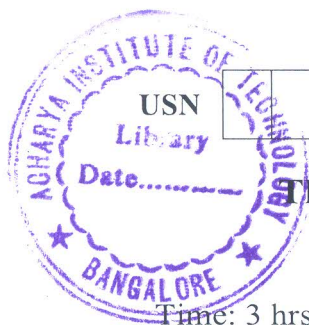


CBCS SCHEME



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17MATDIP31

Third Semester B.E. Degree Examination, July/August 2021 Additional Mathematics – I

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1
 - a. Find the modulus and amplitude of $\frac{4+2i}{2-3i}$. (06 Marks)
 - b. Find a unit vector normal to both the vectors $4i - j + 3k$ and $-2i + j - 2k$. Find also sine of the angle between them. (07 Marks)
 - c. Show that $\left[\vec{a} + \vec{b}, \vec{b} + \vec{c}, \vec{c} + \vec{a} \right] = 2 \left[\vec{a}, \vec{b}, \vec{c} \right]$. (07 Marks)

- 2
 - a. Express $(2+3i) + \frac{1}{1-i}$ in $x+iy$ form. (06 Marks)
 - b. Find the modulus and amplitude of $1 + \cos\theta + i\sin\theta$. (07 Marks)
 - c. Find λ so that $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{c} = \hat{j} + \lambda\hat{k}$ are coplanar. (07 Marks)

- 3
 - a. Find the n^{th} derivative of $e^{ax} \cos(bx + c)$. (06 Marks)
 - b. Find the angle of intersection of the curves $r = \sin\theta + \cos\theta$ and $r = 2\sin\theta$. (07 Marks)
 - c. If, $z = f(x, y)$ where $x = e^u + e^{-v}$, $y = e^{-u} - e^v$. Prove that $x \frac{\partial z}{\partial x} - y \frac{\partial z}{\partial y} = \frac{\partial z}{\partial u} - \frac{\partial z}{\partial v}$. (07 Marks)

- 4
 - a. If $y = \tan^{-1} x$, then show that $(1+x^2)y_{n+2} + 2(n+1)xy_{n+1} + n(n+1)y_n = 0$. (06 Marks)
 - b. Find the pedal equation for the curve $\frac{2a}{r} = 1 + \cos\theta$. (07 Marks)
 - c. If, $u = x^2 + y^2 + z^2$, $v = xy + yz + zx$, $w = x + y + z$, then find $\frac{\partial(u, v, w)}{\partial(x, y, z)}$. (07 Marks)

- 5
 - a. Obtain the reduction formula for $\int \cos^n x dx$. (06 Marks)
 - b. Using reduction formula, find the value of $\int_0^1 x^2(1-x^2)^{\frac{3}{2}} dx$. (07 Marks)
 - c. Evaluate $\int_{-1}^1 \int_0^{2-x} \int_{x-z}^z (x+y+z) dx dy dz$. (07 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.

- 6 a. Evaluate $\int_0^{\pi} x \sin^8 x \, dx$. (06 Marks)
- b. Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} x^3 y \, dx \, dy$. (07 Marks)
- c. Evaluate $\int_0^{\pi} x \sin^2 x \cos^4 x \, dx$. (07 Marks)
- 7 a. A particle moves along the curve $\vec{r} = 3t^2\hat{i} + (t^3 - 4t)\hat{j} + (3t + 4)\hat{k}$. Find the component of velocity and acceleration at $t = 2$ in the direction of $\hat{i} - 2\hat{j} + 2\hat{k}$. (06 Marks)
- b. Find the angle between the tangents to the surface $x^2y^2 = z^4$ at $(1, 1, 1)$ and $(3, 3, -3)$. (07 Marks)
- c. Find $\text{div } \vec{F}$ and $\text{curl } \vec{F}$ where $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$. (07 Marks)
- 8 a. Find the angle between the tangents and to the curve $\vec{r} = \left(t - \frac{t^3}{3}\right)\hat{i} + t^2\hat{j} + \left(t + \frac{t^3}{3}\right)\hat{k}$ at $t = \pm 3$. (06 Marks)
- b. Find the directional derivative of $f = x^2yz + 4xz^2$ at $(1, -2, -1)$ along $2\hat{i} - \hat{j} - 2\hat{k}$. (07 Marks)
- c. Prove that $\text{div}(\text{curl } \vec{F}) = 0$. (07 Marks)
- 9 a. Solve $\frac{dy}{dx} = e^{3x-2y} + x^2e^{-2y}$. (06 Marks)
- b. Solve $x^2y \, dx - (x^3 + y^3) \, dy = 0$. (07 Marks)
- c. Solve $\frac{dy}{dx} - \frac{2y}{x} = x + x^2$. (07 Marks)
- 10 a. Solve $x \, dy - y \, dx = \sqrt{x^2 + y^2} \, dx$. (06 Marks)
- b. Solve $(5x^4 + 3x^2y^2 - 2xy^3) \, dx + (2x^3y - 3x^2y^2 - 5y^4) \, dy = 0$. (07 Marks)
- c. Solve $\frac{dy}{dx} - \frac{y}{x+1} = e^{3x}(x+1)$. (07 Marks)
