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# DEPARTMENT OF MATHEMATICS

## III SEMESTR B.TECH. (CIVIL ENGINEERING)

## MAKE UP END SEMESTER EXAMINATION

Subject: ENGINEERING MATHEMATICS III MAT 2125

Date of Examination: 12/1/2024 Time: 9.30 AM to 12.30 PM MAX.MARKS: 50

| Q. No | Question | M | CO | PO | Blooms Taxonomy |
|---|---|---|---|---|---|
| 1A | Express $f(x) = \frac{x}{2}$ as a Fourier series in the interval $-\pi < x < \pi$. | 4 | 1 | | 1,2,3 |
| 1B | Find the half range Fourier cosine series for $f(x) = x(1-x), 0 \le x \le 1$. | 3 | 1 | | 2,3 |
| 1C | In a class 70% are boys and 30% are girls. 5% of boys, 3% of the girls are irregular to the classes. If an irregular student is selected at random, what is the probability that the student is a girl? | 3 | 2 | | 2,3 |
| 2A | Find the Fourier Transform of $f(x) = \begin{cases} a - \lvert x \rvert, & \lvert x \rvert < a \\ 0, & \lvert x \rvert > a > 0 \end{cases}$. | 4 | 1 | | 2,3 |
| 2B | A number is chosen at random from 1, 2, …50. Find the probability that the chosen number is divisible by 6 or divisible by 8. | 3 | 2 | | 1,2,3 |
| 2C | If A and B are any two events, prove that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. | 3 | 2 | | 1,2,3 |
| 3A | A two-dimensional random variable $(X, Y)$ has joint pdf $f(x) = \begin{cases} 2 - x - y, & 0 < x < 1, 0 < y < 4 \\ 0 & otherwise \end{cases}$. Compute the coefficient of correlation between X and Y. | 4 | 3 | | 2,3 |

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|---|---|---|---|---|---|
| **3B** | A box contains 12 balls of which 3 are white and 9 are red. A sample of 3 balls is selected from the box. Let X denote the number of white balls in the sample. Find the p.d.f. of X. Hence find the mean of the distribution. | **3** | **3** | | 2,3 |
| **3C** | Prove that $div(curl\vec{A}) = 0$ where $\vec{A} = xi + yj + zk$. | **3** | **4** | | 2,3 |
| **4A** | Find the value of the constant 'a' such that $\vec{f} = (axy - z^3)i + (a-2)x^2j + (1-a)xz^2k$ is irrotational and hence find a scalar function such that $\nabla\emptyset = \vec{f}$ | **4** | **4** | | 2,3 |
| **4B** | Evaluate $\int_C f.dr$ where $f = (2xy + z^3)i + x^2j + 3xz^2k$ along the straight line joining $(1,-2,1)$ and $(3,1,4)$. | **3** | **4** | | 2,3 |
| **4C** | Solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$ where $u(x,0) = 6e^{-3x}$ by the method of separation of variables | **3** | **5** | | 2,3 |
| **5A** | Verify Stoke's theorem for the function $f = (x^2 - y^2)i + 2xyj$ over the rectangle in the XY plane bounded by $x = 0, x = a, y = 0, y = b$. | **4** | **3** | | 2,3 |
| **5B** | Derive one dimensional heat equation. | **3** | **5** | | 1,2,3 |
| **5C** | Form the differential equation from $\emptyset(x + y + z, x^2 + y^2 - z^2) = 0$. | **3** | **5** | | 2,3 |