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17MATDIP31

**Third Semester B.E. Degree Examination, Dec.2019/Jan.2020**  
**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

$$\frac{3+i}{2+i}$$

(07 Marks)

If  $x = \cos \theta + i \sin \theta$ , then show that  $x^n = \cos n\theta + i \sin n\theta$ .

(07 Marks)

- c. Simplify  $\frac{(\cos 30^\circ + i \sin 30^\circ)^4 (\cos 40^\circ + i \sin 40^\circ)^5}{(\cos 40^\circ + i \sin 40^\circ)^3 (\cos 50^\circ + i \sin 50^\circ)^4}$

(06 Marks)

**OR**

- 2 a. Find the sine of the angle between  $A = 2i + 3j - k$  and  $B = 6i - 3j + 2k$ . (07 Marks)

- b. Find the value of  $\lambda$ , so that the vectors  $a = 2i - 3j + k$ ,  $b = i + 2j - 3k$  and  $c = i + \lambda j + k$  are coplanar. (07 Marks)

- c. Prove that  $a \times (b \times c) + b \times (c \times a) + c \times (a \times b) = 0$ . (06 Marks)

**Module-2**

- 3 a. Find the  $n^{\text{th}}$  derivative of  $e^x \cos(bx + c)$ . (07 Marks)

- b. If  $y = a \cos(\log x) + b \sin(\log x)$  prove that  $x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$ . (07 Marks)

- c. If  $u = \sin^{-1} \frac{x-y}{x+y}$ , prove that  $x \frac{du}{dx} + y \frac{du}{dy} = \tan u$ . (06 Marks)

**OR**

- 4 a. Find the pedal equation of  $r = \cos n\theta$ . (07 Marks)

- b. Expand  $\log_e(1+x)$  in ascending powers of  $x$  as far as the term containing  $x^4$ . (07 Marks)

- c. If  $x = r \cos \theta$ ,  $y = r \sin \theta$ , find  $\frac{\partial^2(x,y)}{\partial(r,\theta)^2}$  (06 Marks)

**Module-3**

- 5 a. Evaluate  $\int_0^1 \int_0^1 (1+xy^2) dx dy$  (07 Marks)

- b. Evaluate  $\int_0^{\pi/4} \sin^4 x \cos^3 x dx$  (07 Marks)

- c. Evaluate  $\int_0^1 \ln(1+x) dx$  (06 Marks)

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OR

- 6 a. Evaluate  $\int_3^4 \int_1^2 (x^2 y + e^y) dy dx$  (07 Marks)
- b. Evaluate  $\int_0^{\pi} x \sin^5 x dx$  (07 Marks)
- c. Evaluate  $\int_0^2 \int_0^1 \int_0^1 (x^2 + y^2 + z^2) dx dy dz$  (06 Marks)

**Module-4**

- 7 a. If particle moves on the curve  $x = 2t^2$ ,  $y = t^2 - 4t$ ,  $z = 3t - 5$  where  $t$  is the time. Find the velocity and acceleration at  $t = 1$ . (07 Marks)
- b. Find the angle between the tangents to the curve  $r = t^2 \mathbf{i} - 2t \mathbf{j} - t^3 \mathbf{k}$  at the point  $t = \pm 1$ . (07 Marks)
- c. If  $\nabla \cdot \mathbf{F} = (3x^2 y - z)\mathbf{i} + (xz^3 + y^4)\mathbf{j} - 2x^3 z^2 \mathbf{k}$  find  $\text{grad}(\text{div } \mathbf{F})$  at  $(2, -1, 0)$ . (06 Marks)

OR

- 8 a. Find the directional derivative of  $(I) = 4xz^3 - 3x^2 y^2 z$  at  $(2, -1, 2)$  along  $2\mathbf{i} - 3\mathbf{j} + 6\mathbf{k}$  (07 Marks)
- b. Find the unit normal to the surface  $x^2 y + 2xz = 4$  at  $(2, -2, 3)$ . (07 Marks)
- c. Show that  $\mathbf{F} = (2xy^2 + yz)\mathbf{i} + (2x^2 y + xz + 2yz^2)\mathbf{j} + (2y^2 z + xy)\mathbf{k}$  is irrotational. (06 Marks)

**Module-5**

- 9 a. Solve  $\frac{dy}{dx} = \sin(x + y)$  (07 Marks)
- b. Solve  $\frac{dy}{dx} + y \cot x = \cos x$  (07 Marks)
- c. Solve  $(x - y + 1)dy - (x + y - 1)dx = 0$  (06 Marks)

OR

- 10 a. Solve  $(e^{x^4} dx + e^{y^4} dy) = 0$ . (07 Marks)
- b. Solve  $(x^3 \cos^2 y - x \sin 2y) dx = dy$ . (07 Marks)
- c. Solve  $(3x^2 y^4 + 2xy)dx + (2x^3 y^3 - x^2)dy = 0$  (06 Marks)