Code No:151AA **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B .Tech I Year I Semester Examinations, December - 2018
MATHEMATICS-I
(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, MMT, AE, MIE, PTM)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) If A is Hermitian matrix and B is a Skew- Hermitian matrix , prove that (B+iA) is Skew -Hermitian matrix. [2]

b) Let A be a square matix of order 3 with Eigenvalues 2, 2 and 3 and A is diagonalizable then find rank of (A-2I). [2]

c) State Cauchy's root test. [2]

d) Find the value of $\Gamma\left(-\frac{1}{2}\right)$ [2]

e) Verify Euler's theorem for the function $xy+yz+zx$. [2]

f) Prove that the transpose of a unitary matrix is unitary. [3]

g) Find the Eigen values of the matrix $A=\begin{pmatrix} 1 & 2 & 2 \\ 0 & 2 & 1 \\ -1 & 2 & 2 \end{pmatrix}$ [3]

h) Test for convergence $\sum_{n=1}^{\infty}\frac{\sqrt{n}}{n^2+1}$. [3]

i) Discuss the applicability of Rolle's Theorem to the function $f(x)=2+(x-1)^{\frac{2}{3}}$ in the interval [0, 2] . [3]

j) If $u=\sin^{-1}\left(\frac{x}{y}\right)+\tan^{-1}\frac{y}{x}$ show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=0$. [3]

PART - B

(50 Marks)

2.a) Reduce the given matrix into normal form and hence find the rank
$$\begin{pmatrix} 2 & 3 & -2 & 5 & 1 \\ 3 & -1 & 2 & 0 & 4 \\ 4 & -5 & 6 & -5 & 7 \end{pmatrix}$$

b) Solve the equations $x+y+z=6;\ 3x+3y+4z=20;\ 2x+y+3z=13$ using Gauss elimination method. [5+5]

OR

3.a) Find the rank of the matrix $\begin{pmatrix} -1 & -3 & 3 & -1 \\ 1 & 1 & -1 & 0 \\ 2 & -5 & 2 & -3 \\ -1 & 1 & 0 & 1 \end{pmatrix}$ by reducing it to Normal form.

b) Solve the system of equations by Gauss-Seidel method $20x+y-2z=17$; $3x+20y-z=-18$; $2x-3y+20z=25$. [5+5]

4.a) Let $A=\begin{pmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}$, and $A^{-1}=\alpha A^2+\beta A+\gamma I$, $\alpha,\beta,\gamma \in R$, then find $\alpha+\beta+\gamma$.

b) Find the nature of the quadratic form $10x^2+2y^2+5z^2-4xy-10xz+6yz$. [5+5]

OR

5.a) Let A be a 3×3 matric over R such that det (A) =6 and tr (A)=0. If det(A+I)=0, where I is the identity matrix of order 3, then find the Eigen values of A .

b) Reduce the quadratic form $5x^2+26y^2+10z^2+4yz+14zx+6xy$ to canonical form. [5+5]

6.a) Test the convergence of the series $1+\frac{x}{2}+\frac{2!}{3^2}x^2+\frac{3!}{4^3}x^3+\ldots$

b) Examine the following series for convergence $\sum\frac{(-1)^{n-1}\sin nx}{n^3}$. [5+5]

OR

7.a) Test for convergence of the series $\sum\frac{x^n}{(2n)!}$.

b) Examine for absolute convergence the series $x-\frac{x^2}{2}+\frac{x^3}{3}-\frac{x^4}{4}+\ldots$ [5+5]

8.a) Show that $\frac{\tan x}{x}>\frac{x}{\sin x}$, $o<x<\frac{\pi}{2}$.

b) Find the surface area of the solid generated by revolving the loop of the curve $9y^2=x(x-3)^2$. [5+5]

OR

9.a) Show that $|\cos b-\cos a|\le|b-a|$.

b) Show that $\int_0^\infty x^{m-1}(a-x)^{n-1}dx=a^{m+n-1}\beta(m,n)$. [5+5]

10.a) If $u=f(y-z,z-x,x-y)$ show that $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}=0$.

b) If $x=uv, y=\frac{u+v}{u-v}$ determine $\frac{\partial(u,v)}{\partial(x,y)}$. [5+5]

OR

11.a) If $U=x+y-z, V=x-y+z, W=x^2+y^2+z^2-2yz$, show that the functions are functionally dependent.

b) The temperature T at any point (x, y, z) in space is $T=400xyz^2$. Find the highest temperature on the surface of the unit sphere $x^2+y^2+z^2=1$. [5+5]

---ooOoo---

R16

Code No:131AA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B .Tech I Year I Semester Examinations, December - 2018

MATHEMATICS-I

(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, ETM, MMT, AE, MIE, PTM, CEE, MSNT)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) Solve : $ydx - xdy = a(x^2 + y^2)dx$ [2]

b) Solve : $(D^4 - 2D^3 - 3D^2 + 4D + 4)y = 0$, $where\ D = \frac{d}{dt}$. [3]

c) If $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$ then find the rank of A [2]

d) Reduce the following matrix to upper triangular form (Echelon form) by elementary row transformations. $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 7 \\ 3 & 1 & 2 \end{bmatrix}$ [3]

e) Find the Characteristic roots of the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ [2]

f) Find the Quadratic form corresponding to the matrix $\begin{bmatrix} 1 & 2 & 5 \\ 2 & 0 & 3 \\ 5 & 3 & 4 \end{bmatrix}$ [3]

g) If $z = f(x + ct) + \emptyset(x - ct)$ then show that $\frac{\partial^2 z}{\partial t^2} = c^2 \frac{\partial^2 z}{\partial x^2}$ [2]

h) If $u = \cos^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}}$ then show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = -\frac{1}{2}\cot u$ [3]

i) Find a Partial differential equation by Eliminating arbitrary function f from $z = f(x^2 - y^2)$ [2]

j) Solve : $p\tan x + q\tan y = \tan z$ [3]

PART – B

(50 Marks)

2. Apply the method of variation of parameters to solve $\frac{d^2y}{dx^2} + y = \tan x$ [10]

OR

3. Solve the equation $L\frac{di}{dt} + Ri = E_0 \sin\omega t$ where L, R and E_0 are constants and discuss the case when t increases indefinitely. [10]

4. Determine the rank of the matrix $A=\begin{pmatrix} 0 & 2 & 3 & 4 \\ 2 & 3 & 5 & 4 \\ 4 & 8 & 13 & 12 \\ 6 & 13 & 21 & 20 \end{pmatrix}$ by reducing to echelon from.

[10]

OR

5. Solve the system of equations $4x+y+z=4, x+4y-2z=4, 3x+2y-4z=6$ by LU - Decomposition method.

[10]

6. Verify Cayley-Hamilton theorem for the matrix $A=\begin{pmatrix} 2 & 1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$ and hence find A^{-1} and A^{4}

[10]

OR

7. Reduce the quadratic form $Q = x_1{}^2 + 3x_2{}^2 + 3x_3{}^2 - 2x_2x_3$ to the canonical form and hence find its index and signature.

[10]

8. If $u = \log(x^3 + y^3 + z^3 - 3xyz)$, show that $\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z}\right)^2 u = -\frac{9}{(x+y+z)2}$. [10]

OR

9. Using Taylor's series expand $f(x,y) = e^y \log(1+x)$ in powers of x and y . [10]

10.a) Solve: $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$

b) Solve: $p + 3q = 5z + \tan(y-3x)$

[5+5]

OR

11.a) Find a Partial differential equation by eliminating the arbitrary function $\emptyset$ *from* $\emptyset(x^2+y^2+z^2, z^2-2xy) = 0$.

b) Solve $xp + yq = z$.

[6+4]

---ooOoo---

R13

Code No:111AL

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year Examinations, December - 2018

MATHEMATICAL METHODS

(Common to EEE, ECE, CSE, EIE, IT)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

Part- A

(25 Marks)

1.a) Prove that $E=e^{hD}$ where D is a differential operator. [2]

b) Write the Normal equations for fitting a curve $y=a+\frac{b}{x}$ from the given data points (x_i, y_i). [3]

c) Explain the solution of the equation $x+1=0$ graphically. [2]

d) Evaluate $\int_0^1 \frac{dx}{1+x}$ using Trapezoidal Rule. [3]

e) Write the finite Fourier cosine transform of f(x) in $[0,\pi]$. [2]

f) Find the half range sine series of $f(x)=x$ in [0,1]. [3]

g) Form PDE by eliminating constants from $z=ax+by+ab$. [2]

h) Solve the PDE $px+qy=1$. [3]

i) State stokes theorem. [2]

j) Find the angle between the surface $x^2+y^2+z^2=9$ and $z=x^2+y^2-3$ at the point (2,-1,2). [3]

Part - B

(50 Marks)

2.a) Find f(2.5) from the following table using Gauss Forward interpolation formula.

X	1	2	3	4
Y	11	20	44	79

b) Fit the curve $y=a+bx+cx^2$ from the following table [5+5]

X	1	2	3	4
Y	0	1	2	3

OR

3.a) Find f(0.5) from the following table using Newton forward interpolation formula.

X	0	1	2	3
Y	7	10	15	34

b) Find polynomial which is passing through the following points
(1, 21),(3,15),(4,18),(6,25)

[5+5]

4.a) Find a positive root of $2^x - 3x = 0$ using Bisection Method.

b) Solve the system of equation using LU decomposition method (Crout's)
x+5y+z = 14, 2x+y+3z = 13, 3x+y+4z = 17. [5+5]

OR

5.a) Evaluate y (1.2) and y (1.4) by RK method of fourth order if $y' = 1 + xy, y(1) = 1$.

b) Solve the system of equation using Gauss –seidel method:
8x-3y+2z = 20, 4x+11y-z = 33, 6x+3y+12z = 35. [5+5]

6.a) Find the Fourier series of $f(x) = \begin{cases} 0, -\pi < x < 0 \\ 1, 0 < x < \pi \end{cases}$
Hence deduce that $1 - \frac{1}{3} + \frac{1}{5} + \ldots = \frac{\pi}{4}$

b) Find the Fourier sine transform of $f(x)$ defined by $f(x) = \begin{cases} x & 0 < x < 1 \\ 1-x & 1 < x < 2 \\ 0, & otherwise \end{cases}$ [5+5]

OR

7.a) Using Fourier integral, Show that $\int_0^\infty \frac{\sin \pi\lambda}{1-\lambda^2} \sin \lambda x d\lambda = \begin{cases} \frac{1}{2}\pi \sin x & if\ 0 < x < \pi \\ 0 & if\ x > \pi \end{cases}$

b) Find the Half range cosine series for f(x) = x+x^2 in [0, 2] [5+5]

8.a) Solve the PDE $z(x^2 - y^2) = px^2 - qy^2$

b) Solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u, u(x,0) = 6e^{-3x}$ by method of separation of variables [5+5]

OR

9.a) Solve the PDE $p^2 y(1+x^2) = qx^2$

b) Solve the Laplace equation $u_{xx} + u_{yy} = 0$ with the following boundary conditions

$u(0, y) = 0 \quad for\ 0 \le y \le \pi$
$u(\pi, y) = 0 \quad for\ 0 \le y \le \pi$
$u(x, \pi) = f(x) \quad for\ 0 \le x \le \pi$
$u(x, 0) = 0 \quad for\ 0 \le x \le \pi$ [5+5]

10.a) If f and g are any two vector functions, then show that
$\nabla \times (f \times g) = (g \cdot \nabla) f - (f \cdot \nabla) g + f div g - g div f$

b) Evaluate $\int_c (xy - y^2)dx + x^2 y dy$ along the closed curve formed by y = 0, x =1 and y = x by Green's theorem. [5+5]

OR

11.a) Prove that div curl $\overline{f} = 0$ where f is a vector point function.

b) Evaluate $\iint_S \overline{A}.\overline{n} ds$ where $\overline{A} = z\overline{i} + x\overline{j} - 3y^2 z\overline{k}$ and S is the surface of the cylinder x^2+y^2=16 included in the first octant between z=0 and z=5. [5+5]

---ooOoo---

Code No:111AC

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year Examinations, December - 2018

ENGINEERING MECHANICS

(Common to CE, ME, MCT, MMT, AE, AME, MIE, PTM, AGE)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) State the Law of equilibrium of two forces. [2]
b) Differentiate between active and reactive force. [3]
c) What are the applications of static friction? [2]
d) Where do you encounter the belt friction? [3]
e) Define the theorem of Pappus. [2]
f) Discuss the method of finding the centroids of lengths of composite curves. [3]
g) Write the differential equation of rectilinear motion. [2]
h) State the principle of angular motion in rotation. [3]
i) What are the characteristics of different states of equilibrium? [2]
j) Discuss the applications of compound pendulum. [3]

PART - B

(50 Marks)

2.a) Explain the theorem of transmissibility of forces.
b) A small block of weight 100 N is placed on an inclined plane which makes an angle $\theta = 30^0$ with the horizontal. What is the component of this weight?
i) parallel to the inclined plane ii) perpendicular to the inclined plane. [5+5]

OR

3.a) Derive the equations of equilibrium for a system of concurrent forces in a plane.
b) A roller of weight W = 4450 N rests on a smooth inclined plane and is kept from rolling down by a string as shown in Figure 1. Using the method of projections, find the tension S in the string and the reaction R_b at the point of contact B. [5+5]

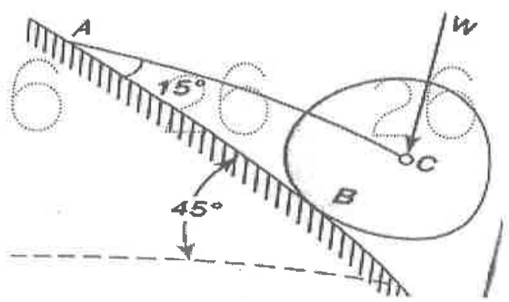

Figure: 1

4.a) Explain cone of friction and its significance.

b) A uniform ladder of 300 N weight rests against a smooth vertical wall and a rough horizontal floor making an angle of 60^0 with the horizontal. Use the method of virtual work to find the frictional force between the foot of the ladder and the rough horizontal floor.
[5+5]

OR

5.a) Explain the term circumferential tension and its application.

b) A rotating flywheel of radius r = 300 mm is braked by the device shown in Figure 2, Calculate the braking moment M produced by a vertical force P applied to the lever at D if the coefficient of friction between the belt AB and the rim of the wheel is μ. [5+5]

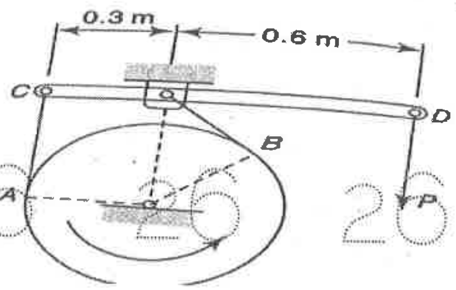

Figure: 2

6.a) Discuss about the Transfer Formula for Product of Inertia .

b) Locate the centroid of the shaded areas shown in Figure 3. [5+5]

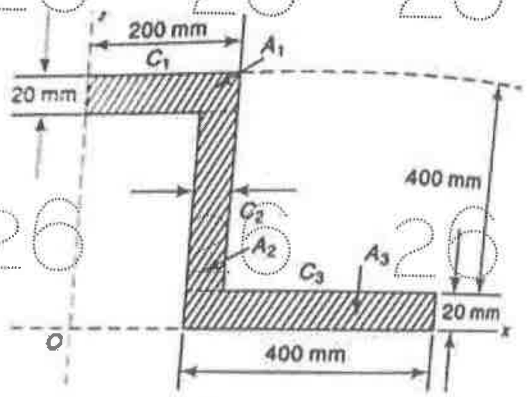

Figure: 3

OR

7.a) Explain the Parallel axis theorem for moments of inertia of plane Figures.

b) Calculate the product of inertia of a rectangle having sides of length a and b with respect to axes x and y coinciding with two adjacent edges. [5+5]

8.a) Derive the differential equation of motion for a rectilinear motion of a particle as stated by D' Alembert Principle.

b) A spring suspended mass hangs from the ceilings of an elevator cage. How will its natural period of free vertical vibration be affected by acceleration of the cage. [5+5]

OR

9.a) Explain the normal and tangential acceleration of curvilinear motion of a particle.

b) A particle travels with constant speed v along a parabolic path defined by the equation $y = kx^2$, where k is a constant. Find the maximum acceleration of a particle. [5+5]

10.a) Explain the terms fully constrained body and partially constrained body.

b) If the pendulum is released from rest in the position A, find the tension T in the string OB as a function of the angle θ. (figure 4) [5+5]

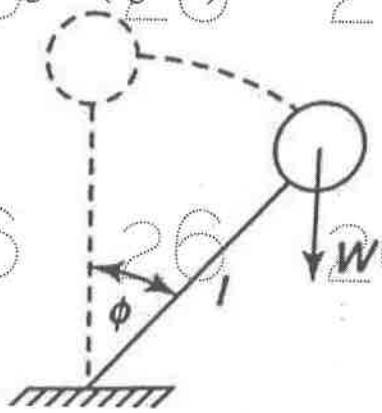

Figure: 4

OR

11.a) Derive the equation for free vibrations without damping.

b) Differentiate between simple and compound pendulums.

c) Explain the Vibrograph with a sketch. [10]

---ooOoo---