Reg. No. :

Question Paper Code : X10664

B.E./B.Tech. DEGREE EXAMINATIONS,NOVEMBER/DECEMBER 2020 AND APRIL/MAY 2021
Fourth Semester
Mechanical Engineering
MA 8452 – STATISTICS AND NUMERICAL METHODS
(Common to Automobile Engineering/Mechatronics Engineering/Production Engineering/Robotics and Automation)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. When do we use Large sample tests and Small sample tests ?
2. What is the formula for testing the ratio of variances ?
3. Define a treatment and a yield in an experimental design.
4. What is contrast and orthogonal contrast in a 2^2 -factorial design ?
5. What are the various methods of solving simultaneous linear equations ?
6. What is the condition for convergence of Gauss-Jacobi and Gauss Seidal methods ?
7. Construct the difference table for the data given :

X :	4	6	8	10
Y :	1	3	8	16

8. Give two practical applications of Simpson's one third rule.
9. What are the different methods of solving an ordinary differential equations ?
10. Why improved Euler method is superior to Euler method ?

PART – B **(5×16=80 Marks)**

11. a) i) In 200 tosses of a coin, 115 heads and 85 tails were observed. Test the hypothesis that the coin is fair using a level of significance of 0.05. **(8)**

ii) A random sample of 100 bulbs in the united States during the past year showed an average life span of 1570 hours with a standard deviation of 120 hours. Does this seem to indicate that the mean life span is greater than 1600 hours. Use a level of significance of 0.05. **(8)**

(OR)

b) i) A test of the breaking strength of 6 ropes manufactured by a company showed a mean breaking strength of 3515 kg and a standard deviation of 66 kg, where as the manufacturer claimed a mean breaking strength of 3630 kg. Can be support the manufacturer's claim at a level of significance of 0.05. **(8)**

ii) An instructor has two classes A and B, in a particular subject. Class A has 16 students while class B has 25 students. On the same examination, although there was no significant difference in mean grade class A has standard deviation of 9, while class B had a standard deviation level of 12. Can we conclude at the 0.01 level of significance that the variability of class B is greater than that of class A. **(8)**

12. a) Table below shows the yields for hectare of four different plant crops grown on lots treated with three different types of fertilizers. Using a suitable design of experiment, test at the 0.05 level of significance whether there is a significant difference in yield per hectare due to fertilizers and there is a significant difference in yield per hectare due to crops. **(16)**

	Crop I	**Crop II**	**Crop III**	**Crop IV**
Fertilizer A	4.5	6.4	7.2	6.7
Fertilizer B	8.8	7.8	9.6	7.0
Fertilizer C	5.9	6.8	5.7	5.2

(OR)

b) A farmer wishes to test the effects of four different fertilizers A, B, C, D on the yield of wheat. In order to eliminate sources of error due to variability in soil fertility, he uses the fertilizers in a Latin square design arrangement as indicated in the table below. Perform an analysis of variance to determine if there is a significant difference between the fertilizers at 0.05 level of significance. **(16)**

A18	C21	D25	B11
D22	B12	A15	C19
B15	A20	C23	D24
C22	D21	B10	A17

13. a) i) Solve the following system of equations by Gauss elimination and Gauss-Jordan methods.

$5x - y = 9$

$-x + 5y - z = 4$

$-y + 5z = -6$ **(8)**

ii) Find by Newton-Raphson method the real root of $3x - \cos x - 1 = 0$. **(8)**

(OR)

b) i) Find the numerically largest eigen value and the corresponding eigen vector of $A = \begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$ by the power method. **(8)**

ii) Solve by Gauss-Seidal method of iteration the equations. **(8)**

$27x + 6y - z = 85$

$6x + 15y + 2z = 72$

$x + y + 54z = 110.$

14. a) i) Compute the third difference of f(32) from the following table and verify the results by means of the difference table. **(8)**

X :	32	33	34	35
Y :	539	8568	8765	24364

ii) Find the fourth degree curve y = f(x) passing through the points (2, 3), (4, 43), (5, 138), (7, 778) and (8, 1515) using Newton's divided difference formula. **(8)**

(OR)

b) i) Using the data of the following table compute the integrals $\int_{0.5}^{1.1} x^2 y \, dx$, by trapezoidal rule. **(8)**

x :	0.5	0.6	0.7	0.8	0.9	1	1.1
y :	0.4804	0.5669	0.6490	0.7262	0.7985	0.8658	0.9281

ii) Evaluate $\int_0^{\pi/2} \int_{\pi/2}^{\pi} \cos(x + y) dx \, dy$ using Simpson's rule. **(8)**

15. a) i) Using Taylor's series method upto fourth order find 'y' at x = 1.1 and 1.2 by solving the equation $\frac{dy}{dx} = x^2 + y^2$, y(1) = 2 with h = 0.1 upto four decimals. **(8)**

ii) Use Runge-Kutta method of the fourth order to find y(0.2) and y(0.4) given that y dy/dx = $y^2 - x$, y(0) = 2 by taking h = 0.2 (upto four decimal places). **(8)**

(OR)

b) i) Given dy/dx = $\frac{1}{2}$ $(1 + x^2) y^2$ and y (0) = y(0.1) = 1.06, y(0.2) = 1.12, y(0.3) = 1.21. Evaluate y(0.4) by Milne's predictor-corrector method upto four decimal places. **(8)**

ii) Given that $\frac{dy}{dx} = \frac{1 - xy}{x^2}$, $y(1) = 1$, y(1.1) = 0.996, y(1.2) = 0.986 y(1.3) = 0.972. Find y(1.4) using Adam Bashforth upto four decimals. **(8)**

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