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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 we 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)