

# AR18

**CODE: 18BST101**

**SET-2**

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI  
(AUTONOMOUS)**

**I B.Tech I Semester Supplementary Examinations, October-2021**

**LINEAR ALGEBRA AND CALCULUS  
(Common to All Branches)**

**Time: 3 Hours**

**Max Marks: 60**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

## UNIT-I

1. a) Determine the rank of the matrix  $A = \begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$  6M
- b) For what values of k the equations  $x+y+z=1$ ,  $2x+y+4z=k$ ,  $4x+y+10z=k^2$  have a solution and solve them completely in each case. 6M

**(OR)**

2. Determine the Eigen values, Eigen vectors of the matrix 12M
- $$A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$$

## UNIT-II

- 3 Expand  $e^x \sin y$  in ascending powers of x and y. 12M
- (OR)**
4. a) Find the stationary points of  $u(x, y) = \cos x \cos y \cos(x+y)$  6M  
where  $0 < x < \pi$ ,  $0 < y < \pi$ . Find the minimum value of  $u(x, y)$ .
- b) Find the dimensions of a rectangular box open at the top of maximum capacity whose surface is 432 sq cm.. 6M

## UNIT-III

5. a) Find the volume of the solid generated by revolving the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  about the major axis. 6M
- b) Find the surface area of the solid generated by the revolution of the asteroid  $x = a \cos^3 t$ ,  $y = a \sin^3 t$  about the y-axis. 6M

**(OR)**

- 6 Find the volume of the solid formed by revolving a loop of the lemniscate  $r^2 = a^2 \cos 2\theta$  about the line  $\theta = \pi/2$ . 12M

### UNIT-IV

7. Change the order of the integration in  $I = \int_0^{4a} \int_{\frac{x^2}{4a}}^{\sqrt{ax}} dx dy$  and hence evaluate it. 12M

(OR)

8. a) Evaluate  $\int_0^a \int_y^a \frac{x^2 dx dy}{\sqrt{x^2 + y^2}}$  by changing into polar coordinates. 6M
- b) Find the volume of the solid bounded by the planes  $x=0, y=0, x+y+z=1$  and  $z=0$ . 6M

### UNIT-V

9. a) Find the angle between the surfaces  $x^2 + y^2 + z^2 = 9$  and  $z = x^2 + y^2 - 3$  at the point  $(2, -1, 2)$ . 6M
- b) Find the work done in moving a particle around a circle if the circle has centre at the origin and radius 3 and if the force field is given by  $\mathbf{F} = (2x - y + z)\mathbf{i} + (x + y - z^2)\mathbf{j} + (3x - 3y + 4z)\mathbf{k}$ . 6M

(OR)

10. Verify Gauss' divergence theorem for  $\mathbf{F} = 4xz\mathbf{i} - y^2\mathbf{j} + yz\mathbf{k}$  and  $S$  is the surface of the cube bounded by  $x=0, x=1, y=0, y=1, z=0$  and  $z=1$ . 12M

# AR16

**CODE: 16BS1001**

**SET-1**

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI  
(AUTONOMOUS)**

**I B.Tech I Semester Supplementary Examinations, October-2021**

**ENGINEERING MATHEMATICS – I  
(Common to All Branches)**

**Time: 3 Hours**

**Max Marks: 70**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

## UNIT-I

1. Prove that  $\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1$  is self-orthogonal, where  $\lambda$  is parameter. 14M

(OR)

2. Solve  $2xydy - (x^2 + y^2 + 1)dx = 0$  14M

## UNIT-II

3. Solve  $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^{-2x} \sin 2x$ . 14M

(OR)

4. Solve  $(D^2 + 2D + 1)y = x \cos x$ . 14M

## UNIT-III

5. a) Expand  $e^x \cos y$  near  $\left(1, \frac{\pi}{4}\right)$  by Taylor's series method. 7M

- b) Prove that  $u = \frac{x^2 - y^2}{x^2 + y^2}$ ,  $v = \frac{2xy}{x^2 + y^2}$  are functionally dependent and find the relation between them. 7M

(OR)

6. Find the maximum and minimum values of  $x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$  14M

## UNIT-IV

7. Change the order of integration and hence evaluate the integral  $\int_0^1 \int_{x^2}^{2-x} xy \, dy \, dx$ . 14M

(OR)

8. a) Evaluate  $\iint (x^2 + y^2) \, dx \, dy$  in the positive quadrant for which  $x + y \leq 1$ . 7M

- b) Evaluate  $\iiint_V dx \, dy \, dz$  where  $V$  is the finite region of space formed by the planes  $x = 0, y = 0, z = 0$  and  $2x + 3y + 4z = 12$ . 7M

## UNIT-V

9. a) Prove that if  $\vec{r}$  is the position vector of any point in space, then  $\vec{r} \times \vec{r}$  is irrotational. 7M

- b) Find the work done by the force  $\vec{F} = z\vec{i} + x\vec{j} + y\vec{k}$ , when it moves a particle along the arc of the curve  $\vec{r} = \cos t \vec{i} + \sin t \vec{j} - t \vec{k}$  from  $t = 0$  to  $t = 2\pi$ . 7M

(OR)

10. Verify Stoke's theorem for  $\vec{F} = (y - z + 2)\vec{i} + (yz + 4)\vec{j} - xz\vec{k}$  where  $S$  is the surface of the cube  $x = 0, y = 0, z = 0, x = 2, y = 2, z = 2$  above the  $xy$ -plane. 14M

# AR13

CODE: 13BS1001

SET-2

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI  
(AUTONOMOUS)

I B.Tech I Semester Supplementary Examinations, October-2021

ENGINEERING MATHEMATICS - I  
(Common to All Branches)

Time: 3 Hours

Max Marks: 70

## PART-A

ANSWER ALL QUESTIONS

[1 x 10 = 10 M]

1. a) Solve  $x dx + y dy = \frac{xy - y dx}{x^2 + y^2}$ . 1 M
- b) Find the general solution of  $2xy dy - (x^2 + y^2 + 1) dx = 0$ . 1 M
- c) Solve  $\frac{d^2 y}{dx^2} + \frac{dy}{dx} + y = 0$  1 M
- d) If  $f(D) = D^2 + 2D + 1$ , then find  $\frac{1}{f(D)} \cos 2x$  1 M
- e) If  $x = \frac{u^2}{v}$ ,  $y = \frac{v^2}{u}$  find  $\frac{\partial(u,v)}{\partial(x,y)}$  1 M
- f) Write the properties of Jacobians. 1 M
- g) Solve  $\int_0^3 \int_{-x}^x xy dy dx$ . 1 M
- h) Evaluate  $\int_0^a \int_0^x \int_0^y x^3 y^2 z dx dy dz$ . 1 M
- i) Show that  $3y^4 z^2 \mathbf{i} + z^3 x^2 \mathbf{j} - 3x^2 y^2 \mathbf{k}$  is solenoidal. 1 M
- j) Write the formula for area in double integration. 1 M

## PART-B

Answer one question from each unit

[5x12=60M]

### UNIT-I

2. a) A body is originally at  $80^\circ \text{C}$  and cools down to  $60^\circ \text{C}$  in 20 minutes. If the temperature of the air is  $40^\circ \text{C}$ , find the temperature of the body after 40 minutes. 6 M
- b) Solve  $\frac{dy}{dx} + y \tan x = y^2 \sec x$  6 M
- (OR)
3. a) Find the orthogonal trajectories of the family of curves  $r^n = a^n \cos n\theta$ . 6 M
- b) Solve  $(x^4 e^x - 2mxy^2) dx + 2mx^2 y dy = 0$  6 M

## UNIT-II

4. a) Solve  $(D^2 - 4)y = x \sinh x + 54x + 8$ . 6 M  
b) Solve  $(D^2 + 1)y = \sin 2x$  6 M

(OR)

5. a) Solve  $(D^4 + 2D^2 + 1)y = x^2 \cos^2 x$  6 M  
b) Find the distance from the centre at which the velocity in SHM will be 6 M  
(i) half and (ii) one-third of the maximum.

## UNIT-III

6. a) Expand  $x^2y + 3y^2$  in powers of  $(x-1)$  and  $(y+2)$  using Taylor's theorem. 6 M  
b) Show that  $u = \sin^{-1} x + \sin^{-1} y$ ,  $v = x\sqrt{1-y^2} + y\sqrt{1-x^2}$  are functionally dependent and find functional relationship. 6 M

(OR)

7. Divide 24 into three parts such that the continued product of the first, square of the second and cube of the third is maximum 12M

## UNIT-IV

8. a) By change of order of Integration evaluate  $\int_0^\infty \int_1^y y e^{-\left(\frac{y^2}{x}\right)} dx dy$  6 M  
b) Evaluate  $\int_{-c}^c \int_{-a}^a \int_{-b}^b (x^2 + y^2 + z^2) dx dy dz$  6 M

(OR)

- 9 Evaluate  $\int \int y dx dy$  bounded by the parabolas  $y^2 = 4x$  and  $x^2 = 4y$ . 12M

## UNIT-V

10. a) Find the directional derivative of  $\phi = xy + yz + zx$  at A in the directional of  $\vec{AB}$  where A (1,2,-1) and B(1,2,3) 6 M  
b) Prove that  $r^n \vec{r}$  is solenoidal if  $n = -3$  6 M

(OR)

11. Verify Gauss Divergence theorem for  $\vec{F} = 2xzi + yzj + z^2k$  over the upper half of the sphere  $x^2 + y^2 + z^2 = a^2$ . 12M