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Reg. No. :

Question Paper Code : 20817

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Fourth Semester

Automobile Engineering

MA 8452 — STATISTICS AND NUMERICAL METHODS

(Common to Mechanical Engineering/Mechatronics Engineering/Production Engineering/Robotics and Automation)

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

(Scientific Calculator should be permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   What is sampling distribution?

2.   Briefly explain about 'estimation of parameter'.

3.   Define Randomized Block Design.

4.   Explain about Latin Square Design.

5.   Find a root of the equation $x^3 - 4x - 9 = 0$, using the bisection method correct to two decimal places.

6.   Derive order of fixed point iteration method.

7.   Find the divided differences of $f(x) = x^3 + x + 2$ for the arguments $x = 1, 3, 6$.

8.   Evaluate $\int_0^1 \dfrac{dx}{1+x}$ using Trapezoidal rule.

9.   Write down the formula for classical Runge-Kutta method.

10. Give an example of multi step method.

PART B — (5 × 16 = 80 marks)

11. (a) (i) A random sample of 100 recorded deaths in India during the past year showed an average life span of 71.8 years. Assuming a population standard deviation of 8.9 years, does this seem to indicate that the mean life span today is greater than 70 years? Use a 0.05 level of significance. (8)

    (ii) Given that 32 values obtained for standard wire yielded $\bar{x} = 0.136$ ohm and $s_1 = 0.004$ ohm, and 32 values obtained for alloyed wire yielded $\bar{y} = 0.083$ ohm and $s_2 = 0.005$ ohm. At the 0.05 level of significance, test the claim that the resistance of electric wire can be reduced by more than 0.050 ohm by alloying. (8)

Or

    (b) (i) A company claims that a vacuum cleaner uses an average of 46 kilowatt hours per year. If a random sample of 12 homes included in a planned study indicates that vacuum cleaners use an average of 42 kilowatt hours per year with a standard deviation of 11.9 kilowatt hours, does this suggest at the 0.05 level of significance that vacuum cleaners use, on average, less than 46 kilowatt hours annually? Assume the population of kilowatt hours to be normal. (8)

    (ii) The below table gives the number of air-craft accidents that occurred during the various days of a week. Test whether the accidents are uniformly distributed over the week. (8)

Day :	Mon	Tue	Wed	Thu	Fri	Sat
No. of accidents :	15	19	13	12	16	15

12. (a) Explain Completely Randomized Design with an example. (16)

Or

    (b) Explain 2^2 factorial design with an example. (16)

13. (a) (i) Find the positive root of $x^4 - x = 10$ correct to three decimal places, using Newton-Raphson method. (6)

    (ii) Using Gauss-Jordan method, solve the system of equations $x + y + z = 9; 2x - 3y + 4z = 13; 3x + 4y + 5z = 40$. (10)

Or

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(b) (i)   Solve the linear system $10x + y - z = 11.19$; $x + 10y + z = 28.08$; $-x - y + 10z = 35.61$, by Gauss Jacobi iteration method, correct to two decimal places.   (10)

(ii)   Find the dominant eigen value of the matrix $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ and hence find the other eigen value also.   (6)

14. (a) (i)   Find the values of y at $x = 21$ from the following data.   (8)

x :	20	23	26	29
y :	0.3420	0.3907	0.4384	0.4848

(ii)   The population y (in thousands) of a certain town is given below. Find the rate of growth of the population in 1961.   (8)

x	1931	1941	1951	1961	1971
y	40.62	60.80	79.95	103.56	132.65

Or

(b)   Evaluate $\int_{0}^{1} \frac{dx}{1+x^2}$ using

(i)   Trapezoidal rule with $h = 1/4$ and

(ii)   Simpson's 1/3 rule with $h = 1/4$. Hence, compute an approximate value of π in each case.   (8+8)

15. (a)   Given $y' = x + y$ with $y(0) = 1$. Assume $h = 0.1$. Find $y(0.1)$ using Euler's method. Hence, find $y(0.2)$ using Modified Euler method. Hence, find $y(0.3)$ using Runge-Kutta method of fourth order.   (4+4+8)

Or

(b)   Given $y' = \frac{1}{2}xy$ with $y(0) = 1$, $y(0.1) = 1.01$ $y(0.2) = 1.022$, $y(0.3) = 1.023$. Find $y(0.4)$ using

(i)   Adam-Bashforth method and

(ii)   Milne's method.   (8+8)

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