CBCS SCHEME

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18MATDIP31

Third Semester B.E. Degree Examination, Feb./Mar. 2022
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 the complex number : $\frac{(2-3i)(2+i)^2}{1+i}$. **(07 Marks)**

b. Prove that $\left(\frac{1+\cos\theta+i\sin\theta}{1+\cos\theta-i\sin\theta}\right)^n = \cos n\theta + i\sin n\theta$. **(06 Marks)**

c. Show that the vectors $\vec{a}-2\vec{b}+3\vec{c},\ -2\vec{a}+3\vec{b}-4\vec{c},\ -\vec{b}+2\vec{c}$ are coplanar. **(07 Marks)**

OR

2 a. Given $\vec{a}=2\hat{i}+2\hat{j}-\hat{k},\ \vec{b}=6\hat{i}-3\hat{j}+2\hat{k}$. Find : i) $\vec{a}\cdot\vec{b}$ ii) $\vec{a}\times\vec{b}$ iii) $|\vec{a}\times\vec{b}|$. **(07 Marks)**

b. Determine the value of λ, so that $\vec{a}=2\hat{i}+\lambda\hat{j}-\hat{k}$, and $\vec{b}=4\hat{i}-2\hat{j}-2\hat{k}$, are perpendicular. **(06 Marks)**

c. Express $1-i\sqrt{3}$ in the polar form and hence find its modulus and amplitude. **(07 Marks)**

Module-2

3 a. Using Euler's theorem, prove that $xu_x + yu_y = -3\cot u$ where $u=\sin^{-1}\left(\frac{x^2y^2}{x+y}\right)$. **(07 Marks)**

b. Using Maclaurin's series, prove that $\sqrt{1+\sin 2x} = 1+x-\frac{x^2}{2}-\frac{x^3}{3}+\frac{x^4}{24}+\ldots$. **(06 Marks)**

c. If $u = x + 3y^2$, $v = 4x^2yz$, $w = 2z^2 - xy$, evaluate $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at the point (1, –1, 0). **(07 Marks)**

OR

4 a. Obtain Maclaurin's series expansion for the function e^x upto x^4. **(07 Marks)**

b. If $u=\sin^{-1}\left[\frac{x^3+y^3}{x+y}\right]$ prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=2\tan u$. **(06 Marks)**

c. If $u=f\left(\frac{x}{y},\frac{y}{z},\frac{z}{x}\right)$, prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z}=0$. **(07 Marks)**

Module-3

5 a. A particle moves along the curve $x = (1 - t^3)$, $y = (1 + t^2)$, $z = (2t - 5)$ determine its velocity and acceleration at t = 1 sec. **(07 Marks)**

b. If $\vec{F}=2x^2\hat{i}-3yz\hat{j}+xz^2\hat{k}$, and $\phi=2z-x^3y$, find $\vec{F}\cdot(\nabla\phi)$ and $\vec{F}\times(\nabla\phi)$ at (1, –1, 1). **(06 Marks)**

c. Find the constants a, b, c so that $\vec{f}=(x+2y+az)\hat{i}+(bx-3y-z)\hat{j}+(4x+cy+2z)\hat{k}$ is irrotational. **(07 Marks)**

OR

6 a. Find the directional derivate of $\phi = x^2yz + 4xz^2$ at (1,–2,–1) along $\vec{a} = 2\hat{i} - \hat{j} - 2\hat{k}$ **(07 Marks)**

b. Find curl $\vec{f}$ given that $\vec{f} = xyz^2\hat{i} + xy^2z\hat{j} + x^2yz\hat{k}$. **(06 Marks)**

c. If $\vec{f} = x^2i + y^2j + z^2k$ and $\vec{g} = yzi + zxj + xyk$. Show that $\vec{f} \times \vec{g}$ is a solenoidal vector. **(07 Marks)**

Module-4

7 a. Obtain the reduction formula, $I_n = \int \cos^n x dx$, where n is a positive integer. **(07 Marks)**

b. Evaluate $\int_0^1 \int_x^{\sqrt{x}} xydydx$. **(06 Marks)**

c. Evaluate $\int_0^1 \int_0^1 \int_0^1 (x+y+z)dxdydz$. **(07 Marks)**

OR

8 a. Evaluate : $\int_0^{\pi/6} \sin^6(3x)dx$. **(07 Marks)**

b. Evaluate : $\int_0^{\pi} x \sin^4 x \cos^6 x \, dx$. **(06 Marks)**

c. Evaluate $\int_0^1 \int_0^1 \int_0^y xyz \, dxdydz$. **(07 Marks)**

Module-5

9 a. Solve : $(2x + y + 1)\,dx + (x + 2y + 1)\,dy = 0$. **(07 Marks)**

b. Solve : $(4xy + 3y^2 - x)\,dx + (x^2 + 2xy)\,dy = 0$. **(06 Marks)**

c. Solve : $y(2xy + e^x)\,dx - e^x\,dy = 0$. **(07 Marks)**

OR

10 a. Solve : $(5x^4 + 3x^2y^2 - 2xy^3)dx + (2x^3y - 3x^2y^2 - 5y^4)dy = 0$. **(07 Marks)**

b. Solve : $y(2xy + 1)dx - x\,dy = 0$. **(06 Marks)**

c. Solve : $\frac{dy}{dx} + y\cot x = \cos x$. **(07 Marks)**

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