

CBCS SCHEME

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15MATDIP31

43 · Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Additional Mathematics — I

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Find modulus and amplitude of $1 - \cos 9 + i \sin 9$. (05 Marks)
- b. Express $\frac{3+4i}{3-4i}$ in $a + ib$ form. (05 Marks)
- c. Find the value of 'X,' so that the points A(-1, 4, -3), B(3., 2, -5), C(-3, 8, -5) and D(-3, I), may lie on one plane. (06 Marks)

OR

- 2 a. Find the angle between the vectors $a = 5j + k$ and $b = 23j + 6k$. (05 Marks)
- b. Prove that $|a \times b, b \times c, c \times a| = |a| |b| |c|$ (05 Marks)
- c. Find the real part of $\frac{1}{1 + \cos \theta + i \sin \theta}$ (06 Marks)

Module-2

- 3 a. Obtain the n^{th} derivative of $\sin(ax + b)$. (05 Marks)
- b. Find the pedal equation of $r = a \cos \theta$ (05 Marks)
- c. If $u = \frac{yz}{x}$, $v = \frac{zx}{y}$, $w = \frac{xy}{z}$, show that $\frac{a(u, v, w)}{a(x, y, z)}$ (06 Marks)

OR

- 4 a. If $u = \frac{x^2 + y^2}{x + y}$ show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 3u$. (05 Marks)
- b. If $u = y, y = z - x$, show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$. (05 Marks)
- c. If $y = a \cos(\log x) + b \sin(\log x)$, show that $x^2 y_{,,} + (2n + 1)xy_{,i} + (n^2 + 1)y_{,,} = 0$ (06 Marks)

Module-3

- 5 a. Evaluate $\int_0^1 x \sin' x dx$ (05 Marks)
- b. Evaluate $\int x^2 (1 - x^2)^{3/2} dx$ (05 Marks)

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- c. Evaluate $\int_{-h}^b \int_{-a}^a f(x^2 + y^2 + z^2) dz dy dx$ (06 Marks)

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OR

- 6 a. Evaluate $\int_0^1 \int_1^2 \int_1^2 xy dy dx$ (05 Marks)
- b. Evaluate $\int_0^1 \int_1^2 \int_1^2 f(x+y+z) dx dy dz$ (05 Marks)
- c. Evaluate $\int_0^4 \frac{x}{(x^2+1)^4} dx$. (06 Marks)

Module-4

- 7 a. If $\mathbf{r} = (t^2 + 1)\mathbf{i} + (4t - 3)\mathbf{j} + (2t^2 - 6t)\mathbf{k}$ find the angle between the tangents at $t = 1$ and $t = 2$. (05 Marks)
- b. If $\mathbf{r} = e^t \mathbf{i} + 2\cos 3t \mathbf{j} + 2\sin 3t \mathbf{k}$, find the velocity and acceleration at any time t , and also their magnitudes at $t = 0$. (05 Marks)
- c. Show that $\mathbf{F} = (y+z)\mathbf{i} + (z+x)\mathbf{j} + (x+y)\mathbf{k}$ is irrotational. Also find a scalar function 'y' such that $\mathbf{F} = \nabla V$. (06 Marks)

OR

- 8 a. Find the unit normal vector to the surface $x^2y + 2xz = 4$ at $(2, -2, 3)$. (05 Marks)
- b. If $\mathbf{F} = xz^3\mathbf{i} - 2x^2yz\mathbf{j} + 2yz^4\mathbf{k}$ find $\nabla \cdot \mathbf{F}$ and $\nabla \times \mathbf{F}$ at $(1, -1, 1)$. (05 Marks)
- c. If $\frac{d}{dt}(ax + by) = wx + ay$ and $\frac{d}{dt}(bx - ay) = wx + by$, then show that $\frac{d}{dt}(ax + by) = wx + ay$. (06 Marks)

Module-5

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

OR

- 10 a. Solve $\frac{dy}{dx} + y \cot x = \cos x$ (05 Marks)
- b. Solve $x^2 y dx - (x^3 + y^2) dy = 0$ (05 Marks)
- c. Solve $y(x+y)dx + (x+2y-1)dy = 0$ (06 Marks)