Q. P. Code: 34811

[2½ Hours]                                                                    [Marks: 75]

N.B.  1) All questions are compulsory.
2) Figures to the right indicate marks.
3) Illustrations, in –depth answers and diagram will be appreciated.
4) Mixing of sub-questions is not allowed.
5) Use of own non-programmable calculator is allowed.

**Q.1**      **Attempt all the questions (Each of 5 marks)**                                         **(15)**
**(a)**    **Multiple Choices questions.**                                                               **(05)**
(i)    A variable which assigns real value to the elements of sample space is called as....
a) Random number   b) Random variable   c) Variable   d) none of the above
(ii)   Binomial distribution is ...... two parameters distribution.
a) two   b) three   c) four   d) none of the above
(iii)  The Critical region is region of ...........
a) Acceptance   b) Total area below the curve   c) Rejection   d) none of the above
(iv)   In statistics, the assumption about the problem is called as .........
a) Comment   b) Hypothesis   c) Statement   d) none of the above
(v)    .........is not a parametric test.
a) t-test   b) z-test for proportion comparison   c) ANOVA   d) all the above

**(b)**    **Fill in the blanks.**                                                                        **(05)**
(i)    If x: 2, 3 ,4 with probabilities p(x):- 0.3, 0.4, 0.3 then E(x) =.............
(ii)   The mean and variance of standard normal variate is .............
(iii)  If level of significance is 5% then the Confidence interval is ..............
(iv)   If null hypothesis is true and if it is rejected then ...........error is committed.
(v)    A sequence of same type of / identical symbol constitute ...........

**(c)**    **Short answers.**                                                                           **(05)**
(i)    Define discrete random variable.
(ii)   State two properties of chi square distribution.
(iii)  State the criterion of rejection at 5% level of significance in case of calculated and tabulated value.
(iv)   Define level of significance.
(v)    State the use of Kruskal-Wallis test.

**Q.2**      **Attempt any three.**                                                                      **(15)**
**(a)**    A coin is tossed three times, let the random variable X denotes number of heads, find the probability distribution and hence find E(X) and V(X).
**(b)**    Write a short note on cumulative distribution function (C.D.F.).
**(c)**    Define variance. With usual notations show that E(aX + b) = aE(X) + b  and V(aX + b) = a²V(X).
**(d)**    A basket contains 20 good oranges and 80 bad oranges. 3 oranges are drawn at random from this basket. Find the probability that out of 3
i) Exactly 2 are good   ii) At least 2 are good   iii) At most 2 are good oranges
(Solve using binomial distribution)
**(e)**    Define standard normal variate. For standard normal variable Z, show the following using normal curve
i) area to the left of Z=a   ii)area in between of Z= -b and Z=a   iii) area to the left of Z= -b
**(f)**    Define t-distribution. Write the properties of t-distribution.

**Q.3**    **Attempt any three.**    (15)

(a)  Explain in detail types of errors in the procedure of testing of hypothesis. Also comment on power of the test.

(b)  In detail explain the procedure of testing the two population means using z-test.

(c)  The class test is conducted for the 10 students and their marks are listed below:
    50, 49, 52, 44, 45, 48, 46, 45, 49, 45
    Test if the average marks of the students can be taken to be 50. Also calculate 95% confidence interval for the mean. *(the table value for the comparison is 2.262)*

(d)  Two random samples are drawn from two normal populations are:

| Sample I | 18 | 22 | 27 | 25 | 35 | 30 | 28 | 25 | 27 | 30 |    |
|----------|----|----|----|----|----|----|----|----|----|----|----|
| Sample II | 27 | 33 | 32 | 26 | 29 | 38 | 20 | 27 | 33 | 28 | 30 |

Obtain the estimate of the variance and test whether two populations have same variance or not. **(F statistics table value for the comparison is 3.10)**

(e)  A special type of fertilizer was used in four agricultural fields A,B,C and D. Each field was divided into four beds and the fertilizers were applied over the time. The respective yields of the four beds are given below: Perform ANOVA and present your results in ANOVA table.

| A | 18 | 22 | 12 | 19 |
|---|----|----|----|----|
| B | 19 | 24 | 17 | 11 |
| C | 13 | 28 | 12 | 15 |
| D | 13 | 27 | 18 | 12 |

(f)  Explain the procedure of obtaining various sums of squares in two way ANOVA. Also give the sample two way ANOVA table.

**Q.4**    **Attempt any three.**    (15)

(a)  State the difference between parametric and Non-Parametric tests. Also state merits of non-parametric tests over parametric test.

(b)  Explain the procedure of sign test in detail.

(c)  What is post-hoc analysis? Explain Duncan's multiple range test.

(d)  Test whether the preference given in choosing investment plans are independent of the sex of an employee

| | Investment options | | |
|--------|------|------|-------|
| | NSC | PPF | Bonds |
| Male | 36 | 24 | 20 |
| Female | 45 | 20 | 15 |

*(chi-square test table value at 2 degrees of freedom is 5.991)*

(e)  A random sample of 10 infants showed the following pulse rate per minute:
    110, 121, 125, 122, 112, 117, 129, 114, 124, 127. Using Wilcoxon signed rank test, verify whether the median pulse rate of infants is more than 120 beats per minute. *(given table value is 10)*

(f)  Solve using Kruskal-wallis test

| A | 44 | 45 | 46 | 47 | 48 | 49 |
|---|----|----|----|----|----|----|
| B | 40 | 42 | 51 | 52 | 55 |    |
| C | 50 | 53 | 58 | 59 |    |    |

**Q.5**      **Attempt any three.**               **(15)**

**(a)** State the properties of p.d.f and Verify whether the following functions are p.d.f.
$f(x) = 2x;$      for $0 < x < 1$
       $= 0 ;$       otherwise

**(b)** Define normal distribution. Write the properties of Normal distribution.

**(c)** Write the procedure of testing of hypothesis.

**(d)** The following data of Success(S) and Failure (F) was recorded for certain experiment. Use run test at 5% l.o.s. to check if the arrangement given in a sequence of success and failure is random or not. (Use normal approximation)
SFSFSFSFFSFSFSFSFSSSFSFSSSSFFFSFFSSFFSSFSSSSFSFSSFS
**(Standard value of for comparison is 1.96)**

**(e)** Write a short note on Yate's correction procedure in chi-square.

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