Silicon
beyond teaching

Silicon Institute of Technology
Silicon Hills, Bhubaneswar
| An Autonomous Institute |

1st Semester B.Tech. End Term Examination 2019-2020
ENGINEERING MATHEMATICS-I(18BS1T01)

Duration: 03:00 Full Marks: 60

1 *Answer All*

a Draw the graph of f(x)=$|x+5|$. 1

b Find the curvature of y=2x+5. 1

c Find the order and degree of $\sqrt{y''+y}=\sqrt[3]{y'+4y}$. 1

d Solve y'= - y/x , y(1)=1. 1

e Find the Wronskian of the bases x^4, x4lnx? 1

f Solve $y''=y'$. 1

g Define Linearly dependent and linearly independent with suitable examples. 1

h Show that the vectors (1, 1, 1), (2, 3, 1) and (3, 4, 2) are linearly dependent vectors. 1

i Identify the type of matrix $\begin{bmatrix} 4i & 0 & i \\ 0 & i & 0 \\ i & 0 & 4i \end{bmatrix}$. 1

j Define trace of a matrix. 1

2 *Answer any Two*

a Find all the asymptotes of $x^3+y^3-3xy=0$. 2.5

b Draw the graph of $f(x)=2+|x+1|$ 2.5

c Find the radius of the curvature of $y^2=12x$ at (3,6). 2.5

d Find all the asymptotes of r logθ =a. 2.5

3 *Answer any Two*

a Solve $y'+ky=e^{-kx}$. 2.5

b *Test for exactness and solve* $(2x+e^x\sin y)dx+e^x\cos y\,dy=0$ *where* $y(0)=\frac{\pi}{2}$ 2.5

c Solve the linear equation y'+y cos x=sin 2x, y(π)=0. 2.5

d *Solve* $y'+1=e^{x+y}$ 2.5

4 *Answer any Two*

a Are the functions $f(x)=x|x|$ and $g(x)=x^2$ are linearly independent over the interval [-1, 1]? Show the work. 2.5

b Solve $xy''+y'=0$. 2.5

c Find a second-order homogeneous linear differential equation which has $\cos 2\pi x$, $\sin 2\pi x$ are solutions? 2.5

[P. T. O.]

d Solve $x^2y'' + xy' + 9y = 0, y(1) = 2, y'(1) = 0.$ 2.5

5 ***Answer any Two***

a Verify whether the vectors (-1, 5,0), (16, 8, -3) and (-64, 56, 9) are LI or LD ? 2.5

b Using Gauss elimination solve 2.5

$4x - 8y + 3z = 16, \quad -x + 2y - 5z = -21, \quad 3x - 6y + z = 7$

c Find the rank of the matrix $\begin{pmatrix} 3 & 0 & 2 & 2 \\ -6 & 42 & 24 & 54 \\ 21 & -21 & 0 & -15 \end{pmatrix}$. 2.5

d Find A^{-1} by Gauss Jordan elimination method where $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{pmatrix}$ 2.5

6 ***Answer any Two***

a Prove that the determinant of an orthogonal matrix is ± 1. 2.5

b Find the eigenvalues for the unitary matrix $\begin{bmatrix} \frac{1}{2} & i\sqrt{\frac{3}{4}} \\ i\sqrt{\frac{3}{4}} & \frac{1}{2} \end{bmatrix}$. 2.5

c Show that $\begin{bmatrix} 0.96 & -0.28 \\ 0.28 & 0.96 \end{bmatrix}$ forms an orthonormal system. 2.5

d Find the spectrum of $\begin{bmatrix} 8 & -4 \\ 2 & 2 \end{bmatrix}$ 2.5

7 ***Answer any One***

a Find all asymptotes of the curve $y^3 + 3xy^2 - x^2y - 3x^3 + y^2 - 2xy + 3x^2 + 4y + 5 = 0$ 5

b Show that $3\sqrt{3}/2$ is the least value of ρ for y=logx. 5

8 ***Answer any One***

a Solve $2\sin y^2 dx + xy\cos y^2 dy = 0, y\left(2\right) = \sqrt{\frac{\pi}{2}}$. 5

b Solve the Bernoulli equation $xy' + 2y = 3x^3y^{4/3}$. 5

9 ***Answer any One***

a Solve $(x^2D^2 + 3xD + 1)y = 0, y(1) = 3, y'(1) = -4$ 5

b Solve $4x^2y'' + 8xy' - 3y = 7x^2 - 15x^3$. 5

10 ***Answer any One***

a Solve the given system of linear equations for all its solutions. 5

$x_2 - 3x_3 + x_4 = 0$
$2x_1 - x_2 + x_3 = 0$
$2x_1 - 3x_2 + 4x_4 = 0$

[P. T. O.]

b Find the inverse of the given matrix using Gauss Jordan elimination $A = \begin{pmatrix} 4 & -1 & -5 \\ 15 & 1 & -5 \\ 5 & 4 & 9 \end{pmatrix}$ 5

11 ***Answer any One***

a Find all the eigenvalues and eigenvector corresponding to the largest eigenvalue of 5

$$A = \begin{bmatrix} 3 & 0 & 1 \\ 0 & 2 & 0 \\ 5 & 0 & -1 \end{bmatrix}$$

b Find a matrix P such that $P^{-1}AP$ will be a diagonal matrix with eigenvalues of A in the diagonal where 5

$$A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$