CONTROLLER OF EXAMINATIONS ADDITIONAL AU CHENNAI 600 025

Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, NOV / DEC 2025

BIOMEDICAL ENGINEERING
VII Semester
BM5023 & Biostatistics
(Regulations 2019)

Time: 3hrs Max.Marks: 100

CO1	Classify common statistical tests and tools.
CO2	Distinguish between p-values and confidence intervals as measures of statistical significance.
CO3	Interpret commonly used regression analysis.
CO4	Explain the data tables and its interpretations in community health.
CO5	Evaluate commonly used statistical and epidemiologic measures.

BL – Bloom's Taxonomy Levels
(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)

PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1	Distinguish descriptive and inferential statistics with an example.	2	1	L2
2	If a box contains 3 red and 7 blue marbles, calculate the probability and odds of: i) Picking a red marble ii) Picking a blue marble	2	1	L2
3	State the significance of hypothesis testing for statistical inference.	2	2	L1
4	Consider the data given in Table I. Check whether the sample frequency corresponds to the expected population frequency based on statistical significance. (Given critical χ^2 =3.841, df=1) **TABLE I** **Observed frequency** Category A: 25, 11 Category B: 145, 80 **Expected Frequency** Category A: 25, 11 Category B: 145, 80	2	2	L3
5	List the types of linear regression analysis. Give an example for each.	2	3	L1
6	Define the equations for non-linear regression methods.	2	3	L2
7	List the role of biostatistics in designing a clinical trial for research purposes.	2	4	L2
8	State the importance of epidemiological studies in the public health domain.	2	4	L2
9	List any two disagreements with META-analysis.	2	5	L1
10	Meta-analysis of studies investigating the link between a specific gene polymorphism and the risk of colorectal cancer is performed. Suggest a suitable plot to visualize the results and give the interpretation.	2	5	L2

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PART- B (5 x 13 = 65 Marks)

<table>
<tr><th>Q. No</th><th>Questions</th><th>Marks</th><th>CO</th><th>BL</th></tr>
<tr><td>11 (a) (i)</td><td>The problem is to investigate the effect of the age at onset of bipolar disorder on the course of the illness. One of the variables investigated is family history of mood disorders. Table II shows the frequency of a family history of mood disorders in the two groups of interest (Early age at onset defined to be 18 years or younger and Later age at onset defined to be later than 18 years).

TABLE II
<table><tr><th>Family history of mood disorders</th><th>Early=18</th><th>Later>18</th></tr><tr><td>Negative (A)</td><td>28</td><td>35</td></tr><tr><td>Bipolar disorder (B)</td><td>19</td><td>38</td></tr><tr><td>Unipolar (C)</td><td>41</td><td>44</td></tr><tr><td>Unipolar and bipolar (D)</td><td>53</td><td>60</td></tr></table>
Suppose a person is picked at random from this sample.
a) What is the probability that this person will be 18 years old or younger?
b) A subject picked at random is 18 years or younger (E). What is the probability that this person will have no family history of mood disorders (A)?
c) What is the probability that a person picked at random will be Early and will be a person who has no family history of mood disorders (A)?
d) What is the probability that this person will be an Early age of onset subject (E) or will have no family history of mood disorders (A) or both?</td><td>13</td><td>1</td><td>L3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>11 (b) (i)</td><td>Write short notes on the importance of the Poisson and Normal distributions with an example.</td><td>8</td><td>1</td><td>L3</td></tr>
<tr><td>(ii)</td><td>Suppose a hospital receives an average of four emergency cases per hour. What is the probability that exactly two cases arrive in an hour? Given e=2.71828</td><td>5</td><td>1</td><td>L3</td></tr>
<tr><td>12 (a) (i)</td><td>Researchers are interested in the mean age of a certain population of 10 individuals. Can we conclude that the mean age of this population is different from 30 years? Use the ten-step significance hypothesis testing to reach a conclusion with a neat illustration showing rejection and non-rejection regions. (Given: sample mean, μ= 27, population variance, σ^2=20, critical z statistic=1.96, α=0.05, p=0.0340)</td><td>13</td><td>2</td><td>L4</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>12 (b) (i)</td><td>In a research study, among 157 Indian-American women, the mean systolic blood pressure was found to be 146mm Hg with a standard deviation of 27. On the basis of these data, the mean systolic blood pressure for a population of Indian-American women is greater than 140. Provide sufficient evidence to conclude that the population mean is greater than 140 if we can reject the null hypothesis that the mean is less than or equal to 140 by performing suitable hypothesis testing. (Given: critical z statistic=1:645, α=0.05, p=:0027). Show rejection and non-</td><td>13</td><td>2</td><td>L4</td></tr>
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	rejection regions.			
13 (a) (i)	Find the regression equation to establish the relationship between the scores of nurse's assessment (X) and a physician's assessment (Y) of the condition of 10 patients at the time of admission to a trauma centre using the data given in Table III. **Table III** **Patient** / **Nurse's assessment (X)** / **Physician's assessment (Y)** 1 / 18 / 23 2 / 13 / 20 3 / 18 / 18 4 / 15 / 16 5 / 10 / 14 6 / 12 / 11 7 / 8 / 10 8 / 4 / 7 9 / 7 / 6 10 / 3 / 4	**13**	3	L3
	OR			
13 (b) (i)	For the data given in Table III, compute Pearson Correlation Coefficient. State the strength of the relationship between the independent and dependent variables based on the outcome.	**13**	3	L3
14 (a) (i)	Elucidate the important considerations in interpreting data from epidemiological studies.	**13**	4	L3
	OR			
14 (b) (i)	For the Life Table given in Table IV, compute the following: i) The probability that a person of age 20 will die in the interval (20,25). ii) State the relationship between columns 4, 3 and 2. iii) Give the radix of the life table. iv) The number of persons dying before age 10. v) The proportion of that a newborn will die before reaching age 25. **Table IV** **Age Interval (x, x+n)** / **$_nq_x$** / **l_x** / **$_nd_x$** <1 / 0.00723 / 100000 / 723 1-4 / 0.00144 / 99277 / 143 5-9 / 0.00092 / 99135 / 91 10-14 / 0.00116 / 99043 / 115 15-19 / 0.00374 / 98929 / 370 20-24 / 0.00492 / 98558 / 485 25-29 / 0.00509 / 98073 / 499 30-34 / 0.00630 / 97574 / 615 35-39 / 0.00840 / 96959 / 814	**8**	4	L3
(ii)	State the importance of Life Table.	**5**	4	L2
15 (a) (i)	Discuss in detail the importance of META analysis with an example.	**13**	5	L2
	OR			

15 (b) (i)	Explain any three graphical tools used to visualize and analyze scientific meta-analyses data with an example.	**13**	5	L2

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

Q. No	Questions	Marks	CO	BL
16. (i)	Discuss the assumptions of linear regression analysis.	**10**	3	L2
(ii)	Consider the following example of modelling the relationship of body fat percentage and weight to predict the bone density in the femur given in Table V.	**5**	3	L3

Table V

Terms	Coef	SE Coef	T-value	P-value	VIF
Constant	0.155	0.132	1.18	0.243	-
%Fat	0.00557	0.00409	1.36	0.176	14.93
Weight in Kg	0.01447	0.00285	5.07	0.000	33.95

a) Comment on the significance of VIF with respect to multicollinearity for each independent variable for the given data.

b) Discuss the procedure to reduce the problem of structural multicollinearity to develop a model to establish the relationship between the independent and dependent variables.

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