

# CBCS SCHEME

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15MATDIP31

Third Semester B.E. Degree Examination, Jan./Feb. 2023

## Additional Mathematics – I

Time: 3 hrs.

Max. Marks: 80

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

### Module-1

- 1 a. Express :  $\frac{(1+i)(2+i)}{3+i}$  in the form  $a + ib$ . (05 Marks)
- b. Express :  $\frac{1+2i}{1-3i}$  in the polar form and their modulus and amplitude. (05 Marks)
- c. Find the values of  $(1+i)^{1/3}$ . (06 Marks)

OR

- 2 a. If  $\vec{a} = 4i + j + k$ ,  $\vec{b} = 2i + j + 2k$ ,  $\vec{c} = 3i + 4j + 5k$  find  $(\vec{a} + \vec{b}) \cdot (\vec{b} + \vec{c})$ . (05 Marks)
- b. Find the angle between the vectors  $\vec{a} = 2i + 6j + 3k$  and  $\vec{b} = 12i - 4j + 3k$ . (05 Marks)
- c. Find the constant  $\lambda$  such that the vectors  $\vec{a} = 2i - j + k$ ,  $\vec{b} = i + 2j - 3k$  and  $\vec{c} = 3i + \lambda j + 5k$  are coplanar. (06 Marks)

### Module-2

- 3 a. Find the  $n^{\text{th}}$  derivative of  $y = \sin(ax + b)$ . (05 Marks)
- b. With usual notation, prove that  $\tan \phi = r \cdot \frac{d\theta}{dr}$ . (05 Marks)
- c. State Euler's theorem on homogeneous function. If  $u = \frac{x^3 + y^3}{\sqrt{x} + \sqrt{y}}$  than prove that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{5}{2} u$ . (06 Marks)

OR

- 4 a. Find the pedal equation of the curve  $r^n = a^n \cos n\theta$ . (06 Marks)
- b. Obtain the Maclaurin's expansion of the function  $f(x) = \sin x + \cos x$  up to the terms containing fourth degree. (05 Marks)
- c. If  $Z = xy^2 + x^2y$  where  $x = at$ ,  $y = 2at$  find  $\frac{du}{dt}$  in terms of 't'. (05 Marks)

### Module-3

- 5 a. Evaluate :  $\int_0^1 \frac{x^9}{\sqrt{1-x^2}} dx$  by using Reduction formula. (05 Marks)
- b. Evaluate  $\int_0^\infty \frac{x^2 dx}{(1+x^6)^{7/2}}$  by using reduction formula. (05 Marks)
- c. Evaluate :  $\int_0^1 \int_x^{\sqrt{x}} xy dy dx$ . (06 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 :  $\int_0^{\pi} x \sin^8 x \, dx$ . (05 Marks)
- b. Evaluate :  $\int_0^2 \frac{x^4}{\sqrt{4-x^2}} \, dx$  by using reduction formula. (05 Marks)
- c. Evaluate :  $\int_0^3 \int_0^2 \int_0^1 (x+y+z) \, dz \, dx \, dy$ . (06 Marks)

**Module-4**

- 7 a. A particle moves along the curve  $C : x = t^3 - 4t, y = t^2 + 4t, z = 8t^2 - 3t^3$ . Determine the velocity and acceleration. (05 Marks)
- b. Find the angle between the surfaces  $x^2 + y^2 + z^2 = 9$  and  $x^2 + y^2 - z = 3$  at  $(2, -1, 2)$ . (05 Marks)
- c. If  $\vec{F} = (x+y+1)\mathbf{i} + \mathbf{j} - (x+y)\mathbf{k}$ . Show that  $\vec{F} \cdot \text{curl } \vec{F} = 0$ . (06 Marks)

OR

- 8 a. Find the angle between the tangents to the curve,  
 $\vec{r} = \left(t - \frac{t^3}{3}\right)\mathbf{i} + t^2\mathbf{j} + \left(t + \frac{t^3}{3}\right)\mathbf{k}$  at  $t = \pm 3$ . (05 Marks)
- b. Find the directional derivative of  $\phi = x^2yz + 4xz^2$  at  $(1, -2, -1)$  in the direction of the vector  $\vec{a} = 2\mathbf{i} - \mathbf{j} - 2\mathbf{k}$ . (05 Marks)
- c. Show that  $\vec{F} = (y+z)\mathbf{i} + (z+x)\mathbf{j} + (x+y)\mathbf{k}$  is irrotational. Also find a scalar point function  $\phi$  such that  $\vec{F} = \nabla\phi$ . (06 Marks)

**Module-5**

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

OR

- 10 a. Solve :  $\frac{dy}{dx} = \frac{y}{x - \sqrt{xy}}$ . (05 Marks)
- b. Solve :  $\frac{dy}{dx} + \frac{y}{x} = xy^2$ . (05 Marks)
- c. Solve  $(x^2 + y^2 + x) \, dx + xy \, dy = 0$ . (06 Marks)

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