

Name: Enrolment No:	
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UPES
End Semester Examination, December 2024

Course : Research Methodology	Semester : VII
Programme : Int-B.Sc.-M.Sc (Chemistry, Maths, Physics)	Time : 03 hrs
Course Code : PHYS4005	Max. Marks: 100
Nos. of page(s): 03 (three)	

Instructions:

- Write your name and enrolment no. at the top of the question paper.
- Do not write anything else on the question paper except your name and roll number.
- Attempt all the parts of a question at one place only.
- CO in the last column stands for course outcomes and it is for official use only.
- Schematic representations and suitable examples are highly encouraged during answering the questions.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO																								
Q 1	Provide a concise definition of research in the context of academic inquiry.	4	CO1																								
Q 2	Define the central limit theorem and state its significance.	4	CO2																								
Q 3	Explain the null hypothesis and alternative hypothesis with examples.	4	CO2																								
Q 4	Define the concept of the coefficient of determination (R^2) in linear regression.	4	CO2																								
Q 5	Consider snapshot of data for some packaged product belonging to two different brands. <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Brand</th> <th>Summer_Weight [g]</th> <th>Monsoon_Weight [g]</th> </tr> </thead> <tbody> <tr><td>A</td><td>99.8</td><td>100.5</td></tr> <tr><td>A</td><td>100</td><td>100</td></tr> <tr><td>B</td><td>101</td><td>101.2</td></tr> <tr><td>A</td><td>98.8</td><td>99.1</td></tr> <tr><td>B</td><td>100.4</td><td>100</td></tr> <tr><td>B</td><td>99.7</td><td>99.8</td></tr> <tr><td>⋮</td><td>⋮</td><td>⋮</td></tr> </tbody> </table> Do the statistical tests to answer the following questions:	Brand	Summer_Weight [g]	Monsoon_Weight [g]	A	99.8	100.5	A	100	100	B	101	101.2	A	98.8	99.1	B	100.4	100	B	99.7	99.8	⋮	⋮	⋮	4	CO3
Brand	Summer_Weight [g]	Monsoon_Weight [g]																									
A	99.8	100.5																									
A	100	100																									
B	101	101.2																									
A	98.8	99.1																									
B	100.4	100																									
B	99.7	99.8																									
⋮	⋮	⋮																									

	<p>i) Do summer and monsoon weights significantly differ from each other considering all brands are same.</p> <p>ii) Are monsoon weights for brand A and brand B significantly different from each other.</p> <p>Choose the correct combination from the options given below</p> <p>A. (1: paired t-test , 2: paired t-test)</p> <p>B. (1: un-paired t-test , 2: paired t-test)</p> <p>C. (1: un-paired t-test , 2: un-paired t-test)</p> <p>D. (1: paired t-test , 2: un-paired t-test)</p>		
SECTION B (4Qx10M= 40 Marks)			
Q6	Provide a detailed comparative analysis of patents, copyrights, and trademarks. Use real-world examples to illustrate how each type of IP is used and protected.	3+3+4	CO1
Q7	Describe the layout of a research report, highlighting the purpose of each section.	10	CO1
Q8	<p>Consider following pmf for a discrete random variable.</p> $P(X = x) = \begin{cases} kx + x/a & \forall x \in \{1,2,3\} \\ 0 & otherwise \end{cases}$ <p>A. if $a = 2$, find value of k.</p> <p>B. find mean of the population/</p> <p>C. find $P(X = 0)$</p>	5 + 3 + 2	CO3
Q9	<p>Discuss the concept and applications of multivariate ANOVA (MANOVA). Compare it with univariate ANOVA.</p> <p style="text-align: center;">OR</p> <p>Discuss the importance and applications of the p-value approach in hypothesis testing. Provide an example where the p-value aids in making decisions.</p>	6+4 6+4	CO2
SECTION-C (2Qx20M=40 Marks)			
Q10	A dataset has the following distribution of weights: 50, 60, 65, 70, 75, 80, 85. Calculate the mean, median, mode, range, variance, standard deviation, skewness and kurtosis. Discuss what these statistics reveal about the dataset (Provide calculations and interpretations with tentative graphical representation).	20	CO3

Q11	<p>Imagine you are guiding a team of researchers in writing their first report. Develop a step-by-step guide for using LaTeX, covering basic commands and features for formatting, indexing, and referencing.</p> <p style="text-align: center;">OR</p> <p>Design a detailed layout of a research report suitable for a scientific journal. Discuss the role of each section and provide an example for one section, such as the abstract or results.</p>	20	CO1
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