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.	**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
⋮	⋮	⋮

Do the statistical tests to answer the following questions:

	i) Do summer and monsoon weights significantly differ from each other considering all brands are same. ii) Are monsoon weights for brand A and brand B significantly different from each other. Choose the correct combination from the options given below A. (1: paired t-test , 2: paired t-test) B. (1: un-paired t-test , 2: paired t-test) C. (1: un-paired t-test , 2: un-paired t-test) D. (1: paired t-test , 2: un-paired t-test)		

<div align="center">

SECTION B
(4Qx10M= 40 Marks)

</div>

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	Consider following pmf for a discrete random variable. $$P(X = x) = \begin{cases} kx + x/a & \forall\ x \in \{1,2,3\} \\ 0 & otherwise \end{cases}$$ A. if $a = 2$, find value of k. B. find mean of the population/ C. find $P(X = 0)$	**5 + 3 + 2**	**CO3**
Q9	Discuss the concept and applications of multivariate ANOVA (MANOVA). Compare it with univariate ANOVA. OR Discuss the importance and applications of the p-value approach in hypothesis testing. Provide an example where the p-value aids in making decisions.	**6+4** **6+4**	**CO2**

<div align="center">

SECTION-C
(2Qx20M=40 Marks)

</div>

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	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. OR 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.	**20**	**CO1**