

Printed Pages: Mid Semester Test-1
 Academic year 2023 – 2024
 Program Name/Code: Bachelor of Engineering
 Semester: 1st
 Subject Title: MATHEMATICS -I
 Subject Code: 23SMT-121
 Time: 1 Hour

UID No:

Maximum Marks: 20

Instructions: Attempt all questions

Q. No	Statement	CO mapping
Section A 5 x 2 = 10 marks		
1	Find A^{-1} from equation $A^2 - 7A + I = 0$ where $A = \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix}$	CO1
2	If $A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$, find k so that $A^2 = kA - 2I$	CO1
3	Differentiate between singular and non-singular matrices with an example	CO2
4	Find the value of k so that the rank of matrix $A = \begin{bmatrix} 2 & -1 & 3 \\ 3 & 7 & 8 \\ 1 & 4 & 5 \end{bmatrix}$ is less than 3	CO2
5	Find the sum and product of the Eigen values of $A = \begin{bmatrix} 2 & 3 & -2 \\ -2 & 1 & 1 \\ 1 & 0 & 2 \end{bmatrix}$	CO2
Section B 2 x 5 = 10 marks		
6	Q.11 Reduce the matrix to Echelon form and hence find rank. $A = \begin{bmatrix} 1 & -1 & 2 & -1 \\ 4 & 2 & -1 & 2 \\ 2 & 2 & -2 & 0 \end{bmatrix}$	CO1
7	For what value of λ , following set of equations has a non-zero solution $2x + y - 2z = 0$ $x + y + 3z = 0$ $4x + 3y + \lambda z = 0$	CO3

ted Pages: Mid Semester Test-1
Academic year 2023 – 2024

UID No: 23BCS10256

gram Name/Code: Bachelor of Engineering
nester:1st

ject Title: MATHEMATICS -I

ject Code: 23SMT-121

ne: 1 Hour

Maximum Marks: 20

structions: Attempt all questions

Q. No	Statement	CO mapping
Section A 5 x 2 = 10 marks		
1	Check whether the matrix $A = \begin{bmatrix} 2 & -3 & 1 \\ 4 & 3 & 1 \\ -3 & 1 & 9 \end{bmatrix}$ is orthogonal or not?	CO1
2	Differentiate between upper and lower triangular matrices with an example.	CO2
3	Find the inverse of the matrix $\begin{bmatrix} \cos x & -\sin x \\ \sin x & \cos x \end{bmatrix}$	CO2
4	Check the following set of vectors are linearly independent or not: $x_1 = (2,2,1), x_2 = (1,3,1), x_3 = (1,2,2)$	CO2
5	Define Eigen values and Eigen vectors of a matrix.	CO2
Section B 2 x 5 = 10 marks		
6	Test the consistency of the following set of equations and solve, if consistent: $2x + 3y + 4z = 10$ $x + 2y + 3z = 14$ $x + 4y + 7z = 10$	CO1
7	Find the Eigen values of A^3 and $A+2I$, where $A = \begin{bmatrix} 2 & 1 \\ 2 & 3 \end{bmatrix}$	CO3

Printed Pages: Mid Semester Test-1
Academic year 2024 – 2025

UID No:.....

Program Name/Code: Bachelor of Engineering

Subject Code: 24SMT-121

Semester:1

Subject Title : Mathematics -I

Time: 1 Hour

Maximum Marks: 20

Instructions: Attempt all questions

NO CALCULATOR IS ALLOWED

Q. No	Statement	CO mapping
Section A 5 x 2 = 10 marks		
1	Reduce the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 7 \\ 3 & 1 & 2 \end{bmatrix}$ to triangular form	CO1
2	what values of k, do the set of vectors (k,1,1), (0,1,1), (k,0,k) are linear independent.	CO1
3	Find the rank of AB where $A = \begin{bmatrix} 1 & 2 \\ 3 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & -2 \\ 1 & 1 \end{bmatrix}$	CO1
4	Differentiate between Hermitian and skew Hermitian matrix.	CO1
5	For what value of x, Matrix $A = \frac{1}{3} \begin{bmatrix} 2 & x & 1 \\ 1 & 2 & 2 \\ 2 & 1 & -2 \end{bmatrix}$ is orthogonal?	CO2
Section B 2 x 5 = 10 marks		
6	Find the value of K for which the set of equations has infinite solutions $2x - 3y + 6z - 5t = 3$ $y - 4z + t = 1$ $4x - 5y + 8z - 9t = k$	CO2
7	Find the Eigen values of the matrix $A = \begin{bmatrix} 2 & 1 & -1 \\ 1 & 1 & -2 \\ -1 & -2 & 1 \end{bmatrix}$	CO3

Printed Pages: Mid Semester Test-1
Academic year 2024 – 2025

UID No:.....

Program Name/Code: Bachelor of Engineering
Subject Code: 24SMT-121
Semester:1

Subject Title : Mathematics -I

Time: 1 Hour

Maximum Marks: 20

Instructions: Attempt all questions

NO CALCULATOR IS ALLOWED

Q. No	Statement	CO mapping
Section A 5 x 2 = 10 marks		
1	Define orthogonal matrix with an example.	CO1
2	Find value of a so that rank of $A = \begin{bmatrix} 2 & 0 & 1 \\ 1 & a & 3 \\ 1 & 2 & 3 \end{bmatrix}$ is less than 3.	CO1
3	Write all normal forms of a matrix.	CO1
4	Write the Characteristic equation of the matrix $A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$	CO1
5	Check the set of vectors (1, 2, -3), (1, -3, 2), (2, -1, 5) are linearly dependent or independent	CO2
Section B 2 x 5 = 10 marks		
6	Does following set of equations has a non-zero solution? $x + 2y + 3z = 0$ $3x + 4y + 4z = 0$ $7x + 10y + 12z = 0$	CO2
7	Find the Eigen values of A^4 and $A - 3I$, where $A = \begin{bmatrix} 1 & 2 \\ -1 & 4 \end{bmatrix}$	CO3

Academic year Semester: 2022-23

Program Name :

Semester: 1

Subject Title: Mathematics-1

Subject Code: 22SMT-121

Maximum Marks: 60

Time: 3 Hours

Instructions: Attempt all questions

L A T E

Q.No.	Statement	CO mapping
Section A 5 x 2 = 10 marks		
1	Find the rank of $A = \begin{bmatrix} 1 & 1 & -1 \\ 2 & -3 & 4 \\ 3 & -2 & 3 \end{bmatrix}$	CO1
2	Simplify $\frac{(\cos 3\theta + i \sin 3\theta)^5 (\cos 2\theta - i \sin 2\theta)^3}{(\cos 4\theta + i \sin 4\theta)^{-9} (\cos 5\theta + i \sin 5\theta)^9}$	CO1
3	$Mdx + Ndy = 0$ is a Homogeneous equation in x and y then what will be the integrating factor.	CO1
4	Solve $(3x^2 + 4xy)dx + (2x^2 + 2y)dy = 0$	CO2
5	Solve $(D^3 + 1)y = 0$	CO2
Section B 4 x 5 = 20 marks		
6	Find A^8 , where $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$, using Cayley Hamilton theorem.	CO2
7	Evaluate $(i)^{\frac{1}{3}}$	CO3

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End Semester Examination
Academic year 2023-2024

Program Name/Code: Bachelor of Engineering

Semester: 1st

Subject Title: MATHEMATICS -I

Subject Code: 23SMT-121

Time: 3 Hour

Maximum Marks: 60

Instructions: Attempt all questions from Section A and B
Attempt any three questions from Section C

Q. No	Statement	CO mapping
Section A 5 x 2 = 10 marks		
1	If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 3 \\ 0 & 0 & 2 \end{bmatrix}$, Find $ AB $	CO1
2	If $\sin \alpha + \sin \beta + \sin \gamma = 0 = \cos \alpha + \cos \beta + \cos \gamma$ then find $\cos \alpha + \cos \beta + \cos \gamma$	CO3
3	Write the order and degree of differential equation $\left(\frac{dy}{dx}\right)^3 - 7\left(\frac{dy}{dx}\right)^4 + 5 = 0$	CO2
4	Check the differential equation $(3x^2 + 4xy)dx + (2x^2 + 2y)dy = 0$ is exact or not	CO3
5	Find P.I of the differential equation $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = e^{4x}$	CO3
Section B 4 x 5 = 20 marks		
6	Using Cayley Hamilton theorem for matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ express A^5 as a linear polynomial in A .	CO3

7	If $\sin(A + iB) = x + iy$, prove that (i) $\frac{x^2}{\cosh^2 B} + \frac{y^2}{\sinh^2 B} = 1$ (ii) $x^2 \operatorname{cosec}^2 A - y^2 \sec^2 A = 1$	CO3
8	Solve $\frac{dy}{dx} + \frac{y}{x} = e^x$	CO3
9	Find P.I. for differential equation $(D^2 - 4)y = x^2$	CO3
Section C 3 x 10 = 30 marks		
10	For what values of α & β do the system of equations $x + y + z = 6$ $x + 2y + 3z = 10$ $x + 2y + \alpha z = \beta$ Have (a) No Solution (b) Unique Solution (c) More than one solution?	CO2
11	Solve the equation: $x^9 - x^5 + x^4 - 1 = 0$	CO3
12	Solve $x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 2y = 10\left(x + \frac{1}{x}\right)$	CO3
13	Solve $(D^2 - 6D + 13)y = 8e^{3x} \sin 4x$	CO3

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Final Reappear/ Improvement Examination
Academic year 2023-2024

UID No: 9

Program Name/Code: All Engineering Programs
Subject Code: 23SMT-121
Subject Title: Mathematics-I
Semester: 1
Time: 3 Hour

Maximum Marks: 60

Instructions:

- The question paper is consisting of three sections. It is compulsory for students to attempt all questions of Section A and Section B.
- Question no. 10 & 11 of section C, are compulsory to be attempted.
- Students to attempt any one question from question no. 12 & question no. 13 of section C

Q. No	Statement	CO mapping
Section A (5 x 2 = 10 marks)		
1	State Cayley Hamilton Theorem.	CO1
2	State De-Moivre's theorem.	CO1
3	Check the differential equation is exact or not. $(3x^2 + 4xy)dx + (2x^2 + 2y)dy = 0$	CO1
4	Define Cauchy's linear differential equation.	CO1
5	Write the order and degree of Differential Equation $[1 + (y')^2]^3 = k^2 (y'')^2$	CO2
Section B (4 x 5 = 20 marks)		
6	Find the Eigen values of A^3 , where $A = \begin{bmatrix} 2 & 1 \\ 2 & 3 \end{bmatrix}$	CO2
7	Separate the real and imaginary parts of $\text{Log}(-5)$	CO2
8	Solve $\frac{dy}{dx} + 5y = 6$	CO2
9	Solve $x^2 \frac{d^2y}{dx^2} - 4x \frac{dy}{dx} + 4y = 0$	CO3

Section C (3 x 10 = 30 marks)		
10	Solve the following system of equations by matrix Method $3x - 2y + 3z = 8$ $2x + y - z = 1$ $4x - 3y + 2z = 4$	CO2
11	Prove that $(1+i)^n + (1-i)^n = 2^{\frac{n+1}{2}} \cos \frac{n\pi}{4}$	CO3
Optional Question of Section C		
12	Solve $y''' - 6y' + 9y = \sin 2x$	CO3
OR		
13	Solve $(x^2y - 2xy^2)dx - (x^3 - 3x^2y)dy = 0$	CO3

Printed Pages : 2

UID No.

End Semester Examination
Sample Paper

Program Name/Code : Bachelor of Engineering

Semester : 1st

Subject : Mathematics - I

Time : 3 hours

Maximum marks : 60

Instructions :

- The question paper is consisting of 3 sections. It is compulsory for students to attempt all questions of Section A and Section B.
- Question no. 11 & 12 of Section C are compulsory to be attempted.
- Students to attempt any one question from question no. 12 & question no. 13 of Section C

Q.No.	Statement	CO mapping
Section A 5 x 2 = 10 marks		
1	Examine the following system of vectors for linear dependence. 1. $X_1 = (1, -1, 1), X_2 = (2, 1, 1), X_3 = (3, 0, 2).$ 2. $X_1 = (1, 2, 3), X_2 = (2, -2, 6).$	CO2
2	Use De-Moivre's theorem to prove : $x^4 - x^3 + x^2 - x + 1 = 0.$	CO2
3	Write the order and degree of the equation : $(x^3 - x) \frac{dy}{dx} - (3x^2 - 1)y = x^5 - 2x^3 + x.$	CO3
4	Solve the equation : $\frac{dy}{dx} = \frac{y}{x} + x \sin \frac{y}{x}$	CO1
5	Solve: $(1 + y^2) dx = (\tan^{-1} y - x) dy.$	CO1
Section B 4 x 5 = 20 marks		
6	Find the sum of the eigen values of the matrix $\begin{bmatrix} 3 & 2 & 1 \\ 1 & 3 & 2 \\ 4 & 1 & 5 \end{bmatrix}$	CO3

7	If $2 \cos \theta = x + \frac{1}{x}$ and $2 \cos \phi = y + \frac{1}{y}$, then prove that $x^p \cdot y^q + \frac{1}{x^p \cdot y^q} = 2 \cos (p\theta + q\phi).$	CO4
8	Solve : $\frac{d^2 y}{dx^2} - 7 \frac{dy}{dx} + 6y = 2 \sin 3x$, given that $y = 1, \frac{dy}{dx} = 0$ when $x = 0.$	CO2
9	Find the value of λ , for the differential equation $(xy^2 + \lambda x^2 y)dx + (x + y)x^2 dy = 0$ is exact Solve the equation for this value of $\lambda.$	CO5
Section C 3 x 10 = 30 marks		
10	Determine the values of a and b for which : $\begin{bmatrix} 3 & -2 & 1 \\ 5 & -8 & 9 \\ 2 & 1 & a \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} b \\ 3 \\ -1 \end{bmatrix}$ has a - (a) unique solution, (b) no solution, (c) infinitely many solutions.	CO2
11	If $\sin (\theta + i\phi) = \cos \alpha + i \sin \alpha$, prove that $\cos^4 \theta = \sin^2 \alpha = \sinh^4 \phi.$	CO3
Optional Question of Section C		
12	Find the complete solution of the differential equation : $\frac{d^3 y}{dx^3} - 7 \frac{d^2 y}{dx^2} + 10 \frac{dy}{dx} = e^{2x} \sin x$	CO4
OR		
13	Solve: $x^2 \frac{d^3 y}{dx^3} + 3x \frac{d^2 y}{dx^2} + \frac{dy}{dx} = x^2 \log x$	CO4

Printed Pages: Mid Semester Test-2
Academic year 2023 – 2024

UID No:

Program Name/Code: Bachelor of Engineering

Semester: 1st

Subject Title: MATHEMATICS -I

Subject Code: 23SMT-121

Time: 1 Hour

Maximum Marks: 20

Instructions: Attempt all questions

Q. No	Statement	CO mapping
	Section A 5 x 2 = 10 marks	
1	Find the value of x and y if $(x + iy)(2 + i) = 3 - i$.	CO1
2	Write the polar form of $1 + i\sqrt{3}$.	CO1
3	If $p = \cos\alpha + i\sin\alpha$, $q = \cos\alpha - i\sin\alpha$ then what is value of $p^n + q^n$.	CO1
4	Write the real and imaginary part of $e^{3xy+4iy^2}$.	CO2
5	Write the principal value of $\text{Log}(1+i)$.	CO2
	Section B 2 x 5 = 10 marks	
6	Prove that $(\sqrt{3} + i)^n + (\sqrt{3} - i)^n = 2^{n+1} \cos \frac{n\pi}{6}$.	CO3
7	Show that $\log \frac{x+iy}{x-iy} = 2i \tan^{-1} \frac{y}{x}$.	CO2

Printed Pages: Mid Semester Test-2
Academic year 2024 – 2025

UID No:

Program Name/Code: BE-ENGG

Subject Code:24SMT-121

Semester:1

Subject Title:Mathematics -I

Time: 1 Hour

Maximum Marks: 20

Instructions: Attempt all questions

Q. No	Statement	CO mapping
Section A 5 x 2 = 10 marks		
1	Express $\frac{1}{4+3i}$ in the form (a+ib) and find its conjugate.	CO1
2	Find argument of -2-2i.	CO1
3	State De-Moivre's theorem.	CO1
4	If $x = \cos 2\alpha + i \sin 2\alpha$, then find the value of $x^m - \frac{1}{x^m}$.	CO1
5	Write the formula of $\tanh \Theta$ in exponential form.	CO2
Section B 2 x 5 = 10 marks		
6	Prove that $(1+i)^n + (1-i)^n = 2^{\frac{n+2}{2}} \cos \frac{n\pi}{4}$.	CO2
7	If $i^{\alpha+i\beta} = \alpha+i\beta$, prove that $\alpha^2 + \beta^2 = e^{-\pi\beta}$	CO3

Time: 1 Hour

Instructions: Attempt all questions

Q. No	Statement	
Section A		
5 x 2 = 10 marks		
1	What is the modulus of $(1 + i)(1 + 2i)(1 + 3i)$.	
2	Write the principal value of argument of $\left(\frac{1-i}{1+i}\right)^2$.	
3	Simplify $\left[\frac{\cos \theta + i \sin \theta}{\sin \theta + i \cos \theta}\right]^4$.	CO1
4	If $x = \cos \frac{\pi}{14} + i \sin \frac{\pi}{14}$, $y = \cos \frac{9\pi}{14} + i \sin \frac{9\pi}{14}$, then find the value of $x^5 y^{15}$.	CO2
5	Write all the values of $(-2)^{1/3}$.	CO2
Section B		
2 x 5 = 10 marks		
6	If $p = \text{cis } 2\theta$ and $q = \text{cis } 2\phi$, prove that $\sqrt{\frac{p}{q}} - \sqrt{\frac{q}{p}} = 2i \sin (\theta - \phi)$.	CO2
7	Solve the equation $x^5 - i = 0$.	CO3

Printed Pages: Mid Semester Test-2
Academic year 2024 – 2025

UID No: 24BDA70012

Program Name/Code: Bachelor of Engineering
Subject Code: 24SMT-121

Semester:1

Subject Title: Mathematics -I

Time: 1 Hour

Maximum Marks: 20

Instructions: Attempt all questions

Q. No	Statement	CO mapping
Section A 5 x 2 = 10 marks		
1	Write standard polar form of $1 + i \tan \alpha$.	CO 1
2	Write the formula of $\cot \theta$ in exponential form.	CO 1
3	What is the general value of $\log(-3)$.	CO 1
4	If $\cos(a + i b) = x + iy$, then find x.	CO 1
5	Write the real and imaginary part of $e^{2y^5 - i 7x^3}$.	CO 2
Section B 2 x 5 = 10 marks		
6	Solve the equation $x^6 + 1 = 0$.	CO2
7	Express $\log(\log i)$ in the form $A + iB$.	CO3

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Roll No.

Printed Pages : 7

15D1013R

B.E. 1st Semester Examination

APPLIED MATHEMATICS-I

Paper-AMT-101

Time allowed : 3 hours]

[Maximum marks : 60

Instruction to the Candidates :

- (i) Answer six questions only.
- (ii) Question No. 1 is compulsory.
- (iii) Attempt not more than two questions from each of the Sections-B, C and D. Each question carries ten marks.

Section-A

(Compulsory Question)

1. (a) Find the rank of the matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 1 & 6 & 5 \end{bmatrix}$$

BE-1st Sem
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All Done

(2)

- (b) Find the approximate value of

$$\left[(0.98)^3 + (2.01)^3 + (1.94)^3 \right]^{1/2}$$

- (c) Find the equation of tangent plane and normal plane to the surface $x^2 + 2y^2 + 3z^2 = 12$ at $(1, 2, -1)$.

- (d) Solve $y = (x-a)p - p^2$.

- (e) Find for what value(s) of k the set of equations

$$2x - 3y + 6z - 5t = 3,$$

$$y - 4z + t = 1,$$

$$4x - 5y + 8z - 9t = k,$$

has no solution.

Section-B

(From Unit-I)

2. (a) Reduce the matrix

$$A = \begin{bmatrix} 3 & 1 & 7 \\ 1 & 2 & 4 \\ 4 & -1 & 7 \\ 2 & 1 & 5 \end{bmatrix}$$

to column echelon form and find its rank.

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(3)

- (b) Examine whether A is similar to B ,

where $A = \begin{bmatrix} 5 & 5 \\ -2 & 0 \end{bmatrix}$ and

$$B = \begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix}.$$

3. (a) Find the value of λ for which the following equations

$$(\lambda - 1)x + (3\lambda + 1)y + 2\lambda z = 0,$$

$$(\lambda - 1)x + (4\lambda - 2)y + (\lambda + 3)z = 0,$$

$$2x + (3\lambda + 1)y + 3(\lambda - 1)z = 0$$

are consistent, and find the ratios of $x : y : z$ when λ has the smallest of these values. What happens when λ has greater of these values?

- (b) Let T be a linear transformation $TX = AX$ from $\mathbb{R}^2$ into $\mathbb{R}^2$, where

$$A = \begin{bmatrix} 2 & 1 \\ 1 & -1 \\ 3 & 2 \end{bmatrix} \text{ and}$$

$$X = \begin{bmatrix} x \\ y \end{bmatrix}. \text{ Find } \ker(T), \text{ rank}(T) \text{ and their dimensions.}$$

[P.T.O.]

15D1013R

4. (a) Find the eigen values and the corresponding eigen vectors of the matrix

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

- (b) For what values of k , the following set of vectors $\{(k, 1, 1), (0, 1, 1), (k, 0, k)\}$ form a basis in $\mathbb{R}^3$?

Section-C

(From Unit-II)

5. (a) Find the value of n so that the equation $v = r^n (3 \cos \theta - 1)$ satisfies the relation

$$\frac{\partial}{\partial r} \left(r^2 \frac{\partial v}{\partial r} \right) + \frac{1}{\sin \theta} \frac{\partial}{\partial \theta} \left(\sin \theta \frac{\partial v}{\partial \theta} \right) = 0$$

- (b) Verify Euler's theorem for

$$u = x^2 \tan^{-1} \left(\frac{y}{x} \right) - y^2 \tan^{-1} \left(\frac{x}{y} \right)$$

and also prove that :

$$\frac{\partial^2 u}{\partial x \partial y} = \frac{x^2 - y^2}{x^2 + y^2}$$

15D1013R

6. Use the method of Lagrange's multipliers to find the volume of the largest rectangular parallelepiped that can be inscribed in the ellipsoid

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1.$$

(5)

7. (a) Find the absolute maximum and minimum values of

$$f(x, y) = 2 + 2x + 2y - x^2 - y^2$$

on the triangular plate in the first quadrant, bounded by the lines $x = 0$, $y = 0$ and $y = 9 - x$.

- (b) Obtain Taylor's expansion of

$$\tan^{-1} \left(\frac{y}{x} \right)$$

about $(1, 1)$ upto and including second order terms. Hence compute $f(1.1, 0.7)$.

Section-D

(From Unit-III)

8. (a) Apply the method of variation of parameters to solve

$$\frac{d^2 y}{dx^2} - y = \left(1 + \frac{1}{e^x} \right)^{-2}$$

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[P.T.O.]

(6)

(b) Solve the following simultaneous differential equations :

$$\frac{dx}{dt} + \frac{dy}{dt} - 2y = 2 \cos t - 7 \sin t,$$

$$\frac{dx}{dt} - \frac{dy}{dt} + 2x = 4 \cos t - 3 \sin t.$$

9. (a) The initial value problem governing the current i flowing in a series RL circuit when a voltage $v(t) = t$ is applied, is given by

$$iR + L \frac{di}{dt} = t, \quad t \geq 0, \quad i(0) = 0,$$

where, R and L are constants. Find the current $i(t)$ at time $t = 2$ secs.

(b) Show that

e^x, e^{2x}, e^{3x} are the fundamental solutions of

$$y''' - 6y'' + 11y' - 6y = 0,$$

on any interval I .

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(7)

10. (a) Solve the differential equation

$$\frac{d^2y}{dx^2} - 2 \frac{dy}{dx} + 2y = \sinh x + \sin \sqrt{2}x.$$

(b) Solve:

$$x^3 \frac{d^3y}{dx^3} + 3x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = x + \log x$$

15D1013R-200

(3)

(1)

(2)

Roll No. 15SD101

Printed Pages : 3

15D101

B.E. 1st Semester (Applied Science) Examination

APPLIED MATHEMATICS-I

Paper-AMT-142/AMT-130

Time allowed : 3 hours] [Maximum marks : 60

Instructions :

- Answer six questions only.
- Question number 1 is compulsory.
- Answer not more than two questions from each of the Sections B, C and D.

Section-A (Marks : 2 each)

1. (a) Find Characteristic equation of the matrix

$$A = \begin{pmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{pmatrix}$$

- (b) If $z = x^3 + y^3 - 3axy$ then show that

$$\frac{\partial^2 z}{\partial x \partial y} = \frac{\partial^2 z}{\partial y \partial x}$$

- (c) Define Jacobian for function of two variables.

15D101-2650

[P.T.O.]

(d) Solve $e^{2y} dy - (e^{3x} + x^2) dx = 0$.

(e) If $f(x, y) = ax^2 + by^2 + 2hxy$, then by Euler theorem find $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$.

Section-B (Marks : 10 each)

2. If $u = f(x, y)$ and $x = r \cos \theta$, $y = r \sin \theta$, prove that

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = \frac{\partial^2 u}{\partial r^2} + \frac{1}{r} \frac{\partial u}{\partial r} + \frac{1}{r^2} \frac{\partial^2 u}{\partial \theta^2}$$

3. If the sides of a plane triangle ΔABC vary in such a way that its circumradius remains constant then prove

$$\text{that } \frac{da}{\cos A} + \frac{db}{\cos B} + \frac{dc}{\cos C} = 0.$$

4. Expand $e^x \log(1+x)$ in power of x and y .

Section-C (Marks : 10 each)

5. Find the matrix P which transform the matrix

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix} \text{ to diagonal form. Hence, calculate } A^4.$$

(3)

6. If $u = \sin^{-1} \left(\frac{x+2y+3z}{x^2+y^2+z^2} \right)$, then find the value of $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z}$.

7. Solve the simultaneous equation

$$\frac{dx}{dt} + 2y + \sin t = 0$$

$$\frac{dy}{dt} - 2x - \cos t = 0$$

given that $x=0$ and $y=1$ at $t=0$.

Section-D (Marks : 10 each)

8. Given $x + y + z = a$, find the maximum value of $x^m y^n z^p$.

9. Solve $\frac{\partial^2 y}{\partial x^2} + 4 \frac{dy}{dx} + 4y = 3 \sin x + 4 \cos x$.

10. Solve $x^2 \frac{\partial^2 y}{\partial x^2} + 3x \frac{dy}{dx} + y = \frac{1}{(1-x)^2}$.

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(10)

Roll No.

Printed Pages : 4

15M273

BE (Applied Sc.) 1st Year Examination

APPLIED MATHEMATICS-I

Paper-AMT-130/AMT-101

Time allowed : 3 hours]

[Maximum marks : 60

- Note :**
- Answer six questions only.
 - Question Number one is compulsory.
 - Answer not more than two questions from each of the sections B, C and D.

Section-A

1. (i) Examine the linear independence or dependence of the system of vectors $(2, -1, 3)$, $(8, 2, 0)$ and $(0, 1, -2)$ 2
- (ii) Define functionally dependence and independence. Also check whether $u = \frac{x}{y}$ and $v = \frac{x+y}{x-y}$ are functionally dependent or not. If so give the relations. 2
- (iii) State Euler's theorem. If $u = f\left(\frac{y}{x}\right)$, then show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 0$. 2
- (iv) State Cayley Hamilton theorem. Using it find A^2

$$\text{If } A = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

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Section-B

10 marks each

2. Expand $\frac{\sin 8\theta}{\cos \theta}$ in the powers of $\sin \theta$.
3. Separate the real and imaginary parts of the following :
 - (i) $\sinh(x + iy)$
 - (ii) $\tanh(x + iy)$
4. Find the sum of n terms of the series

$$\sin x + \sin 3x + \sin 5x + \dots$$

Section-C

10 marks each

5. Discuss the behaviour of the series

$$x - \frac{1}{2} \frac{x^3}{3} + \frac{1.3}{2.4} \frac{x^5}{5} - \frac{1.3.5}{2.4.6} \frac{x^7}{7} + \dots$$
6. Discuss the behaviour of the series

$$\sum_{n=1}^{\infty} \frac{\cos n\pi}{n^2 + 1}$$

(b) Evaluate $\int_0^1 \int_0^1 \frac{x \, dx \, dy}{x^2 + y^2}$ by changing the order of integration.

7. (a) Find the area lying between $y = 4x - x^2$ and $y = x$.
- (b) Using triple integration find the volume of sphere of radius a .

Section-D

10 marks each

8. Prove the following :

(i) $\operatorname{div} \left(\frac{\vec{r}}{r^3} \right) = 0$

(ii) $\nabla^2 (r^n) = n(n+1)r^{n-2}$, where

$$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$$

9. (a) Compute $\oint_C \vec{F} \cdot d\vec{r}$, where $\vec{F} = \frac{iy - jx}{x^2 + y^2}$ and C is the circle $x^2 + y^2 = 1$, traversed counter clockwise.

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P.T.O.