



Fourth Semester B.E. Degree Examination, April 2023  
Advanced Mathematics – II

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1
  - a. Find the angle between any two diagonals of a cube. (06 Marks)
  - b. Show that the points  $A(-4,9,6)$ ,  $B(-1,6,6)$  and  $C(0,7,10)$  form a right angled isosceles triangle. (06 Marks)
  - c. If  $\cos\alpha$ ,  $\cos\beta$ ,  $\cos\gamma$  are direction cosines of a line, then prove that  $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$ . (08 Marks)
- 2
  - a. Find the equation of the plane which passes through the point  $(3, -3, 1)$  and is normal to the line joining the points  $(3, 2, -1)$  and  $(2, -1, 5)$ . (06 Marks)
  - b. Derive the equation of the plane in the intercept form  $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ . (06 Marks)
  - c. Find the angle between the planes,  $x - y + z = 6$  and  $2x + 3y + z = -5$ . (08 Marks)
- 3
  - a. Find the unit normal to sum of the vectors  $4i - j + 3k$  and  $-2i + j - 2k$ . (06 Marks)
  - b. Find  $\vec{b} \times (\vec{a} \times \vec{c})$ , where  $\vec{a} = i + j - k$ ,  $\vec{b} = 2i - j + 2k$ ,  $\vec{c} = 3i - j - k$ . (06 Marks)
  - c. Find the angle between the vectors  $\vec{a} = 5i - j + k$  and  $\vec{b} = 2i - 3j + 6k$ . (08 Marks)
- 4
  - a. A particle moves along the curve  $\vec{r} = \cos 2t\mathbf{i} + \sin 2t\mathbf{j} + t\mathbf{k}$ . Find its velocity and acceleration. (06 Marks)
  - b. If  $R = xi + yj + zk$ , show that  $\nabla \cdot R = 3$ . (06 Marks)
  - c. Find the  $\text{F.curl } \vec{F}$  where  $\vec{F} = (x + y + 1)\mathbf{i} + j - (x + y)\mathbf{k}$ . (08 Marks)
- 5
  - a. A particle moves along the curve  $\vec{r} = (1 - t^3)\mathbf{i} + (1 + t^2)\mathbf{j} + (2t - 5)\mathbf{k}$ . Determine its velocity and acceleration. (06 Marks)
  - b. Show that the vector field,  $\vec{F} = (3x + 3y + 4z)\mathbf{i} + (x - 2y + 3z)\mathbf{j} + (3x + 2y - z)\mathbf{k}$  is solenoidal. (06 Marks)
  - c. Find  $\text{curl } \vec{A}$  where  $\vec{A} = xy\mathbf{i} + y^2z\mathbf{j} + z^2y\mathbf{k}$ . (08 Marks)
- 6
  - a. Find the Laplace transform of  $1 + 3t^2 + 4e^{-3t}$ . (06 Marks)
  - b. Find the Laplace transform of  $\sin 4t + t^3$ . (06 Marks)
  - c. Find the Laplace transform of  $1 + e^{2t} + t^2 + \cosh t$ . (08 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.

- 7 a. Find the Laplace transform of  $e^{-2t} \sin 4t$ . (06 Marks)  
b. Find the Laplace transform of  $t \sin 2t$ . (06 Marks)  
c. Find the inverse Laplace transform of  $\frac{s+2}{(s-1)(s-3)}$ . (08 Marks)
- 8 a. Find the inverse Laplace transform of  $\frac{1}{s^2-5s+6}$ . (06 Marks)  
b. Find  $L^{-1}\left\{\frac{1}{(s^2+1)(s^2+9)}\right\}$ , by using convolution theorem. (06 Marks)  
c. Solve  $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = e^{+t}$ ,  $y(0) = y'(0) = 0$  by using Laplace transform method. (08 Marks)

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