CBCS SCHEME

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17MATDIP31

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 100

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

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.

Module-1

1 a. Find the modulus and amplitude of $\dfrac{(3-\sqrt{2}i)^2}{1+2i}$ **(07 Marks)**

b. Show that $\left(\dfrac{\cos\theta + i\sin\theta}{\sin\theta + i\cos\theta}\right)^4 = \cos 8\theta + i\sin 8\theta$ **(06 Marks)**

c. If $\vec{a} = 3i - 2j + 4k$ and $\vec{b} = i + j - 2k$ find the angle between vector $\vec{a}$ and $\vec{b}$ **(07 Marks)**

OR

2 a. Find the value of λ such that the vectors $\vec{a} = 2i - 3j + k$, $\vec{b} = i + 2j - 3k$, $\vec{c} = j + \lambda k$ are co-planar. **(07 Marks)**

b. Find the real part of $\dfrac{1}{(1+\cos\theta) + i\sin\theta}$ **(06 Marks)**

c. If $\vec{A} = i - 2j - 3k$, $\vec{B} = 2i + j - k$, $\vec{C} = i + 3j - k$ find,
i) $(\vec{A}\times\vec{B})\times(\vec{B}\times\vec{C})$ ii) $(\vec{A}\times\vec{B})\cdot\vec{C}$ **(07 Marks)**

Module-2

3 a. Find the nth derivative of $\sin^3 x \cos^2 x$. **(07 Marks)**

b. If $Y = a\cos(\log x) + b\sin(\log x)$, find the value of $x^2 y_{n+2} + (2n+1)x y_{n+1} + (n^2+1) y_n = 0$ **(06 Marks)**

c. Find the angel between the curves $r = a(1+\cos\theta)$ and $r = b(1-\cos\theta)$. **(07 Marks)**

OR

4 a. Obtain by Maclaurins theorem the first four terms of log sec x. **(07 Marks)**

b. If $u = f(y-z, z-x, x-y)$ then find the value of $u_x + u_y + u_z$. **(06 Marks)**

c. If $u = \dfrac{yz}{x}$, $v = \dfrac{xz}{y}$, $w = \dfrac{xy}{z}$ find $\dfrac{\partial(u,v,w)}{\partial(x,y,z)}$ **(07 Marks)**

Module-3

5 a. Obtain the reduction formula for $\int \sin^n x\, dx$ and hence find $\int \sin^5 x\, dx$ **(07 Marks)**

b. Evaluate $\int_0^{\infty} \frac{x^2}{(1+x^2)^{7/2}} dx$ **(06 Marks)**

c. Evaluate $\int_1^2 \int_3^4 (xy + e^y)\, dy dx$ **(07 Marks)**

OR

6 a. Evaluate $\int_0^{\pi/6} \cos^4 3\theta \sin^3 6\theta\, d\theta$ **(07 Marks)**

b. Evaluate $\int_1^3 \int_{1/x}^1 \int_0^{\sqrt{xy}} xyz\, dz\, dy\, dx$ **(06 Marks)**

c. Evaluate $\int_0^{2a} x^2 \sqrt{2ax - x^2}\, dx$ **(07 Marks)**

Module-4

7 a. A particle moves along the curve $x = 1 - t^3$, $y = 1 + t^2$, $z = 2t - 5$, find the components of velocity and acceleration at $t = 1$ along the direction $2i + j + 2k$. **(07 Marks)**

b. Find the directional derivative of x^2yz^3 at (1, 1, 1) in the direction of $i + j + 2k$. **(06 Marks)**

c. If $\vec{F} = \text{Grad}(x^3y + y^3z + z^3x - x^2y^2z^2)$ then find div $\vec{F}$ at (1,1,1) **(07 Marks)**

OR

8 a. If $\vec{V} = 3xy^2z^3 i + y^3z^2 j - 2y^2z^3 k$ and $\vec{F} = (x^2yz)i + (y^2 - zx)j + (z^2 - xy)k$ then prove that $\vec{V}$ is solenoidal and $\vec{F}$ is irrotational. **(07 Marks)**

b. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at (2, 1, -2). **(06 Marks)**

c. Find the constants a, b, c such that $\vec{F} = (x + y + az)i + (bx + 2y - z)j + (x + cy + 2z)k$ is irrotational also find ϕ such that $\vec{F} = \nabla\phi$. **(07 Marks)**

Module-5

9 a. Solve the differential equation
$e^{-y} \sec^2 y\, dy = dx + x\, dy$ **(07 Marks)**

b. Solve $(y^2 + 2xy)\, dx + (2x^2 + 3xy)\, dy = 0$ **(06 Marks)**

c. Solve $(1 + x^3)\frac{dy}{dx} + 6x^2y = e^x$ **(07 Marks)**

OR

10 a. Solve $y(2x - y + 1)\, dx + x(3x - 4y + 3)\, dy = 0$ **(07 Marks)**

b. Solve $e^y\left(\frac{dy}{dx} + 1\right) = e^x$ **(06 Marks)**

c. Solve $xy(1 + xy^2)\frac{dy}{dx} = 1$ **(07 Marks)**

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