

Final Assessment Test (FAT) - APRIL/MAY 2023

Programme	B.Tech	Semester	Winter Semester 2022-23
Course Title	PROBABILITY AND STATISTICS	Course Code	BMAT202L
Faculty Name	Prof. ASHISH KUMAR	Slot	E1+TE1
		Class Nbr	CH2022235002625
Time	3 Hours	Max. Marks	100

SECTION A (10 X 10 Marks)

Answer any 10 questions

01. In the Men's FIH Hockey World Cup 2023 held at Odisha, the finalists Germany and Belgium [10]
scored the following number of goals in the tournament

Team	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Game 7
Germany	3	2	7	5	2	4	3
Belgium	5	2	7	-	2	2	3

Note that Belgium had played one match lesser than Germany. Which team was more consistent in scoring the goals and which team had better average in scoring goals?

02. (a) Three cards are drawn without replacement from the collection of 12 face cards (jacks, queens, and kings) of an ordinary deck of 52 playing cards. Let X be the number of queens selected and Y the number of jacks. Find the joint probability mass function of (X, Y) and hence find $P(Y = 2/X = 1)$. [10]

(b) The probability mass function of a discrete random variable X is given by

$$p_x(X) = \begin{cases} k * \frac{1}{4}^x & x = 1, 2, 3, \dots \\ 0 & \text{otherwise} \end{cases}$$

03. Consider two continuous random variables X and Y with joint pdf [10]

$$f(x, y) = \begin{cases} \frac{2}{81} x^2 y & 0 < x < k \text{ \& } 0 < y < k \\ 0 & \text{otherwise} \end{cases}$$

(i) Find the value of k so that $f(x, y)$ is a joint pdf of (X, Y)

(ii) Evaluate $P(X > 3Y)$

(iii) Find $P(X + Y > 3)$

(iv) Find $cov(X, Y)$

04. (a) Consider the following data. [10]

	X	Y
Arithmetic mean	36	85
Standard Deviation	11	8

If correlation coefficient between X & Y is 0.66, then find the two regression equations.

(b) The first of two sub groups has 40 items with mean 50 and S.D. 12. The whole group has 100 items with mean 44 and S.D. $\sqrt{1416}$. Find the mean and S.D. of the second sub group.

05. Find the Pearson's correlation coefficient for (10,74), (14,61), (15,50), (28,54), (35,43) and (48,36). [10]

06. Find the mean and standard deviation of a normal distribution in which 7% of the items are under 35 and 89% are under 63. [10]

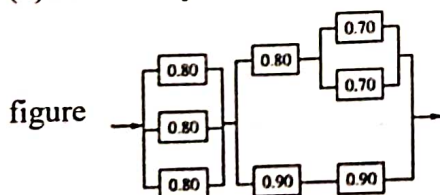
07. (a) Suppose that the time (in hours) taken by a homeowner to mow his lawns is a random variable X having a gamma distribution with parameters $\alpha = 2$ and $\lambda = 2$. Find the probability that it takes (a) at most 1 hour and (b) at least 2 hours. [10]
 (b) The number of monthly breakdowns of a computer is a random variable having a poisson distribution with mean=1.8. Find the probability that this computer will function for a month (a) without a breakdown (b) with at least one breakdown.
08. (a) A statistics teacher claims that the mean score of students in his class is greater than 85 with a standard deviation of 20. If a sample of 70 students was selected with a mean score of 90 then check if there is enough evidence to support this claim at a 0.05 significance level. [10]
 (b) Random samples of 400 men and 600 women were asked whether they would like to have a flyover near their residence. 200 men and 325 women were in favor of the proposal. Test the hypothesis that proportions of men and women in favor of the proposal, are same against that they are not, at 5% level.
09. It is believed that the precision of an instrument is not more than 0.16. Write down the null and alternative hypothesis for testing this belief. Carry out the chi-square test at 1% level given 11 measurements of the same subject on the instrument [10]

2.5, 2.3, 2.4, 2.3, 2.5, 2.7, 2.5, 2.6, 2.6, 2.7, 2.5

10. Analyse the variance in the following Latin square. [10]

A8	C18	B9
C9	B18	A16
B11	A10	C20

11. (a) The means of two single large samples of 1500 and 2500 members are 67.7 inches and 67.5 inches respectively. Can the samples be regarded as drawn from the same population of standard deviation 2.5 inches? Use 5% level of significance. [10]
 (b) Find the system reliability of the following system. Component reliabilities are given in



12. Let the failure distribution be defined as $f(t) = \frac{3t^2}{10^6}$, $0 \leq t \leq 1000$ [10]
 (i) What is the probability of failure within a 100 hour warranty period?
 (ii) Compute the MTTF.
 (iii) Find the design life for a reliability of 0.99.
 (iv) Derive the reliability function
 (v) Determine the reliability for the first year of operation.

