$S_{2(PCA02C12)}$ MCA

Enrolment No. ☐☐☐☐☐☐☐☐

MCA 2nd Semester End Term Examination-2022
Name of the Subject: Mathematical Foundations
Code No: PCA02C12

Full Marks: 50

Symbols used here have their usual meanings

Time: 2 hours

GROUP- A

Answer all the questions:

Marks: 10

1. Give one example of each discrete and continuous random variable.
2. Is every uncorrelated random variables are independent? Justify.
3. What is stationary point and saddle point?
4. Find out the characteristic equation of $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$.
5. Solve the difference equation $u_{n+2} - 4u_{n+1} + 4u_n = 0$.
6. Define consistency and inconsistency of the system of linear equations.

[1+2+2+1+2+2]=10

GROUP- B

Answer all the questions:

Marks: 20

1. A) Find the Eigen values and the corresponding Eigen vectors of the Matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$.

   B) Solve: $(D^2 + 3D + 2)y = e^{e^x}$

[7+3]=10

2. A) Investigate for which values of λ and μ, the system of equations

$$x + 4y + 2z = 1,$$
$$2x + 7y + 5z = 2\mu,$$
$$4x + \lambda y + 10z = 2\mu + 1$$

will have **(i)** no solution, **(ii)** a unique solution and **(iii)** an infinite number of solution.

   B) Solve the difference equation, $u_{x+2} - 8u_{x+1} + 25u_x = 2x^2 + x + 1$.

[5+5]=10

GROUP- C

Answer all the questions:

Marks: 20

1. A) State Euler's theorem and hence find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}$, if $u = sin^{-1}\left(\frac{x+2y+3z}{x^8+y^8+z^8}\right)$.

   B) Show that the rectangular solid of maximum volume that can be inscribed in a sphere is a cube, by Lagrange's multiplier.

[5+5=10]

2. A) There are six hundred Economics students in the post-graduate classes of a university, and the probability for any student to need a copy of a particular book from the university library on any day is **0.05**. How many copies of the book should be kept in the university library so that the probability may be greater than **0.90** that none of the students needing a copy from the library has to come back disappointed?

   B) In a partially destroyed laboratory, records of an analysis of correlation data, the following results only are legible:
   Variance of **X = 9**; Regression equations: **8X – 10Y +66 = 0 and 40X – 18Y = 214.**
   Find (i) the mean values of X and Y.
   (ii) the correlation coefficient between X and Y.
   (iii) the standard deviation of Y.

[5+5=10]

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$S_{2(PCA02C12)}$ MCA

MCA 2nd Semester Mid Term Examination-2022
Name of Subject: Mathematical Foundations
Code No: PCA02C12

Full Marks: 20 **Time: 1 hour**

Symbols used here have their usual meanings

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Answer all the following questions:

GROUP- A [4 Marks]

Answer the following questions: 4×1=4

1. Write down the general form of non-homogeneous linear differential equations of higher order with constant coefficients.
2. Find out the complementary function of the following differential equation

$$(4D^2 - 4D + 1)y = e^{\frac{x}{2}}$$

3. At which point maximum height of the normal curve is attained?
4. If ce^{-ax} is a p.d.f for $0 < x < \infty$, what is the value of c?

GROUP- B [8 Marks]

Answer the following questions: 4×2=8

1. Find out the particular integral of $(x^2D^2 + 5xD + 3)y = \frac{logx}{x^2}$
2. Solve :$(9x^2D^2 + 3xD + 10)y = 0$
3. If X is a random variable with $E(X) = 3$ and $E(X^2) = 13$, find the lower bound of $P(-2 < X < 8)$ using Chebychev's inequality.
4. The probability of getting no misprint in a page of a book is e^{-4}. Determine the probability that a page of a book contains more than 2 misprints.

GROUP- C [8 Marks]

Answer the following questions: 2×4=8

1. Solve the following ODE by finding the C.F and P. I

$$(D^2 + 3D + 2)y = xe^x sinx$$

2. In four tosses of a coin, let X be the number of heads. Tabulate the all possible outcomes with the corresponding values of X. By simple counting, derive the probability distribution of X and hence calculate the expected value of X.

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