

- Note: 1. All questions are compulsory  
 2. All questions carry equal marks  
 3. Draw neat, labelled diagrams wherever necessary

**Q.1) Attempt the following (Any Four)****(20M)**

- 1) Two fair dice are rolled. If the sum 10 has appeared, find the probability that one of the dice shows number 4
- 2) Define Probability density function for continuous random variable.  
 Let X be continuous random variable with f(x) as,

$$f(x) = \begin{cases} \frac{x^3(10-x)}{5000}, & 0 \leq x \leq 10 \\ 0, & \text{otherwise} \end{cases}$$

Verify the given function f(x) is probability density function.

- 3) A random variable X has the following probability distribution with p.m.f. p(X)

X	0	1	2	3	4	5	6	7
P(X)	0	2k	3k	k	2k	k <sup>2</sup>	7k <sup>2</sup>	2k <sup>2</sup> + k

- a) Find the value of k
- b) Find P(X < 3)
- 4) There are 5 boys and 4 girls in managing committee of NSS unit of college. A group of 3 students from this committee is to be send for seminar. Find the probability that the group contains
  - a) At least 2 girls
  - b) Exactly 2 boys
- 5) Define Cumulative distribution function for continuous random variable.  
 Also state the properties of Cumulative distribution function
- 6) 5 Indians and 3 Americans stands for photograph at random, Find the probability that
  - a) 2 extreme positions are occupied by 2 Indians
  - b) All Americans are together

**Q.2) Attempt the following (Any Four)****(20M) .**

- 1) It is observed that if student works hard then the chance of passing an exam is very high i.e. 80%. A random sample of 10 students were selected. What is the probability that
  - a) no student will pass.
  - b) only 3 students will pass.
- 2) Define F distribution. State the properties of F distribution.
- 3) Let X be a discrete variable with probability density function  
 $P(X = x) = \frac{x}{15}, x = 1, 2, 3, 4, 5$ . Find E(X) and var(X)
- 4) The weight of adult goats is normally distributed with mean  $\mu = 25\text{kg}$  and S.D.  $= \sigma = 3\text{ kg}$ . Select goat randomly.
  - a) Find the probability that the goat's weight is between 20kg and 27kg.
  - b) Find the probability that the goat's weight is more than 29 kg.



- 5) If X is continuous random variable with probability density function

$$f(x) = \begin{cases} \frac{1}{(\log 5)x}, & 1 < x < 3 \\ 0, & \text{otherwise} \end{cases}$$

Find mean and variance of X.

- 6) An online medicine shop claims that the mean delivery time for medicines is less than 120 minutes with a standard deviation of 30 minutes. Is there enough evidence to support this claim at a 0.05 significance level if 49 orders were examined with a mean of 100 minutes? (use Z test)

**Q.3) Attempt the following (Any Four)**

**(20M)**

- 1) A soap manufacturing company was distributing a particular brand of soap through a large number of retail shops. Before a heavy advertisement campaign, the mean sale per week per shop was 160 dozens. After the campaign, a sample of 25 shops was taken and the mean sale was found to be 167 dozens with S.D. 16. Can you consider the advertisement effective? (use t test)
- 2) A study is undertaken to know that the impact of proper exercise on blood pressure of students. Total of 15 students were selected and blood pressure recorded before the commencement of exercise program. Then proper exercise was given to these students and again blood pressure was measured after completion of program. Following are readings. Check whether Exercise significantly improves the blood pressure? (use Wilcoxon signed rank test)

Students	BP before exercise	BP after exercise
1	125	118
2	132	134
3	138	130
4	120	124
5	125	105
6	127	130
7	136	130
8	139	132
9	131	123
10	132	128
11	135	126
12	136	140
13	128	135
14	127	126
15	130	132

- 3) Write a short note on One tailed test and Two tailed test
- 4) Explain Run test with suitable example.



- 5) A small-scale manufacturing company want to know the effect of new machinery installed on defects produced in a lot. A total of 10 machines were chosen including new and old machines. Quality-control managers were asked to record the defects per lot. The data are shown below.

Old Machines	7	5	6	4	12
New Machines	3	6	4	2	1

Using Mann-witney U test , check whether there is any difference in defects produced by old and new machines.

- 6) A company wants to test whether it's three salesmen A,B,C has same selling ability. The record (in Rs. 1000) during various weeks of last month are recorded in the following table

Salesmen	1 <sup>st</sup> week	2 <sup>nd</sup> week	3 <sup>rd</sup> week	4 <sup>th</sup> week
A	16	21	18	25
B	22	20	15	26
C	25	24	16	20

Prepare One way ANOVA table.

**Q.4) Attempt the following (Any Five)**

**(15M)**

- 1) Define the following
  - a) Random variable
  - b) Discrete random variable
  - c) Continuous random variable
- 2) Explain the procedure of testing of Hypothesis shortly.
- 3) Define Null hypothesis and Alternative Hypothesis with suitable example.
- 4) Define the following terms
  - a) Exhaustive event
  - b) Complementary event
  - c) Sample space
- 5) State the properties of Chi-square distribution.
- 6) Differentiate between Non-Parametric test and Parametric test.