

<b>Name:</b> <b>Enrolment No:</b>	
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**UPES**  
**End Semester Examination, December 2024**

<b>Course</b> : Research Methodology	<b>Semester</b> : VII
<b>Programme</b> : Int-B.Sc.-M.Sc (Chemistry, Maths, Physics)	<b>Time</b> : 03 hrs
<b>Course Code</b> : PHYS4005	<b>Max. Marks:</b> 100
<b>Nos. of page(s):</b> 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;"> <thead> <tr> <th style="width: 10%;">Brand</th> <th style="width: 20%;">Summer_Weight [g]</th> <th style="width: 20%;">Monsoon_Weight [g]</th> </tr> </thead> <tbody> <tr><td>A</td><td style="text-align: center;">99.8</td><td style="text-align: center;">100.5</td></tr> <tr><td>A</td><td style="text-align: center;">100</td><td style="text-align: center;">100</td></tr> <tr><td>B</td><td style="text-align: center;">101</td><td style="text-align: center;">101.2</td></tr> <tr><td>A</td><td style="text-align: center;">98.8</td><td style="text-align: center;">99.1</td></tr> <tr><td>B</td><td style="text-align: center;">100.4</td><td style="text-align: center;">100</td></tr> <tr><td>B</td><td style="text-align: center;">99.7</td><td style="text-align: center;">99.8</td></tr> <tr><td style="text-align: center;">⋮</td><td style="text-align: center;">⋮</td><td style="text-align: center;">⋮</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>		
<b>SECTION B</b> <b>(4Qx10M= 40 Marks)</b>			
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.	<b>3+3+4</b>	<b>CO1</b>
Q7	Describe the layout of a research report, highlighting the purpose of each section.	<b>10</b>	<b>CO1</b>
Q8	<p>Consider following pmf for a discrete random variable.</p> $P(X = x) = \begin{cases} kx + x/a & \forall x \in \{1,2,3\} \\ 0 & \text{otherwise} \end{cases}$ <p>A. if <math>a = 2</math>, find value of k.</p> <p>B. find mean of the population/</p> <p>C. find <math>P(X = 0)</math></p>	<b>5 + 3 + 2</b>	<b>CO3</b>
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>	<b>6+4</b>  <b>6+4</b>	<b>CO2</b>
<b>SECTION-C</b> <b>(2Qx20M=40 Marks)</b>			
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).	<b>20</b>	<b>CO3</b>

Q11	<p>Imagine you are guiding a team of researchers in writing their first report. Develop a step-by-step guide for using <b>LaTeX</b>, 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>	<b>20</b>	<b>CO1</b>
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