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.

Module-1

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

b. Show that $\left(\frac{\cos\theta+i\sin\theta}{\sin\theta+i\cos\theta}\right)^4 = \cos 8\theta + i\sin 8\theta$ **(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 $\frac{1}{(1+\cos\theta)+i\sin\theta}$ **(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 $u = \frac{yz}{x}$, $v = \frac{xz}{y}$, $w = \frac{xy}{z}$ find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ **(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 $\vec{V} = 3xy^2z^3i + y^3z^2j - 2y^2z^3k$ 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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