Duration: 3 Hours   **Maximum Marks: 100**

Instructions to the candidates:- Please check that you have got the correct question paper

1) **All the questions are compulsory. Choice is internal.**
2) **Figures to the right indicate full marks.**
3) **All questions carry equal marks.**
4) **Draw flowcharts /diagrams wherever necessary.**
5) **Assume suitable information if necessary.**
6) **Use of simple calculators is permitted.**
7) **Use of statistical tables is permitted**
8) **Values for statistical problems:**

($\Psi 2$ 0.05, 1) = 3.84; ($\Psi 2$ 0.05,2) 5.991 ; ($\Psi 2$ 0.05, 3) = 7.82; (t 0.05, 7) = 1.89; (t 0.05, 8) = 1.85;
(t 0.05, 9) = 1.83; (t 0.05, 10) = 1.86; (t 0.05, 11) = 2.81; (t 0.05, 12) = 2.79; (t 0.05, 13) = 2.71;
(t 0.05, 14) = 2.69; (t 0.05, 15) = 2.63; (t 0.05, 16) = 2.59 ; (t 0.05, 20) = 2.53; (t 0.025, 7) = 2.365;
(t 0.025, 8) = 2.306; (t 0.025, 9) = 2.26; (t 0.025, 10) = 2.22; (t 0.025, 11) = 2.20; (t 0.025, 12) = 2.18 ;
(t 0.025, 13) = 2.14; (t 0.025, 14) = 2.11; (t 0.025, 15) = 2.07; (t 0.025, 16) = 2.04; (t 0.025, 20) = 1.88,
Z (1,0)= 0.3413; Zα (0.01, One tailed) = 2.33; Zα (0.05, One tailed)= 1.645; Zα (0.1, One tailed)= 1.28;
Zα (0.01, two tailed) = 2.58; Zα (0.05, two tailed)= 1.96; Zα (0.1, two tailed)= 1.645

Q1A)   **Match the following**   **4**

Statistical Analysis	Description
(i)Positively skewed distribution	(a) deviation with positive and negative values
(ii)Negatively skewed distribution	(b) Deviation with positive value
(iii) Standard deviation	(c) Mean > Median > Mode
(iv) Mean deviation	(d) Mean < Median < Mode
	(e) Mode < Mean < Median

Q1B)   **Attempt ANY ONE**   **4**
  i) There are 60 students in a third-year biology class of which 25 are girls. The average
     weight of girls is 40 kg and that of boys is 53 kg. Find the mean weight in kg of the
     entire class.
  ii) Create a note on Normal distribution

Q1C)   **Answer ANY TWO**   **12**
  i) Nisha is a research student and is interested in taking biostatistics for her studies.
     Explain her scope and applications of biostatistics.
  ii) The following table gives the marks obtained in applied biotechnology by the
     students of a class of SY BSc. Find the median, and standard deviation.

Marks	11-20	21-30	31-40	41-50	51-60	61-70	71-80
No. of students	42	38	125	84	45	36	30

  iii) In a class in which all students practice at least one sport, 60% of the students play
     soccer or basketball, and 10% practice both. If there are 60% who do not play soccer,
     what is the probability that a student is chosen at random from the class: a) plays
     soccer only, b) plays basketball only, c) plays only one sport, d) plays neither soccer
     nor basketball.

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Q2A) **Fill in the blanks** 4

- i) _____ an example of homology and similarity tool
- ii) Microarray analysis is based on the _____ principle.
- iii) _____ gives the exact order of the biopolymer as a linear sequence.
- iv) _____ is the study of the pathway of evolution.

Q2B) **Attempt ANY ONE** 4

- i) Give a comparative account of proteomics and genomics
- ii) With the help of a flow chart, explain the procedure for the cDNA microarray.

Q2C) **Answer ANY TWO** 12

- i) Compose a note on GenBank and PIR.
- ii) Elaborate on the classification of the databases citing suitable examples.
- iii) Enlisting various sequence analysis tools, give a comparative account of RASMOL and CLUSTAL-X giving their important characteristics and unique features.

Q3A) **Fill in the blanks:** 4

- i) Type I error is depicted by the symbol _____.
- ii) Test to be conducted when n= 45 is ____ test
- iii) The standard error decreases as the sample size _____.
- iv) In a one-tail test for the population mean, if the null hypothesis is not rejected when the alternative hypothesis is true, then _____error has been committed.

Q3B) **Attempt ANY ONE** 4

- i) Write a short note on null and alternative hypothesis
- ii) Compare : One tailed and Two tailed tests

Q3C) **Attempt any TWO** 12

- i) Describe the different types of errors possible during hypothesis testing

- ii) a) Schematically represent the acceptance and rejection zone for Z test at 5% level of significance for a two tailed test.
  - b) Mumbai Municipal Corporation is associated with two schools A and B in Andheri region and claims that the quality of education imparted at the two schools is at par. The mean result of 100 students from School A was 72.4 with standard deviation 14.8, while the mean result of 200 students passing out from School B had a mean of 73.9 with standard deviation of 17.9. Is the claim of Mumbai Municipal Corporation that the two schools are at par, true?

iii) The mean of 2 sets of plots and their variability of yield are as below. Examine whether the difference in mean yields is significant.

	Set 1 of plots	Set 2 of plots
Mean yield / plot	1258 kg	1243 kg
Variance / plot	1156	784
Number of plots in each set	40	60

Q4B) **Fill in the blanks** **4**

i) Reno Pharmacy examines the effect of high protein and high lipid diet to increase body weight, on 10 patients from paediatric ward and 10 patients from oncology ward. Use of _____ t test is recommended

ii) The degree of freedom for a _____ t test is calculated as (n_1+n_2-2)

iii) The synonym for t-test is _____ test

iv) _____ is a non-parametric rest

Q4B) **Compare ANY ONE** **4**

i) Paired and unpaired T test
ii) T test and Chi Square test

Q4) **Attempt any TWO** **12**

i) 11 students were given a test on biostatistics. On analysing the performance they were given 2 months special coaching and then a second test was conducted. Marks obtained in test before and after coaching is depicted. Do the marks indicate that the special coaching has benefitted the students?

Roll No of student	1	2	3	4	5	6	7	8	9	10	11
Marks before Coaching	23	20	19	21	18	20	18	17	23	16	19
Marks after Coaching	24	19	22	18	20	22	20	20	23	20	18

ii) The amount of fortified Vitamin D content in two brands of Milk- Brand A and B, was found to be as :

Brand A	49	53	51	52	47	50	52	53
Brand B	52	55	52	53	50	54	54	53

Can we conclude that brand B has more Vitamin D fortification?

iii) In an anti-malaria campaign in a certain area, quinine was administered. The number of cases, wherein fever was observed is shown below:

Treatment	Fever	No Fever
Quinine	140	30
No Quinine	60	20

Suggest the association between quinine and fever.

Q5A) **Define and explain:** 8
  a) Interquartile range

<div align="center">**OR**</div>

  b) Decile
  c) GDB

<div align="center">**OR**</div>

  d) AMMP
  e) Level of significance

<div align="center">**OR**</div>

  f) Parametric test
  g) Contingency table

<div align="center">**OR**</div>

  h) Degree of freedom

Q5B) **State True or False with justification** 12
  i) In a normal distribution, mean $\pm$ S.D. covers almost 50% area under the curve.
  ii) P50 value is similar to that of median
  iii) The phylogenetic tree depicts evolutionary relationships in the form of a Dendrogram
  iv) If test statistic value is greater than the table value, null hypothesis is accepted
  v) Mendel's laws can be tested by the Chi square test
  vi) In statistics, in absence of any mention of level of significance , $\alpha = 0.1$

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