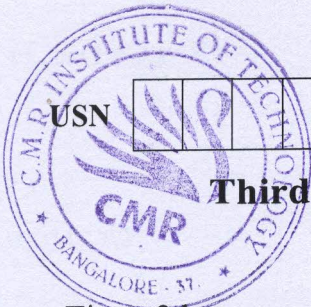


CBCS SCHEME

17MATDIP31



Third Semester B.E. Degree Examination, June/July 2024 Additional Mathematics - I

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- Find the sine of the angle between $\vec{a} = 2\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + 2\hat{k}$. (08 Marks)
 - Express the complex number $\frac{(1+i)(1+3i)}{1+5i}$ in the form $a + ib$. (06 Marks)
 - Find the modulus and amplitude of $\frac{(1+i)^2}{3+i}$. (06 Marks)

OR

- Show that $(1 + \cos\theta + i\sin\theta)^n + (1 + \cos\theta - i\sin\theta)^n = 2^{n+1} \cdot \cos^n\left(\frac{\theta}{2}\right) \cdot \cos\left(\frac{n\theta}{2}\right)$. (08 Marks)
 - If $\vec{a} = 2\hat{i} + 3\hat{j} - 4\hat{k}$ and $\vec{b} = 8\hat{i} - 4\hat{j} + \hat{k}$, then prove that \vec{a} is perpendicular to \vec{b} . Also find $|\vec{a} \times \vec{b}|$. (06 Marks)
 - Determine λ such that $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} - 4\hat{k}$ and $\vec{c} = \hat{i} + \lambda\hat{j} + 3\hat{k}$ are coplanar. (06 Marks)

Module-2

- If $y = e^{a\sin^{-1}x}$ then prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2+a^2)y_n = 0$. (08 Marks)
 - Find the angle between the curves $r = \frac{a}{1+\cos\theta}$ and $r = \frac{b}{1-\cos\theta}$. (06 Marks)
 - If $u = \log\left(\frac{x^4 + y^4}{x+y}\right)$ then show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3$. (06 Marks)

OR

- Using Maclaurin's series expand $\sin x$ upto the term containing x^5 . (08 Marks)
 - Find the pedal equation of the curve $r^m \cos m\theta = a^m$. (06 Marks)
 - If $u = x + y + z$, $v = y + z$, $w = z$ then find $\frac{\partial(u, v, w)}{\partial(x, y, z)}$. (06 Marks)

Module-3

- Obtain a reduction formula for $\int_0^{\pi/2} \cos^n x dx$, ($n > 0$). (08 Marks)
 - Evaluate $\int_0^a \frac{x^7}{\sqrt{a^2 - x^2}} dx$. (06 Marks)
 - Evaluate $\int_1^2 \int_1^3 \int_1^3 xy^2 dx dy$. (06 Marks)

OR

- 6 a. Obtain a reduction formula for $\int_0^{\pi/2} \sin^n x dx$, ($n > 0$). (08 Marks)
- b. Evaluate $\int_0^{2a} x^2 \sqrt{2ax - x^2} dx$ (06 Marks)
- c. Evaluate $\int_{-1}^1 \int_0^z \int_{x-z}^{x+z} (x + y + z) dx dy dz$ (06 Marks)

Module-4

- 7 a. A particle moves along the curve $\vec{r} = \cos 2t \hat{i} + \sin 2t \hat{j} + t \hat{k}$. Find the components of velocity and acceleration at $t = \frac{\pi}{8}$ along $\sqrt{2} \hat{i} + \sqrt{2} \hat{j} + \hat{k}$. (08 Marks)
- b. Find divergence and curl of the vector $\vec{F} = (xyz + y^2z) \hat{i} + (3x^2 + y^2z) \hat{j} + (xz^2 - y^2z) \hat{k}$. (06 Marks)
- c. Find the directional derivative of $\phi = x^2yz^3$ at $(1, 1, 1)$ in the direction of $\hat{i} + \hat{j} + 2\hat{k}$. (06 Marks)

OR

- 8 a. Find the angle between the tangents to the curve $x = t^2, y = t^3, z = t^4$ at $t = 2$ and $t = 3$. (08 Marks)
- b. Find $\text{curl}(\text{curl} \vec{A})$ where $\vec{A} = xy \hat{i} + y^2z \hat{j} + z^2y \hat{k}$. (06 Marks)
- c. Find the constants a, b, c such that the vector field $(\sin y + az) \hat{i} + (bx \cos y + z) \hat{j} + (x + cy) \hat{k}$ is irrotational. (06 Marks)

Module-5

- 9 a. Solve: $(x^2 - y^2)dx - xy dy = 0$. (08 Marks)
- b. Solve: $(1 + y^2)dx = (\tan^{-1}y - x)dy$. (06 Marks)
- c. Solve: $(x^2 + y^2 + 1)dx + 2xy dy = 0$. (06 Marks)

OR

- 10 a. Solve: $x^2y dx - (x^3 + y^3)dy = 0$. (08 Marks)
- b. Solve: $\left\{y\left(1 + \frac{1}{x}\right) + \cos y\right\}dx + (x + \log x - x \sin y)dy = 0$. (06 Marks)
- c. Solve: $(x+1) \frac{dy}{dx} - ye^{3x}(x+1)^2 \frac{dy}{dx} + \frac{y}{x} = 1$. (06 Marks)

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