(Time:2 ½ Hours) [Total Marks: 75]

N.B. 1) All questions are compulsory.
2) Figures to the right indicate marks.
3) Illustrations, in-depth answers and diagrams will be appreciated.
4) Mixing of sub-questions is not allowed.

Q. 1 **Attempt All the questions** (15M)
Multiple choices questions
(a) 1 The mean of the binomial distribution is ---------
   a) npq b) np c) pq d) nq
2 Cumulative distribution function is a --------- continuous function
   a) Right b) Left c)Bounded d) None of above
3 The critical region is region of ---------
   a) Rejection b) Acceptance c) positive d) Negative.
4 For a two sided test the Rejection region lies at ---------tails
   a) One b)two c)both a & b d) None of above
5 Chi square test of association is used for --------- data
   a) Qualitative b)Quantitative c) Time series d)Geographic

(b) **Fill in the blanks.**
1 The curve of Normal distribution is ---------
2 Number of children in a family is a --------- random variable
3 ANOVA is used for testing ---------
4 Power of statistical test must always be ---------
5 Sign test is a --------- test

(c) **Answer in one sentence**
1 Define discrete random variable with an example
2 State one property of the Normal distribution
3 Write the sample space when a coin is tossed two times
4 Describe the curve of the F distribution
5 Define type I error for a statistical hypothesis

Q. 2 **Attempt the following (Any THREE)** (15M)
(a) Define probability density function ,cumulative distribution function and expectation for a continuous random variable X.
(b) State the density function of the chi square distribution and any two properties of it.
(c) Define t distribution. Write any two properties of the same
(d) Explain briefly the Normal distribution with the help of its curve
(e) Define a Binomial distribution ? State the mean and variance of the Binomial distribution
(f) Chances that a student of Mumbai university clears UPSC exam are 70 %. If 20 students appear for the exam, what is the chance that more than 3 students and exactly 8 students will clear the exam.

Q. 3 **Attempt the following (Any THREE)** (15M)
(a) Define null and alternative hypothesis. State an example of null hypothesis
(b) Describe the paired t test with an example .
(c) Distinguish between type I and type II error
(d) Describe the large sample test for testing $H0: \mu = \mu0$ against $H1: \mu > \mu0$
(e) Explain briefly ANOVA with an example of one way ANOVA
(f) A health club advertised a weight reducing program and claimed that it will reduce the weight in 3 months. To check the claim 10 persons before and after weight was noted. Does the data suppot the claim at 1 % Level of significance. Table value=2.822

No	1	2	3	4	5	6	7	8	9	10
Wt before	61	65	68	72	75	73	74	66	69	82
Wt after	52	54	60	62	67	66	64	59	60	76

Q. 4 **Attempt the following (Any THREE)** (15)
(a) Explain in short Non parametric tests
(b) Write a short note on Wilcoxon's signed rank test
(c) State the test statistics for Mann Whitney U test and Kruskal Wallis test
(d) Explain the concept of post hoc Analysis of variance.
(e) Write a short note on Chi square test of Association
(f) Test if there is an association between gender and acceptance of application for the following data.(Table value at 5% LOS=3.84)

	Application successful	Application not successful	TOTAL
Male	23	40	63
Female	31	39	70
TOTAL	54	79	133

Q. 5 **Attempt the following (Any THREE)** (15)
(a) Define probability mass function and expectation of a discrete random variable
(b) Define one sided and two sided hypothesis
(c) Write a short note on sign test
(d) Differentiate between parametric and non parametric tests
(e) If X follows binomial (3,0.5) find the mean and variance

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