A gambler has Rs. 2. He bets Rs.1 at a time and wins Rs.1 with probability 0.5. He stops Playing if he looses Rs.2 or wins Rs.4.i)What is the Transition probability matrix of the related markov chain? (b) What is the probability that he has lost his money at the end of 5 plays	Apply	14
6	Check whether the following markov chain is regular and	Apply	13

S. No	Question	Blooms Taxonomy Level	Course Outcome
	ergodic?		
7	The transition probability matrix of a marker chain is given by irreducibleor not?	Apply	13
8	. Which of the following matrices are Stochastic i) ii) iii)	Apply	13
9	Which of the following Matrices are Regular i) ii) iii)	Apply	13
10	a) Is the Matrix irreducible? (b) Is the Matrix p= Stochastic?	Apply	13

Group - III (Analytical Questions)

S. No	Questions	Blooms Taxonomy Level	Course Outcome
	UNIT-I SINGLE RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS		
1	When the classical definition of probability fails.	Understand	2
2	The function $f(x)=Ax^2$ In 0<x0<1 is valid probability density function then find the value of A.	Apply	3
3	Define Normal distribution	Understand	5
4	Explain about Moments	Understand	6
5	Derive mean deviation from the mean for Normal Distribution	Apply	5
6	What is the area under the whole normal curve?	Understand	5
7	In which distribution the mean, mode and median are equal.	Understand	5
8	The mean and variance of a binomial variable X with parameters n and p are 16 and Find $P(X \geq 1)$	Apply	4
9	Where the traits of normal distribution lies.	Understand	5
10	Write the properties of continuous random variable	Understand	2
	UNIT-II MULTIPLE RANDOM VARIABLES, CORRELATION &REGRESSION		
1	Derive the angle between the two regression lines	Apply	7
2	If θ is the angle between two regression lines then show that $\sin\theta \leq 1-r^2$	Apply	7
3	What is the marginal distributions of X and Y.	Understand	6
4	Write the normal equations of straight line	Understand	7
5	Find mean value of the variables X and Y and coefficient of correlation from the following regression equations 2Y-X-50=0, 3Y-2X-10=0	Apply	7

S. No	Questions	Blooms Taxonomy Level	Course Outcome
6	Define regression and give its uses	Knowledge	7
7	What are normal equations for regression lines?	Understand	7
8	When the Regression coefficient is independent	Understand	7
9	Find correlation coefficient if b_{xy}=085y, b_{yx}=089x σ_x =3	Apply	7
10	When the coefficient of correlation is maximum	Understand	7
UNIT-III SAMPLING DISTRIBUTIONS AND TESTING OF HYPOTHESIS			
1	Which error is called producer's risk?	Understand	9
2	Which error is called consumer's risk.	Understand	9
3	When the single tailed test is used.	Understand	9
4	What is test statistics for testing single mean?	Understand	9
5	How to calculate limit for true mean.	Understand	9
6	If p=0.15 q=0.85 n=10 find confidence limits	Apply	9
7	What must be sample size to apply t test.	Understand	8
8	If $\bar{x}$ =47.5, $\mu = 42.1, s = 8.4, n = 24$ find t.What is shape of t	Apply	10
9	What is the range of F distribution?	Understand	10
10	Which distribution is used to test the equality of population means?	Understand	10
UNIT-IV QUEUING THEORY			
1	What is probability of arrivals during the service time of any given customer?	Understand	11
2	What is FIFO means?	Knowledge	11
3	Define Jack eying.	Understand	11
4	Define reneging.	Understand	11
5	Define m/m/1:FIFO	Understand	11
6	Model of queuing system.	Understand	11
7	Define balking.	Understand	10
8	What is the pattern according to which customers are served?	Understand	11
9	What is variance of queue length?	Understand	11
10	How to calculate the idle time of the server according to queue theory	Apply	10
UNIT-V STOCHASTIC PROCESSES			
1	What do you call the random variable in stochastic process?	Understand	13
2	When the state is said to be Ergodic.	Understand	13
3	What is null persistent state?	Understand	13
4	What is Markov process?	Understand	13
5	Give an example of discrete parameter Markov chain.	Understand	13
6	When a matrix is said to be regular.	Understand	13
7	What is the use of Markov process?	Understand	13
8	When the state is said to be commute with each other.	Understand	13
9	Let – – then find the expected duration of the game	Apply	14
10	If the stakes are doubled while the initial capital remain unchanged the probability ruin decreases for the player whose probability of success is P<1/2 and increases for the adversary	Apply	14