Reg. No.															

Question Paper Code	14693

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026

Third Semester

Computer Science and Engineering (AIML)

(Common to Computer Science and Engineering (IoT) & Artificial Intelligence and Data Science)

20BSMA302 - PROBABILITY AND STATISTICAL MODELLING

Regulations - 2020

(Use of Statistical table is permitted)

PART – A (i) (MCQ)
(16 × 1 = 16 Marks)
Answer ALL Questions

		Marks	*K – Level*	*CO*
1.	What is the probability of getting odd prime number in tossing a die experiment? a) 4/6 b)3/6 c) 2/6 d)1/6	*1*	*K2*	*CO1*
2.	The variance of a uniform distribution defined on the interval (0,1) is a) 1/12 b) 2/12 c) 3/12 d) 4/12	*1*	*K1*	*CO1*
3.	$If\ P(A) = \frac{1}{3},\ P(B) = \frac{3}{4},\ P(A \cup B) = \frac{11}{12}$ then $P(A\|B)$ is a) $\frac{2}{9}$ b) $\frac{1}{9}$ c) $\frac{1}{6}$ d) $\frac{1}{4}$	*1*	*K3*	*CO1*
4.	If $P(x,y) = kxy, x = 1,2, y = 1,2$ is the joint probability mass function of x, y, then the value of k is a) 5/9 b) 7/9 c) 3/9 d) 1/9	*1*	*K2*	*CO2*
5.	The value of k, if $f(x,y) = kxy\ for\ x = 1,2,3\ and\ y = 1,2,3$ can serve as a joint probability distribution a) $\frac{1}{32}$ b) $\frac{1}{36}$ c) $\frac{1}{34}$ d) $\frac{1}{30}$	*1*	*K3*	*CO2*
6.	The value of Cov(ax+by) = …. a) a^2b^2 Cov(x,y) b) 0 c) ab Cov(x,y) d) (a+b)Cov(x,y)	*1*	*K1*	*CO2*
7.	The value of correlation coefficient lies between a) 0 and 1 b) 1 and 2 c) -1 and 1 d) -2 and 2	*1*	*K3*	*CO3*
8.	If r_{12}= 0.7, r_{23}= 0.5 and r_{13}= 0.5 then find $R_{1.23}$ a) 0.22 b) 1.52 c) 2.52 d) 0.52	*1*	*K3*	*CO3*
9.	Which is not the basic principle of design of experiment? a) Randomization b) Replication c) Local control d) Observation	*1*	*K2*	*CO3*

10.	Which is not a non-parametric test ?		*1*	*K3*	*CO4*
	a) Mann-Whitney U test	b) Kruskal-Wallis test			
	c) Wilcoxon signed-rank test	d) Student's t-test			
11.	Which is one of the basic assumptions of non-parametric test?		*1*	*K2*	*CO4*
	a) The population follows a normal distribution	b) The population variances are equal			
	c) The observations are independent	d) The data must be measured on an interval or ratio scale			
12.	The run of the following sequence MMTMTTTMT is		*1*	*K3*	*CO4*
	a) 3	b) 4			
	c) 5	d) 6			
13.	Which is the parameter used in Estimation theory?		*1*	*K2*	*CO5*
	a) Sample mean	b) Sample size			
	c) Sample standard deviation	d) Population standard deviation			
14.	Maximum Likelihood Estimation (MLE) chooses parameter values that:		*1*	*K2*	*CO5*
	a) Minimize variance	b) Maximize posterior probability			
	c) Maximize likelihood function	d) Minimize sample size			
15.	Graph of time series is called		*1*	*K2*	*CO5*
	a) Line graph	b) Trend			
	c) Historigram	d) Histogram			
16.	In an AR(p) model, "p" indicates		*1*	*K1*	*CO5*
	a) Number of error terms	b) Order of integration			
	c) Number of lagged variables	d) Seasonal period			

PART – A (ii) (Short Answer Questions)
(8 × 3 = 24 Marks)
Answer ALL Questions

17.	List the axioms of probability.	*3*	*K4*	*CO1*
18.	If A and B are independent find P(A/B)?	*3*	*K3*	*CO1*
19.	If $f(x,y) = cx^2y^2, 0 < x < 1, 0 < y < 1$ is the joint pdf of , y , then find the value of c?	*3*	*K3*	*CO2*
20.	State central limit theorem.	*3*	*K3*	*CO2*
21.	Compare Type-1 and Type-2 errors.	*3*	*K4*	*CO3*
22.	List the uses of non-parametric tests.	*3*	*K4*	*CO4*
23.	Identify the disadvantages of Komogorov- Smirov test.	*3*	*K3*	*CO4*
24.	Define consistency of good estimator?	*3*	*K3*	*CO5*

PART - B (Descriptive Answer Questions)
(5 × 12 = 60 Marks)
Answer ALL Questions

25.	a) (i)	In a bolt factory, machines A, B, C manufacture 25%, 35% and 40% respectively of the total bolts. Of their output 95%, 96% and 98% respectively are non-defective bolts. A bolt is drawn at random and is found to be defective. Find the probability that it is manufactured by machine C.	*6*	*K3*	*CO1*
	(ii)	Suppose X is the normal random variable with mean 70 and variance 4. Find $P[63 \leq X \leq 68]$ and $P[X \geq 73]$.	*6*	*K3*	*CO1*

OR

b) (i) A continuous random variable X has probability density function $f(x)=\begin{cases}3x^2, 0\le x\le 1\\ 0, Otherwise\end{cases}$. Find the moment generating function of X. *6 K3 CO1*

(ii) If the probability that an applicant for a driver's license will pass road test on any given trial is 0.8, what is the probability that he will finally pass the test (i) on the fourth trail and (ii) on the fifth trial. *6 K3 CO1*

26. a) Let X and Y be discrete random variables with probability function $f(x,y)=\frac{x+2y}{27}, x=0,1,2;\ y=0,1,2$. Evaluate all the marginal and conditional probability distributions. *12 K3 CO2*

OR

b) Suppose that orders at a restaurant are independent and identically distributed random variables with mean $\mu = Rs.8$ and standard deviation $\sigma = Rs.2$. Estimate *12 K3 CO2*
$(i)\ P(X_1+X_2+\ldots.+X_{100} > 840)$
$(ii)\ P(780 < X_1+X_2+\ldots.+X_{100} < 820)$
$(iii) P(700 < X_1+X_2+\ldots.+X_{100})$.

27. a) Obtain the regression lines for the following. Also estimate the value of Y given X=38 and the value of X given Y=18. *12 K4 CO3*

X	22	26	29	30	31	31	34	35
Y	20	20	21	29	27	24	27	31

OR

b) The sales of 4 salesmen in three seasons are tabulated here. Carry out an analysis of variance. *12 K4 CO3*

		Salesman			
		A	B	C	D
Seasons	Summer	45	40	38	37
	Winter	43	41	45	38
	Monsoon	39	39	41	41

28. a) The following are the Rockwell hardness numbers obtained for six aluminum die castings randomly selected from production lot A and eight from production lot B *12 K3 CO4*
Production Lot A : 76, 55, 65, 71, 58, 74
Production Lot B: 65, 86, 75, 80, 86, 76, 72, 82.
Use the U test at 0.05 level of significance to test whether the castings of production lot B are on the average equally hard or whether they are harder than those of production lot A.

OR

b) The following is an arrangement of men M, women W. Test the randomness at the 0.05 level of significance using Run test. *12 K3 CO4*

M W M W M M M W W M W M M M W W M M M M W W M W M M M W M M W W W M W M M M W M W M M M M W W M

29. a) If $X_1, \ldots\ldots X_n$ form a simple random variable with finite variance $\sigma^2>0$ then prove that $S^2 = \frac{\sum_{i=1}^{n}(Xi - \overline{X})^2}{n-1}$ is an unbiased estimator of σ^2. *12 K3 CO5*

OR

b) Derive ARIMA model of order (p, d, q). *12 K3 CO5*