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18MATDIP41

Fourth Semester B.E. Degree Examination, June/July 2024 Additional Mathematics – II

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Test for consistency and solve
 $5x + 3y + 7z = 5$, $3x + 26y + 2z = 9$, $7x + 2y + 10z = 5$ (07 Marks)
- b. Find the eigen values and the corresponding eigen vectors for the matrix

$$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$$
 (07 Marks)
- c. Solve the system of equations by Gauss-Elimination method :
 $2x + y + 4z = 12$, $4x + 11y - z = 33$, $8x - 3y + 2z = 20$ (06 Marks)

OR

- 2 a. Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$. (07 Marks)
- b. Investigate the value of λ and μ such that the system of equations,
 $x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + \lambda z = \mu$ may have,
 (i) Unique solution
 (ii) Infinite solution
 (iii) No solution (07 Marks)
- c. Solve the system of equations by Gauss-elimination method :
 $x + y + z = 6$, $x - y + 2z = 5$, $3x + y + z = 8$ (06 Marks)

Module-2

- 3 a. Find $y(1.4)$ given that,

x	1	2	3	4	5
y	10	26	58	112	194

 Using Newton's forward interpolation formula. (07 Marks)
- b. Find a real root of $f(x) = x^3 - 2x - 5 = 0$, correct to three decimal places, using Regula-Falsi method. (07 Marks)
- c. Evaluate $\int_0^6 3x^2 dx$ dividing the interval $[0, 6]$ into SIX equal parts by applying Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 4 a. Given $f(40) = 184$, $f(50) = 204$, $f(60) = 226$, $f(70) = 250$, $f(80) = 276$, $f(90) = 304$, find $f(85)$ using Newton's backward interpolation formula. (07 Marks)
- b. Find the real root of the equation $f(x) = xe^x - 2 = 0$ correct to three decimal places, by using Newton-Raphson method. (07 Marks)
- c. Evaluate $\int_4^{5.2} \log_e x \, dx$, taking 6 equal strips by applying Weddle's rule :

x	4	4.2	4.4	4.6	4.8	5.0	5.2
$y = \log_e x$	1.3863	1.4351	1.4816	1.5261	1.5686	1.6094	1.6487

(06 Marks)

Module-3

- 5 a. Solve : $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$. (07 Marks)
- b. Solve : $(6D^2 + 17D + 12)y = e^{-x}$ (07 Marks)
- c. Solve : $y'' + 9y = \cos 2x \cos x$ (06 Marks)

OR

- 6 a. Solve : $(D^3 - 2D^2 + 4D - 8)y = 0$ (07 Marks)
- b. Solve : $(D^2 - 4D + 13)y = e^{2x}$ (07 Marks)
- c. Solve : $(D^2 - 8D + 9)y = 8 \sin 5x$ (06 Marks)

Module-4

- 7 a. Form the PDE, by eliminating the arbitrary function from $z = f(x^2 + y^2)$ (07 Marks)
- b. Solve : $\frac{\partial^2 z}{\partial x \partial y} = x^2 y$, by direct integration. (07 Marks)
- c. Solve : $\frac{\partial^2 z}{\partial x^2} - a^2 z = 0$ under the conditions $z = 0$ and $\frac{\partial z}{\partial x} = a \sin y$ when $x = 0$. (06 Marks)

OR

- 8 a. Solve the equation $\frac{\partial^2 z}{\partial x^2} + z = 0$, given that $z = e^y$ and $\frac{\partial z}{\partial x} = 1$ when $x = 0$. (07 Marks)
- b. Solve : $\frac{\partial^2 z}{\partial x \partial y} = \frac{x}{y}$ subject to the conditions $\frac{\partial z}{\partial x} = \log_e x$ when $y = 1$ and $z = 0$ when $x = 1$. (07 Marks)
- c. Form the PDE, by eliminating the arbitrary constants a and b from the equation :
 $z = a \log(x^2 + y^2) + b$ (06 Marks)

Module-5

- 9 a. In a certain computer centre, 47% of the programmers can program in FORTRAN 35% in PASCAL and 20% in COBOL and every programmer can program in at least one of these languages. If the probability that a randomly chosen programmer can program in FORTRAN and PASCAL is 0.23, COBOL and FORTRAN is 0.12, PASCAL and COBOL is 0.11, determine the probability that a randomly chosen programmer can program in all three languages. (07 Marks)

- b. Three students x, y, z write an examination. Their chances of passing are $\frac{1}{2}, \frac{1}{3}$ and $\frac{1}{4}$ respectively. Find the probability that, (i) All of them pass (ii) at least one of them passes and (iii) at least two of them pass. (07 Marks)
- c. A person is known to speak truth 3 out of 4 times. He throws a die and reports that the die shows a six. Find the probability that it is actually a SIX. (06 Marks)

OR

- 10 a. Find the probability that the birth days of 5 persons chosen at random will fall in 12 different calendar months. (07 Marks)
- b. If A and B are events with $P(A \cup B) = \frac{7}{8}$, $P(A \cap B) = \frac{1}{4}$, $P(A \cap \bar{B}) = \frac{1}{3}$, find $P(A)$, $P(B)$ and $P(\bar{A} \cap B)$. (07 Marks)
- c. Given $P(A) = \frac{1}{4}$, $P(B) = \frac{1}{3}$ and $P(A \cup B) = \frac{1}{2}$, evaluate $P\left(\frac{A}{B}\right)$, $P\left(\frac{B}{A}\right)$, $P(A \cap \bar{B})$ and $P\left(\frac{A}{\bar{B}}\right)$. (06 Marks)
