St. Peter's Engineering College (Autonomous)	Dept.	:	CSM/CSC/CSD
Dullapally (P), Medchal, Hyderabad – 500100. **QUESTION BANK**		Academic Year 2024-25	

Subject Code	:	AS22-00BS09	Subject	:	PROBABILITY AND STATISTICS			
Class/Section	:	B. Tech.	Year	:	II	Semester	:	II

BLOOMS LEVEL					
Remember	L1	Understand	L2	Apply	L3
Analyze	L4	Evaluate	L5	Create	L6

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Q. No	Question (s)	Marks	BL	CO
	UNIT - I			
1	a) Define Discrete and continuous random variable.	1M	L1	C221.1
	b) Define mean and variance of a continuous random variable.	1M	L1	C221.1
	c) A random sample with replacement of size 2 is taken from $S = \{1,2,3\}$. Let the random variable X denote the sum of the two numbers taken, write the probability distribution.	1M	L1	C221.1
	d) Define Expectation and variance of discrete random variable	1M	L2	C221.1
	e) If a random variable has the probability density f(x) as $f(x) = \begin{cases} 2e^{-2x}, & x > 0 \\ 0, & x \leq 0 \end{cases}$. Find the probability between 1 and 3	1M	L1	C221.1
2	a) Prove that If X is a discrete random variable and K is a constant, then E (X + K) = E (X) + K.	3M	L2	C221.1
	b) A fair coin is tossed until a head or five tails occurs. Find the expected number E of tosses of the coin.	3M	L3	C221.1
	c) If the probability density of a random variable is given by $f(x) = \begin{cases} k(1 - x^2), & 0 < x < 1 \\ 0, & otherwise \end{cases}$ find the value of k	3M	L4	C221.1
	d) If X is a continuous random variable and Y = a X +b. Prove that E(Y) = a E(X)+b and $V(Y) = a^2 V(X)$ where V stands for variance and a, b are constants.	3M	L2	C221.1
	e) A random variable X is defined as the sum of the numbers on the faces when two dice are thrown. Find the mean of X.	3M	L4	C221.1
3	a) A player tosses two fair coins. He wins Rs.100/- if a head appears, Rs.200/- if two heads appear. On the other hand, he loses Rs.500/- if no head appears. Determine the expected value E of the game and is the game favorable to the player,	5M	L4	C221.1
	b) A continuous random variable has the probability density function	5M	L3	C221.1

$$f(x) = \begin{cases} kxe^{-x\lambda} & for\ x \geq 0, \lambda > 0 \\ 0 & ,otherwise \end{cases}$$

Determine (i) k (ii) Mean (iii) Variance.

c) A random variable X has following probability distribution	5M		C221.1

X	0	1	2	3	4	5	6	7	8
P(X)	a	3a	5a	7a	9a	11a	13a	15a	17a

(i) Determine the value of a.
(ii) Find P(x<3) and P(0<X<5).

		L4	

d) For a continuous probability density function is given by $f(x) = c\ e^{-|x|}, -\infty < x < \infty$. Find the value of c and hence mean	5M	**L3**	C221.1
e) Let X denote the minimum of two numbers that appear when a pair of fair dice is thrown once. Determine the (i) Discrete probability distribution, (ii) Expectation	5M	**L3**	C221.1

4	a) A random variables X has the following probability function	10M		C221.1

x	0	1	2	3	4	5	6	7
P(X=x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

i). Determine k

ii) $P(X \leq k) > \dfrac{1}{2}$, find the minimum value of k

iii) Determine the distribution function of x.
iv) Mean
v) Variance

L4

b) I) A sample of 4 items is selected at random from a box containing 12 items of which 5 are defected. Find the expected number E of defective items. II) Find the mean and variance of the uniform probability distribution given by $f(x) = \dfrac{1}{n}$ for x=1,2,…n.	10M	**L3**	C221.1
c) I) If X is a continuous random variable and k is a constant. Then prove that: (i) $Var(X+K) = Var(X)$ (ii) $Var(KX) = K^2\ Var(X)$ II) For the continuous probability function f(x) = $kx^2 e^{-x}$ when $x \geq 0$, find mean.	10M	**L4**	C221.1

Q. No	Question (s)	Marks	BL	CO
	UNIT - II			
1	a) Define Binomial Distribution.	**1M**	**L1**	**C221.2**
	b) Write the conditions of Binomial distribution.	**1M**	**L3**	**C221.2**
	c) Define Poisson Distribution	**1M**	**L1**	**C221.2**
	d) Write the applications of Normal Distribution	**1M**	**L1**	**C221.2**
	e) The mean and variance of a binomial distribution are 4 and $\frac{4}{3}$ respectively. Find P(x≥1)	**1M**	**L2**	**C221.2**
2	a) A fair coin is tossed ten times. Find the probability of getting at least 6 heads.	**3M**	**L3**	**C221.2**
	b) If the probability of a defective bolt is 1/8. (i) Find mean, (ii) The variance for the distribution of defective bolts of 640.	**3M**	**L4**	**C221.2**
	c) Derive mean o f normal distribution.	**3M**	**L3**	**C221.2**
	d) 20% of items produced from a factory are defective. Find the probability that in a sample of 5 chosen at random (i) none is defective (ii) one is defective (iii) lies between 1 and 4.	**3M**	**L5**	**C221.2**
	e) If X is a normal variate with mean 30 and S.D. 5. Find the probabilities that (i) $26 \leq X \leq 40$ (ii) P($X \geq 45$)	**3M**	**L4**	**C221.2**
3	a) Six dice are thrown 729 times. How many times do you except at least three dice to show a 5 or 6.	**5M**	**L5**	**C221.2**
	b) Derive mean and variance of Poisson distribution.	**5M**	**L2**	**C221.2**
	c) If a Poisson distribution is such that P(x=1).$\frac{3}{2}$ = P(x=3), Find (i) P(x≥1) (ii) P(x≤3) and (iii)P(2≤x≤5).	**5M**	**L4**	**C221.2**
	d) Fit a Poisson distribution to the following data: <table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>Total</td></tr><tr><td>f</td><td>142</td><td>156</td><td>69</td><td>27</td><td>5</td><td>1</td><td>400</td></tr></table>	**5M**	**L4**	**C221.2**
	e) Find the mean and variance of the distribution. In a Normal distribution, 7% of the items are under 35 and 89% are over 63.	**5M**	**L5**	**C221.2**
4	a) I) Out of 800 families with 5 children each, how many would you expect to have a)3 boys b)5 girls c) either 2 or 3 boys? Assume equal probabilities for boys &girls. II) Derive mean and variance o f binomial distribution	**10M**	**L4**	**C221.2**
	b) I) If X is a poisson variate such that $3P(x=4) = \frac{1}{2}P(x=2) + P(x=0)$ find (i) the mean of x (ii) $P(x \leq 2)$. II) If the masses of 300 students are normally distributed with mean 68kgs and standard deviation 3 kgs, How many students have masses (i) greater than 72 kg (ii) less than or equal to 64kg (iii) between 65 and 71kgs.	**10M**	**L4**	**C221.2**

	c) I) Seven coins are tossed and the number of heads are noted. The experiment is repeated 128 times and the following distribution is obtained.	**10M**	**L4**	**C221.2**

X	0	1	2	3	4	5	6	7	Total
F	7	6	19	35	30	23	7	1	128

Fit a binomial distribution assuming the coin is unbiased

Q. No	Question (s)	Marks	BL	CO
	UNIT - III			
1	a) Define Alternative Hypothesis.	**1M**	**L1**	**C221.3**
	b) Define Critical Region.	**1M**	**L1**	**C221.3**
	c) Define type I and type II errors.	**1M**	**L1**	**C221.3**
	d) Write the four important tests to test the significance under large sample tests.	**1M**	**L1**	**C221.3**
	e) Derive critical values of Z for both two tailed and single tailed tests at 1%, 5% and 10% level of significance.	**1M**	**L1**	**C221.3**
2	a) A sample of 64 students has a mean weight of 70kg. Can this be regarded as a sample from a population which mean weight 56kgs and standard deviation 25kgs.	**3M**	**L1**	**C221.3**
	b) A die is tossed 960 times and it falls with 5 upwards 184 times. Is the die unbiased at a level of significance of 0.01.	**3M**	**L4**	**C221.3**
	c) Among 900 people in a state, 90 are found to be chapatti eaters. Construct 99% confidence interval for the true proportion.	**3M**	**L1**	**C221.3**
	d) In big city 325 mean out of 600 men were found to be smokers. Does this information support the conclusion that the majority of men in this city are smokers?	**3M**	**L3**	**C221.3**
	e) A manufacturer claimed that at least 95% of the equipment which he supplied to a factory conformed to specifications. An examination of a sample of 200 pieces of equipment revealed that 18 were faulty. Test his claim at 5% level of significance.	**3M**	**L4**	**C221.3**
3	a) Write the procedure of Testing Hypothesis	**5M**	**L1**	**C221.3**
	b) The mean life of a sample of 10 electric light bulbs was found to be 1456 hours with standard deviation of 423 hours. A second sample of 17 bulbs chosen from a different batch showed a mean life of 1280 hours with standard deviation of 398 hours. Is there significant difference between the means of two batches?	**5M**	**L3**	**C221.3**
	c) A sample of 400 items is taken from a population whose standard deviation is 10. The mean of the sample is 40. Test whether the sample has come from a population with mean 38. Also calculate 95% confidence interval for the population.	**5M**	**L5**	**C221.3**
	d) An ambulance service claims that it takes on the average less than 10 minutes to reach its destination in emergency calls. A sample of 36 calls has a mean of 11 minutes and the variance of 16 minutes. Test the claim at 0.05 level significance.	**5M**	**L4**	**C221.3**

	e) In a random sample of 1000 persons from town A, 400 are found to be consumers of wheat. In a sample of 800 from town B, 400 are found to be consumers of wheat. Do these data reveals a significant difference between town A and town B, so far as the proportion of wheat consumers is concerned?	5M	L4	C221.3
4	a) I) A Sample of 900 members has a mean of 3.4 cms and S. D 2.61 cms. Is this samples have been taken from a large population of mean 3.25 cm and S.D 2.61cms. If the population is normal and its mean is unknown. Find the 95% fiducial limits of true mean. II) In a sample of 1000 people in Karnataka 540 are rice eaters and the rest are wheat are equally popular in this state at 1% level of significance?	10M	L4	C221.3
	b) I) If two large populations, there are 30% and 25% respectively of fair haired people. Is this difference likely to be hidden in samples of 1200 and 900 respectively from the two populations. II) In a sample of 500 from a village in Rajasthan, 280 are found to be wheat eaters and the rice eaters. Can we assume that the both articles are equally popular	10M	L5	C221.3
	c) I) 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. II) 20 people were affected by a disease and only 18 survived. Will you reject the hypothesis that the survival rate affected by this disease is 85% in favour of the hypothesis that is more at 5% level.	10M	L4	C221.3

Q. No	Question (s)	Marks	BL	CO
	UNIT - IV			
1	a) Write down the applications of the F- distribution.	1M	L1	C221.4
	b) What is that Degree of freedom?	1M	L2	C221.4
	c) Write the applications of Chi–Square distribution.	1M	L2	C221.4
	d) Write the uses of the t–test.	1M	L1	C221.4
	e) Write the formula for Chi–Square test.	1M	L2	C221.4
2	a) Producer of gutkha claims that the nicotine content in his gutkha on the average is 1.83mg. can this claim accepted if a random sample of 8 gutkha items of this type have the nicotine contents of 2.0, 1.7, 2.1, 1.9, 2.2, 2.1, 2.0, 1.6mg? Use 0.05 level of significance.	3M	L1	C221.4
	b) A random sample of size 25 from a normal population has the mean $\bar{x} = 47.5$ and S.D S=8.4. Does this information tend to support or refute the claim that the mean of the population is $\mu = 42.5$?	3M	L3	C221.4
	c) The average breaking strength of the steel rods is specified to be 18.5 thousand pounds. To test this sample of 14 rods were tested.	3M	L4	C221.4

	The mean and standard deviations obtained were 17. 85 and 1.955 respectively. Is the result of experiment significant?			
	d) The means of two random samples of sizes 9 and 7 are 196.42 and 198.82 respectively. The sum of the squares of the deviations from the mean is 26.94 and 18.73 respectively. The sample be considered to have been drawn from the same normal population.	3M	L3	C221.4
	e) The number of automobile accidents per week in a certain community are as follows: 12, 8, 20, 2, 14, 10, 15, 6, 9, 4. Are these frequencies in agreement with the belief that accident conditions were the same during this 10 week period.	3M	L2	C221.4
3	a) To compare two kinds of bumper guards, 6 of each kind were mounted on a car and then the car was run into a concrete wall. The following are the costs of repairs. Use the 0.01 level of significance to test whether the difference between two samples means is significant?	5M	L5	C221.4
	b) A sample of 26 bulbs gives a mean life of 990 hrs with a S.D. of 20 hrs. The manufacturer claims that the mean life of bulbs is 1000 hrs. Is the sample not up to the standard.	5M	L3	C221.4
	c) A random sample of six steel beams has a mean compressive strength of 58,392 p.s.i with a standard deviation of 648 p.s.i. Use this information and the level of significance 0.05 to test whether the true average compressive strength of the steel from which this sample came is 58000 p.s.i. Assume normality?	5M	L2	C221.4
	c) A die is thrown 264 times with the following results. Show that the die is biased. (Given $\chi^2_{0.05} = 11.07$ for 5 d.f)	5M	L4	C221.4
	e) Pumpkins were grown under two experimental conditions. Two ransom samples of 11 and 9 pumpkins. Show the sample standard deviations of their weights as 0.8 and 0.5 respectively. Assuming that the weight distribution are normal, test the hypothesis that the true variances are equal.	5M	L4	C221.4
4	a) A random sample of 10 boys had the following I.Q's: 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. (i) Do these data support the assumption of a population mean I.Q of 100? (ii) Find a reasonable range in which most of the mean I.Q values of samples of 10 boys lie.	10M	L5	C221.4
	b) The time taken by workers in performing a job by method I and method II is given below. Do these data show that the variances of time distribution from population from which these samples are drawn differ significantly?	10M	L3	C221.4

Guard I table (question 3a):

Guard I	107	148	123	165	102	119
Guard I	134	115	112	151	133	129

Die table (question 3 c):

No. on the die	1	2	3	4	5	6
Frequency	40	32	28	58	54	52

Method table (question 4b):

Method I	20	16	26	27	23	22	-

Method II	27	33	42	35	32	34	38			
c) A pair of dice are thrown 360 times and the frequency(Y) of each sum(X) is indicated below: (table below) Would you say that the dice are fair on the basis of the chi- square test at 0.05 level of significance?								**10M**	L3	C221.4

X	2	3	4	5	6	7	8	9	10	11	12
Y	8	24	35	37	44	65	51	42	26	14	14

Q. No	Question (s)	Marks	BL	CO
	UNIT - V			
1	a) Write the formula for Karl Pearson's coefficient of correlation.	1M	L2	C221.5
	b) Define Regression	1M	L2	C221.5
	c) Write the formula for rank Correlation (Spearman's rank Correlation)	1M	L1	C221.5
	d) Write the applications of Regression	1M	L1	C221.5
	e) Write the formula for the regression equation of X on Y	1M	L2	C221.5
2	a) Find the coefficient of correlation between X and Y for the following data (table below)	3M	L1	C221.5
	b) From sample of 200 pairs observation the following quantities were calculated. $\sum X = 11.34, \sum Y = 20.72, \sum X^2 = 12.16, \sum Y^2 = 84.96, \sum XY = 22.13$ From the above data show how to compute the coefficient of the equations $Y = a + bX$	3M	L3	C221.5
	c) Calculate the regression equations of Y on X from the data given below taking deviations from actual means of X on Y (table below)	3M	L2	C221.5
	d) Difference between Correlation and Regression.	3M	L2	C221.5
	e) The Rank of 16 students in Mathematics and Statistics are as follows (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). Calculate the rank correlation coefficient for proficiencies of this group in Mathematics and Statistics.	3M	L3	C221.5
3	a) Calculate the coefficient of correlation between age of cars and annual maintenance cost and comment: (table below)	5M	L5	C221.5
	b) Find Karl pearson's coefficient of correlation from the following the	5M	L5	C221.5

Question 2 a) table:

X	10	12	18	24	23	27
Y	13	18	12	25	30	10

Question 2 c) table:

Price	10	12	13	12	16	15
Amount Demanded	10	22	24	27	29	33

Question 3 a) table:

Age of cars	2	4	6	7	8	10	12
Annual cost	1600	1500	1800	1900	1700	2100	2000

data

Wages	100	101	102	102	100	99	97	98	96	95
Cost of living	98	99	99	97	95	92	95	94	90	91

c) Determine the equation of a straight line which best fits the data. | 10	12	13	16	17	20	25		5M	L3	C221.5

c) Determine the equation of a straight line which best fits the data. **5M** **L3** **C221.5**

X	10	12	13	16	17	20	25
Y	10	22	24	27	29	33	37

d) Find the most likely production corresponding to a rainfall 40 from the following data **5M** **L4** **C221.5**

	Rainfall	Production
Average	30	500kgs
Standard deviation	5	100kgs
Coefficient of correlation	0.8	

e) Following are the rank obtained by 10 students in two subjects, Statistics (X) and Mathematics (Y). To what extent the knowledge of the students in two subjects is related. **5M** **L3** **C221.5**

X	1	2	3	4	5	6	7	8	9	10
Y	2	4	1	5	3	9	7	10	6	8

4 a) Calculate the Karl Pearson's coefficient of correlation for the following paired data. What inference would you draw from the estimate? **10M** **L2** **C221.5**

X	28	41	40	38	35	33	40	32	36	33
Y	23	34	33	34	30	26	28	31	36	38

b) A sample of 12 fathers (F) and their elder sons gave the following data about their elder sons (S). Calculate the coefficient of correlation. **10M** **L5** **C221.5**

F	65	63	67	64	68	62	70	66	68	67	69	71
S	68	66	68	65	69	66	68	65	71	67	68	70

d) Given the bivariate data **10M** **L5** **C221.5**

X	1	5	3	2	1	1	7	3
Y	6	1	0	0	1	2	1	5

I) Find the regression line of Y on X and hence predict Y if X=10.
II) Fit a Regression line of X on Y and hence predict X if Y=2.5.

All the best