OSMANIA UNIVERSITY FACULTY OF ENGINEERING UNIVERSITY COLLEGE OF ENGINEERING (AUTONOMOUS) B.E. (All Branches) II-Semester (Main) Examinations August/September 2022

ENGINEERING MATHEMATICS-II

Time: 3 hours Max. Marks: 70

Note: i) Answer Question No. 1 (Compulsory) and answer any four questions from the remaining questions (2-7).

- ii) Answers must be written in same order as they occur in the Question Paper.
- iii) Missing data, if any, may sultably be assumed.

		Marks	вт	со
1. a)	Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 1 \\ -1 & 0 & 2 \\ 2 & 1 & -3 \end{bmatrix}$	2	4	1
b)	Solve $(hx + by + f)dy + (ax + hy + g)dx = 0$	2	3	2
c)	Find the Particular Integral of $(D^2 + 6D + 9)y = 5e^{3x}$	2	2	3
d)	Determine whether $\frac{1}{z}$ is analytic or not.	2	5	4
c)	For the conformal transformation $w = z^2$, find the coefficient of magnification at $z = 2 + i$	2	1	5
f)	Define Cauchy's Residue Theorem.	2	6	5
g)	Find Integrating factor of $(2x \log x - xy)dy + 2y dx = 0$	2	5	2
2. a)	Find the values of k such that the system of equations $x + ky + 3z = 0$, $4x + 3y + kz = 0$, $2x + y + 2z = 0$ has non-trivial solution.	7	4	I
b)	Reduce the following Quadratic form into "Sum of squares" by an orthogonal transformation and give the matrix of transformation $x^2 + 2y^2 - 7z^2 - 4xy + 8xz$ and discuss with nature.	7	3	1
3, a)	Find the orthogonal trajectory of family of curves $r^n sinn\theta = a^n$	7	4	2
-	Solve $y^1 + y \tan x = \cos x$, $y(0) = 0$	7	5	2

(P.T.O.)

4. a) Solve
$$(x^2D^2 - xD - 3)y = x^2 \log x$$

b) Using the Method of Variation of Parameters 7 3 3 solve
$$\frac{d^2y}{dx^2} + 4y = \tan 2x$$

$$\int_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)} dz$$
, where C is the circle $|z| = 3$

b) Show that
$$e^x(x \cos y - y \sin y)$$
 is a harmonic function. Find the analytic function for which $e^x(x \cos y - y \sin y)$ is imaginary part.

6. a) Find the bilinear transformation which maps the points
$$z \neq 1$$
, $i, -1$ into the points $w = i, 0, -i$

b) Find the residue of
$$\frac{z^3}{(z-1)^4(z-2)(z-3)}$$
 at a pole of order 4

7. a) Evaluate
$$\int_{c}^{c} \frac{e^{2z}}{(z+1)^4} dz$$
 around $c: |z-1| = 3$

b)
$$\int_C \frac{1-2z}{z(z-1)(z-2)} dz$$
, where c is the circle $|z|=1.5$ by using Cauchy's

Residue Theorem.

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FACULTY OF ENGINEERING

B.E. II-Semester (AICTE) (Main & Backlog) Examination, November 2020

Subject: Mathematics - II

Time: 2 Hours

Max. Marks: 70

Note: Answer Any five Questions from Part-A & Any Four Questions From Part-B.

PART - A (5x4=20 Marks)

- 1 Examine whether the vector (1, 2,), (3, 4), (3, 7) are linearly independent.
- 2 If 1, -1, 2 are the eigen values of a 3 x 3 matrix A, find the determinant of the matrix A³ 2A⁻¹ + I.
 - 3 Define exact differential equation.
- 4 Find the singular solution of the Clairant's equation y + xy
- 5 Find the complementary function of $(D^2 + D + 1)^2y = e^{-x} \tan x$
- 6 Solve $x \frac{d^2 y}{dx^2} + \frac{dy}{dx} = 0$.
- 7 Evaluate $r\left(-\frac{3}{2}\right)$.
- 8 State Rodrigue's formula and hence find P2
- 9 Find L{e-t sint cost}
- 10 Evaluate $\int_{1}^{\sin t} dt$ using Laplace transform.

PART - B (4x15=60 Marks)

- 11 (a) Test for consistency and hence solve the following system of equations. $x_1 + 2x_2 + x_3 = 2$, $3x_1 + x_2 2x_3 = 1$, $4x_1 3x_2 x_3 = 3$, $2x_1 + 4x_2 + 2x_3 = 4$
 - (b) Find the characteristics equation of $A = \begin{pmatrix} 4 & 3 & 1 \\ 2 & 1 & -2 \\ 1 & 2 & 1 \end{pmatrix}$ and hence find A⁻¹.
- 12 (a) Solve $(3x^2y^4 + 2xy)dx + (2x^3y^3 x^2)dy = 0.p$
 - (b) Find the orthogonal trajectories of the family of parabolas $y^2 = 2cx + c^2$.
- 13 (a) Find the general solution of the differential equation

$$\frac{d^3y}{dx^3} - y = (e^x + 1)^2.$$

- (b) Solve $y'' + 2y' + 2y = e^{-x} \cos x$ by the method of variation of parameters.
- 14 (a) Evaluate $\int_{0}^{1} \frac{dx}{\sqrt{1-x^4}}$ using Beta and Gamma functions.
 - (b) Show that $P_{2n}(0) = (-1)^n \frac{1 \cdot 3 \cdot 5 \cdot \dots \cdot (2n-1)}{2 \cdot 4 \cdot 6 \cdot \dots \cdot 2n}$ and $P_{2n+1}(0)=0$.

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15 (a) Find the inverse Laplace transform of $\log \left(\frac{5+a}{5+b} \right)$.

- (b) Apply Laplace transforms to solve $y'' + y = 3\cos 2x$, y'(0) = 0 = y(0).
- =46 Reduce the quadratic form Q = 2(xy + yz + zx) to Canonical form using orthogonal transformation.
- 17 (a) Show that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$.
 - (b) Apply convolution theorem to find $L^{-1}\left\{\frac{s}{(s^2+1)(s-1)}\right\}$

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FACULTY OF ENGINEERING B.E. II - Semester (AICTE) (Main) Examination, October 2021

Subject: Mathematics - II

Time: 2 Hours

Max. Marks: 70

- Note: i) First Question is compulsory and answer any three questions from the remaining six questions.
 - ii) Answers to each question must be written at one place only and in the same order as they occur in the question paper.
 - iii) Missing data, if any, may suitably be assumed.

Answer any four questions from the following.



- 1 a Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 3 & 4 \\ 1 & 3 & -1 \\ 8 & 13 & 14 \end{bmatrix}$
 - b Solve $y(2xy + e^x)dx = e^x dy$.
 - c Solve $(D^2 + 9)y = \sin 3x$.
 - d Evaluate $\int_{0}^{\infty} e^{-tx} (1-e^{-x})^{2} dx$ in terms (bet) function.
 - e Find $L\{r^3e' + \sin^2 t\}$.
 - f Find $E^4\left\{\frac{1}{(r^2+1)(r^2+3)}\right\}$
 - g Evaluate $6P_3(x) + 4P_3(x) + 16P_1(x)$ as a polynomial of x

(3x18=54 Marks)

2 (a) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 11 & -4 & -7 \\ 7 & -2 & -5 \\ 10 & -4 & -6 \end{bmatrix}$.

- (b) Reduce the quadratic form $8x_1^2 + 7x_2^2 + 3x_3^2 + 12x_1x_2 + 4x_1x_3 8x_2x_3$ into canonical form.
- 3 (a) Solve $y(x+y)dx x^2dy = 0$.
 - (b) Solve $y(2xy+1)dx + x(1+2xy-x^3y^3)dy = 0$.
- $4 (a) Solve y' + 4y = x \cos x.$
 - (b) Solve $y' + 2y' + y = e^{-x} \log x$ by the method of variation of parameters.
- 5 (a) Find the power series solution of the differential equation y' + 2xy' + y = 0 about the origin.

(b) Evaluate
$$\frac{d}{dx} [erf(ax)]$$
.

(b) Find
$$L^{-1}\left\{\frac{1}{s^2(s+2)}\right\}$$
.

- 7 (a) Find the orthogonal dejectories of the family of curves y' + 3x' = y' where c is arbitrary constant.
- (b) Solve $x^2y' xy' 3y = x^2 \log x$.

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FACULTY OF ENGINEEERING

B.E. II - Semester (AICTE) (Main & Backlog) New) Examination, September/ October - 2022

Subject: MATHEMATICS-II

Time: 3 Hours

Max. Marks: 70

Note: (i) First question is compulsory and answer any four questions from the remaining six questions. Each Questions carries 14 Marks.

- (ii) Answer to each question must be written at one place only and in the same order as they occur in the question paper.
- (iii) Missing data, if any, may be suitably assumed.
- 1. (a) If λ is an eigenvalue of a non-singular matrix A, show that $\frac{A}{\lambda}$ is an eigenvalue of Adj A.
 - (b) Obtain the general solution of the differential equation $y = xy' + e^{-y'}$.
 - (c) Find the second order differential equation for which e^x, e^{-x} are solutions.
 - (d) Prove that erf(x) + erfc(x) = 1.
 - 1 (e) Find $L\{(\cos t \sin t)^2\}$.
 - (f) Find the matrix of the quadratic form $Q = 2(x^2 + xy + y^2)$.
 - (g) Find a particular integral of $y'' + 2y' + y = \sin x$.
- 2. (a) Show that the system of equations x-3y-8z+10=0, 3x+y-4z=0, 2x+5y+6z-13=0 is consistent and solve the same
 - (b) Verify Cayley-Hamilton theorem for $A = \begin{pmatrix} 2 & 1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$.
- 3. (a) Find the general solution of $(x^3 + y^3) dx xy^2 dy = 0$.
 - (b) Solve the differential equation $xy(1+xy^2)\frac{dy}{dx}=1$.

4. (a) Solve
$$\frac{d^3y}{dx^3} - y = (e^x + e^{-x})^2$$
.

(b) Solve
$$x^2y'' - 2xy' + 2y = \frac{1}{x}$$
.

5. (a) Prove that
$$\beta(m,n) = \beta(n,m)$$
 and $\beta(m+1,n) + \beta(n+1,m) = \beta(m,n)$.

(b) Find the power series solution of the differential equation $(1-x^2)y' + 2xy' + 2y = 0$ about the origin.

6. (a) Evaluate
$$\int_{0}^{\infty} t^{3}e^{-t} \sin t \, dt$$
 using Laplace transform.

(b) Apply convolution theorem to find
$$L^{-1}\left\{\frac{1}{s\left(s^2-1\right)}\right\}$$

7. (a) Define rank of a matrix. Find all values of k such that the rank of the matrix

$$A = \begin{pmatrix} k & -1 & 0 & 0 \\ 0 & k & -1 & 0 \\ 0 & 0 & k & -1 \\ -6 & 11 & -6 & 1 \end{pmatrix}$$
 is equal to 3.

(b) Find the orthogonal trajectories of the family of curves
$$\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1$$
, where λ is a parameter.

FACULTY OF ENGINEERING

B.E. (Common to all Branches) II Semester (AICTE) (Main & Backlog) Examination, September / October 2023

Subject: Mathematics-II

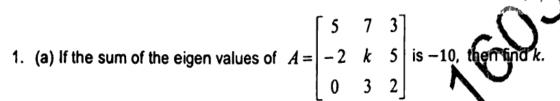
Time: 3 Hours

Max. Marks: 70

Note: (i) First question is compulsory and answer any four questions from the remaining six questions. Each questions carries 14 Marks.

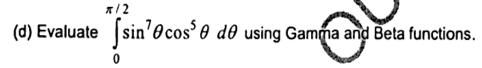
(ii) Answer to each question must be written at one place only and in the same order as they occur in the question paper.

(iii) Missing data, if any, may be suitably assumed.



(b) Define an exact differential equation.

(c) Solve
$$x^2y'' - 2xy' - 4y = 0$$
.



(e) Find
$$L\{e^{-4t} t^2\}$$
.

(f) Find the matrix of the quadratic form

$$Q = 2x_1^2 + 4x_2^2 + 5x_3^2 - 6x_1x_2 + 8x_2x_3 - 10x_3x_1.$$

(g) Obtain the singular solution of $y = xy' - \frac{1}{y'}$.

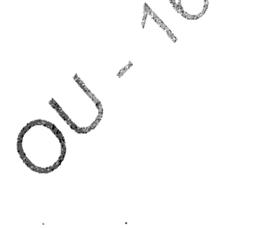
2. (a) Find the rank of the matrix
$$A = \begin{bmatrix} 2 & -1 & 3 & 2 \\ -4 & 0 & 3 & 5 \\ 7 & 2 & 1 & 1 \end{bmatrix}$$
 by reducing to echelon form.

(b) Verify Cayley-Hamilton theorem for
$$A = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$$
 and hence find A^{-1} .

3. (a) Solve
$$(x^2 + y^3)dx - xy^2dy = 0$$
.

(b) Find the orthogonal trajectories of the family of circles passing through (0,2) and (0,-2).

- 4. (a) Solve $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 4y = 3e^{-x} + 2x + \sin x$.
 - (b) Solve $\frac{d^2y}{dx^2} + y = \tan x$ by the method of variation of parameters.
- 5. (a) Prove that $\beta(m,n) = \frac{\Gamma(m) \Gamma(n)}{\Gamma(m+n)}$.
 - (b) State Rodrigue's formula and hence find $P_0(x)$, $P_1(x)$, $P_2(x)$ and $P_3(x)$.
- 6. (a) Find (i) $L\left\{\frac{\sinh t}{t}\right\}$ and (ii) $L\left\{e^{-t}\sin^2 t\right\}$
 - (b) Using Laplace transforms, solve $\frac{d^2y}{dt^2} + 25y = 10 \cos 5t$, y(0) = 2, y'(0) = 0
- 7. (a) Find the values of λ and μ for which the system equations x + y + z = 3, x + 2y + 2z = 6, $x + \lambda y + 3z = \mu$ has (i) no solution (ii) a unique solution and (iii) infinite number of solutions.
 - (b) Using convolution theorem, find $L^{-1}\left\{\frac{1}{s(s^2+4)}\right\}$



FACULTY OF ENGINEERING

B.E. II - Semester (AICTE) (Backlog) (New) Examination, February/ March 2024

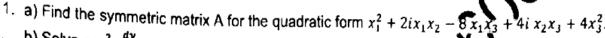
Subject: Mathematics-II

Time: 3 Hours

Max. Marks: 70

Note: (i) First question is compulsory and answer any four questions from the remaining six questions. Each question carries 14 Marks.

- (ii) Answer to each question must be written at one place only and in the same order as they occur in the question paper.
- (iii) Missing data, if any, may be suitably assumed.



b) Solve
$$\cos^2 x \frac{dy}{dx} + y = \tan x$$

c) Solve
$$(D^3 + 2D^2 + D)y = x^2e^{2x} + \sin^2 x$$
.

- d) Show that $\Gamma(\alpha+1)=\alpha\Gamma(\alpha)$ and find the value of $\Gamma(7/2)$.
- e) Express $6P_3(x) 2P_1(x) + P_0(x)$ in terms of powers of

f) Write Cayley -Hamilton theorem and verify it for the hat
$$x = \begin{bmatrix} 1 & 4 \\ 3 & 2 \end{bmatrix}$$

g) Find L-1
$$\left\{\frac{s+3}{(s-1)(s+2)}\right\}$$

2. a) Find the rank of the matrix
$$A = \begin{bmatrix} 1 & 3 & -4 \\ -4 & 4 & -5 \end{bmatrix}$$
 using elementary row operations.

b) Find Eigen values and Eigen

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

3. a) Find the integrating factor and solve the differential equation

$$y(1+xy^2)dx + 2(x^2y^2 + x + y^4)dy = 0$$
, $y(0) = 1$.
b) Solve $x^2 \frac{d^2y}{dx^2} = 3x \frac{dy}{dx} + 4y = (1+x)^2$.

b) Solve
$$x^2 \frac{d^2y}{dx^2} = 3x \frac{dy}{dx} + 4y = (1+x)^2$$

- 4. a) Solve $y'' 2y' + y = e^x \log x$ by method of variation of parameters.
 - b) Find the orthogonal trajectory of family of curves $r = c(1 + \cos \theta)$.
- 5. a) Solve Legendre's differential equation $(1-x^2)y'' 2xy' + n(n+1)y = 0$, $n \in \mathbb{Z}^+$ and write its General solution.
 - b) Write an expression for Legendre's polynomial $P_n(x)$, and find $P_0(x)$, $P_1(x)$ and $P_2(x)$.

..2..

-2-

- 6. a) Test for consistency and solve the following system of equations: 2x 3y + 7z = 5, 3x + y 3z = 13, 2x + 19y 47z = 32.
 - b) Reduce the quadratic form $6x_1^2 + 3x_2^2 + 3x_3^2 4x_1x_2 2x_22x_3 + 4x_3x_1$ to canonical form through orthogonal transformation. Find index and signature
- 7. a) Write Convolution theorem, use it to solve the differential equation

$$y'' + 3y' + 2y = e^{-t}, y(0) = 0, y'(0) = -1$$

b) Apply Laplace transform to solve the initial value problem

$$y''' - 3y'' + 3y' - y = t^2 e^t$$

$$y(0) = 1, y'(0) = 0, y''(0) = 0$$