KERALA AGRICULTURAL UNIVERSITY

B.Tech.(Food Technology) 2022 Admission

III Semester Final Examination – February 2024

Beas.2108 **Statistical Methods and Numerical Analysis (1+1)** **Marks: 50**

Time: 2 hours

I **Fill in the blanks** **(10x1=10)**

1. Testing of hypothesis involves comparing observed data with the .... hypothesis.
2. The Chi-square test is used to determine the .... between observed and expected frequencies in a contingency table
3. ANOVA is an extension of the t-test and is used when comparing means among .... groups.
4. Response surface methodology is a statistical technique used for optimizing response variables. It involves fitting a mathematical model to the observed data and exploring the relationship between the response and the .... variables.
5. When analyzing a completely randomized design (CRD) with an unequal number of observations across treatments, the degrees of freedom for error in the analysis of variance are calculated as the total degrees of freedom minus the degrees of freedom for ....

State True or False

6. Newton's forward interpolation formula is equally effective for regularly spaced and irregularly spaced data points.
7. Picard's method for solving ordinary differential equations may fail to converge if the Lipschitz condition is not satisfied. State
8. The classical fourth-order Runge-Kutta method is always more accurate than the Euler's method, irrespective of the nature of the differential equation.
9. In a mixed factorial design, the interaction effect can only be attributed to within-subjects factors.
10. In regression analysis, if the residuals exhibit heteroscedasticity, it violates the assumption of homoscedasticity.

II **Write short notes on ANY FIVE of the following** **(5x2=10)**

1. In a mixed factorial design involving irrigation frequency (high and low) and temperature (continuous), if the crop yield increases by 5 units for every 2-degree Celsius increase in temperature, and the temperature is 25 degrees Celsius, what is the expected increase in crop yield due to temperature?
2. What is the key difference between one-way and two-way classification in ANOVA?
3. Explain the concept of testing the significance of the correlation coefficient in correlation analysis.
4. Find the solution using Weddle's rule for the following table.

x	7.47	7.48	7.49	7.50	7.51	7.52	7.53
$f(x)$	1.93	1.95	1.98	2.01	2.03	2.06	2.09

5. Describe the analysis approach for a Completely Randomized Design with unequal numbers of observations.
6. What is a Latin Square Design in experimental design, and what is its primary purpose?
7. What type of mathematical models are commonly used in Response Surface Methodology, and why are they useful?

III Answer ANY FIVE of the following (5x4=20)

1. Evaluate $\int_0^1 e^x\, dx\ by$ Simpson's $\frac{1}{3}$ rule.
2. How does RSM help in optimizing processes? Provide a brief overview of the key steps involved in a typical RSM analysis.
3. Explain the concept of a randomized block design and its advantages over a completely randomized design. Provide a layout for a randomized block design with an equal number of observations.
4. Discuss the key features and advantages of a 2^3 factorial experiment. Provide a brief example layout.
5. Explain the significance testing in correlation and regression. How is it done, and what does it indicate? Provide an example.
6. Explain the concept of error in numerical integration methods. How does the accuracy of the Trapezoidal rule and Simpson's rule change as the number of subintervals increases?
7. Apply Newton's forward formula to evaluate $y = e^{2x}$ for $x = 0.05$ using the following table.

x	0.00	0.10	0.20	0.30	0.40
$y = e^{2x}$	1.00	1.2214	1.4918	1.8221	2.2255

IV Write an essay on ANY ONE of the following (1x10=10)

1. For the equation $\frac{dy}{dx} = y + x$
   (i) Using Picard's process of successive approximations obtain a solution upto fifth approximation of the given equation, such that $y = 1$ when $x = 0$.
   (ii) Apply Runge's method to find an approximate value of y when $x = 0.2$, for the given equation such that $y = 1$ when $x = 0$
2. Apply the Runge-Kutta Method to find the approximate value of y for x=0.2 in steps of 0.1, if $\frac{dy}{dx} = x + y^2, y = 1$ where $x = 0$.

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