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Question Paper Code : 80610

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fourth Semester

Mechanical Engineering

MA 6452 — STATISTICS AND NUMERICAL METHODS

(Common to Fourth Semester Automobile Engineering, Mechatronics Engineering and Fifth Semester for Mechanical Engineering (Sandwich))

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Use of statistical tables is permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the main use of χ^2 test.

2. Write down the formula of test statistic t to the significance of difference between the mean (large samples).

3. What is ANOVA?

4. Define experimental error.

5. Derive a formula to find the value of $N^{1/2}$ and $1/N$ where $N \neq 0$, using Newton Raphson method.

6. Solve the equations $5x - 2y = 1$, $4x + 28y = 23$ using the Gauss elimination method.

7. Find the polynomial which takes the following values given $f(0) = -1$, $f(1) = 1$ and $f(2) = 4$ using the Newton's interpolating formula.

8. State any two properties of divided differences.

9. Write down the Euler formula for $y' = f(x, y)$, $y(x_0) = y_0$.

10. Using Taylor's method find y at $x = 0.1$ when $y' = x^2 - y$.

11. (a) (i) A sample of 900 members has a mean 3.4 and standard deviation 261 cms. Is the sample from a large population of mean 3.25 cms and standard deviation 2.61 cms? (8)

   (ii) Two random samples gave the following results :

Sample	Size	Sample mean	Sum of squares of deviation from the mean
1	10	15	90
2	12	14	108

   Test whether the samples come from the same normal population at 5% level of significance (given $F_{0.05}(9,11) = 2.90$, $F_{0.05}(11,9) = 3.10$, $t_{0.05}(20) = 2.086$, $t_{0.05}(22) = 2.07$ approximately). (8)

Or

(b) (i) The mean height of 50 male students who showed above average participation in college athletics was 68.2 inches with a standard deviation of 2.5 inches; while 50 male students who showed no interest in such participation had a mean height of 67.5 inches with a standard deviation of 2.8 inches

   (1) Test the hypothesis that male students who participate in college athletics are taller than other male students.

   (2) By how much should the sample size of each of the two groups be increase in order that the observed difference of 0.7 inches in the mean height be significant at the 5% level of significance. (8)

   (ii) A group of 10 rats fed on diet A and another group of 8 rats fed on diet B. recorded the following increase in weight.

   Diet A   5   6   8   1   12   4   3   9   6   10

   Diet B   2   3   6   8   10   1   2   8

   Find the variances are significantly different. (8)

12. (a) (i) The following table gives the yields of 15 samples of plot under three varieties of seed.

   A   20   21   23   16   20

   B   18   20   17   15   25

   C   25   28   22   28   32

   Test using analysis of variance whether there is a significant difference in the average of yield of seeds. (8)

(ii) A variable trial was conducted on wheat with 4 varieties in a latin square design. The plan of the experiment and the per plot yield are given below.

C	25	B	23	A	20	D	20
A	19	D	19	C	21	B	18
B	1	A	14	D	17	C	20
D	17	C	20	B	21	A	15

Analyse data and interpret the result. (8)

Or

(b) A company appoints 4 salesmen A, B, C and D and observes their sales in 3 seasons, summer winter and monsoon. The figures are given in the following table :

Season	Salesmen			
	A	B	C	D
Summer	45	40	28	37
Winter	43	41	45	38
Monsoon	39	39	43	41

Carry out an analysis of variances. (16)

13. (a) (i) Find the largest eigenvalue and eigenvector of the matrix $\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$, by power method. (8)

(ii) Using Gauss-Jordon method, find the inverse of the

matrix $\begin{pmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 1 & 1 & 2 \end{pmatrix}$. (8)

Or

(b) (i) Solve the following system of equations using Gauss — Seidel iterative method $8x - y + z = 18$, $2x + 5y - 2z = 3$, $x + y - 3z = -6$.

(8)

(ii) Solve the following equations using Jacobi's iteration method

$28x + 4y - z = 32$, $x + 3y + 10z = 24$, $2x + 17y + 4z = 35$. (8)

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14. (a) (i) Using Lagrange's formula, fit a polynomial to the data   (6)

$$x: \quad -1 \quad 0 \quad 2 \quad 3$$

$$y: \quad -8 \quad 3 \quad 1 \quad 12$$

Hence find y at $x = 1.5$ and $x = 1$.

(ii) Evaluate $\int_{-3}^{3} x^4 \, dx$ correct to three decimals dividing the range of integration into 8 equal parts using Trapezoidal rule. Simpson's $1/3^{rd}$ rule and 3/8 rule. Also compare the results with actual integration.   (10)

Or

(b) (i) From the data given below, find θ at $x = 43$ and at $x = 84$ (8)

$$x: \quad 40 \quad 50 \quad 60 \quad 70 \quad 80 \quad 90$$

$$\theta: \quad 184 \quad 204 \quad 226 \quad 250 \quad 276 \quad 304$$

(ii) Evaluate $\int_{0}^{2} \int_{1}^{2} \sin(9x + y) dx \, dy$ by Simpson's $1/3^{rd}$ rule and Trapezoidal rule with $h = 0.25$ and $k = 0.5$.   (8)

15. (a) (i) Consider the IVP $y' = 1 - y$, $y(0) = 0$. Using the Euler's method find $y(0.2)$ and Modified Euler method find $y(0.4)$ and $y(0.6)$ then by using Milne's method obtain $y(0.8)$.   (10)

(ii) Solve the following by finite difference method $y'' - y = 0$ given $y(0) = 0, y(1) = 1$ with $h = 0.25$.   (6)

Or

(b) Given $y' = y - x^2$, $y(0.6) = 1.7379$ find $y(0.7), y(0.8)$ using R.K method of Fourth order.   (16)

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