



CBCS SCHEME

15MATDIP31

Third Semester B.E. Degree Examination, Aug./Sept.2020 Additional Mathematics – I

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Express $\frac{5+2i}{5-2i}$ in the form $xi + iy$. (06 Marks)
- b. Find the modulus and amplitude of $\frac{(1+i)^2}{3+i}$ (05 Marks)
- c. If $\vec{a} = (3, -1, 4)$, $\vec{b} = (1, 2, 3)$, $\vec{c} = (4, 2, -1)$ find $\vec{a} \times (\vec{b} \times \vec{c})$ (05 Marks)

OR

- 2 a. Prove that $(1 + \cos \theta + i \sin \theta)^n + (1 + \cos \theta - i \sin \theta)^n = 2^{n+1} \cos^n \frac{\theta}{2} \cdot \cos \frac{n\theta}{2}$. (06 Marks)
- b. Find the sine of angle between $\vec{a} = 2i - 2j + k$ and $\vec{b} = i - 2j + 2k$ (05 Marks)
- c. Find the value of λ , so that the vector $\vec{a} = 2i - 3j + k$, $\vec{b} = i + 2j - 3k$ and $\vec{c} = j + \lambda k$ are coplanar. (05 Marks)

Module-2

- 3 a. If $y = \tan^{-1}x$, prove that $(1+x^2)y_{n+2} + 2(n+1)xy_{n+1} + n(n+1)y_n = 0$ (06 Marks)
- b. Find the angle between the radius vector and tangent to the curve $r = a(1 - \cos \theta)$ (05 Marks)
- c. If $u = \sin^{-1}\left(\frac{x^3 + y^3}{x + y}\right)$ prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 2 \tan u$. (05 Marks)

OR

- 4 a. Find the pedal equation of the curve $r = 2(1 + \cos \theta)$ (06 Marks)
- b. Find the total derivative of $u = x^3y^2$, where $x = e^t$, $y = \log t$. (05 Marks)
- c. Obtain the Maclaurin's series expansion of the function $\sin x$. (05 Marks)

Module-3

- 5 a. Evaluate $\int_0^\pi x \cos^6 x \, dx$ (06 Marks)
- b. Evaluate $\int_0^1 \int_0^3 x^3 y^3 \, dx \, dy$ (05 Marks)
- c. Evaluate $\int_0^1 \int_0^1 \int_0^1 (x + y + z) \, dx \, dy \, dz$ (05 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.

OR

- 6 a. Evaluate $\int_0^{\pi/2} \sin^6 x \cos^5 x \, dx$ using Reduction formula. (06 Marks)
- b. Evaluate $\int_0^1 \int_x^{\sqrt{x}} xy \, dy \, dx$ (05 Marks)
- c. Evaluate $\int_0^1 \int_0^1 \int_0^y xyz \, dx \, dy \, dz$ (05 Marks)

Module-4

- 7 a. A particle moves along the curve $\vec{r} = (t^3 - 4t)\mathbf{i} + (t^2 + 4t)\mathbf{j} + (8t^2 - 3t^3)\mathbf{k}$. Determine the velocity and acceleration at $t = 2$. (06 Marks)
- b. Find the directional derivative of $\phi = x^2yz + 4xz^2$ at $(1, -2, -1)$ in the direction of $2\mathbf{i} - \mathbf{j} - 2\mathbf{k}$. (05 Marks)
- c. Find the constants a and b , such that $\vec{F} = (axy + z^3)\mathbf{i} + (3x^2 - z)\mathbf{j} + (bxz^2 - y)\mathbf{k}$ is irrotational. (05 Marks)

OR

- 8 a. Find the angle between the tangents to the curve $x = t^2 + 1, y = 4t - 3, z = 2t^2 - 6t$ at $t = 1$ and $t = 2$. (06 Marks)
- b. Find $\text{div} \vec{F}$ and $\text{curl} \vec{F}$ where $\vec{F} = (3x^2 - 3yz)\mathbf{i} + (3y^2 - 3xz)\mathbf{j} + (3z^2 - 3xy)\mathbf{k}$ (05 Marks)
- c. Find 'a' for which $\vec{F} = (x + 3y)\mathbf{i} + (y - 2z)\mathbf{j} + (x + az)\mathbf{k}$ is solenoidal. (05 Marks)

Module-5

- 9 a. Solve $\frac{dy}{dx} = 1 + \frac{y}{x} + \left(\frac{y}{x}\right)^2$ (06 Marks)
- b. Solve $x^2 \frac{dy}{dx} = 3x^2 - 2xy + 1$ (05 Marks)
- c. Solve $(x^2 + y)dx + (y^3 + x)dy = 0$ (05 Marks)

OR

- 10 a. Solve $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$ (06 Marks)
- b. Solve $x \frac{dy}{dx} = y + x \cos^2\left(\frac{y}{x}\right)$ (05 Marks)
- c. Solve $(x^4 + y^2)dy = 4x^3y \, dx$ (05 Marks)
