**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 suitably be assumed.*

---

| | | Question | Marks | BT | CO |
|---|---|---|---|---|---|
| 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 |
| | e) | 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 $(2x\,logx - xy)dy + 2y\,dx = 0$ | 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 | 1 |
| | 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 $r^n sin n\theta = a^n$ | 7 | 4 | 2 |
| | b) | Solve $y^1 + y\,tanx = cosx$, $y(0) = 0$ | 7 | 5 | 2 |

(P.T.O.)



https://www.osmaniaonline.com

| | | | | | |
|---|---|---|---|---|---|
| 4. | a) | Solve $(x^2D^2 - xD - 3)y = x^2\, logx$ | 7 | 2 | 3 |
| | b) | Using the Method of Variation of Parameters solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$ | 7 | 3 | 3 |
| 5. | a) | Use Cauchy's Integral formula to evaluate $\int_C \frac{sin\pi z^2 + cos\pi z^2}{(z-1)(z-2)}\, dz$ , where C is the circle $\lvert z \rvert = 3$ | 7 | 5 | 4 |
| | b) | Show that $e^x(x\, cosy - y\, siny)$ is a harmonic function. Find the analytic function for which $e^x(x\, cosy - y\, siny)$ is imaginary part. | 7 | 1 | 4 |
| 6. | a) | Find the bilinear transformation which maps the points $z = 1, i, -1$ into the points $w = i, 0, -i$ | 7 | 6 | 5 |
| | b) | Find the residue of $\frac{z^3}{(z-1)^4(z-2)(z-3)}$ at a pole of order 4 | 7 | 4 | 5 |
| 7. | a) | Evaluate $\int_c \frac{e^{2z}}{(z+1)^4} dz$ around $c: \lvert z-1 \rvert = 3$ | 7 | 3 | 4 |
| | b) | $\int_C \frac{1-2z}{z(z-1)(z-2)} dz$, where c is the circle $\lvert z \rvert = 1.5$ by using Cauchy's Residue Theorem. | 7 | 6 | 5 |

******

https://www.osmaniaonline.com
Whatsapp @ 9300930012
Send your old paper & get 10/-
अपने पुराने पेपर्स भेजे और 10 रुपये पायें,
Paytm or Google Pay से

Code No. 2882/AICTE/M

# 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 $A^3 - 2A^{-1} + I$.

3 Define exact differential equation.

4 Find the singular solution of the Clairant's equation $y + xy'$ [illegible] $\frac{1}{y'}$

5 Find the complementary function of $(D^2 + D + 1)^2 y = e^{[illegible]} \tan x$.

6 Solve $x\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$.

7 Evaluate $\Gamma\left(-\frac{3}{2}\right)$.

8 State Rodrigue's formula and hence find $P_2(x)$.

9 Find $L\{e^{-t} \sin t \cos t\}$

10 Evaluate $\int_0^\infty \frac{\sin t}{t} dt$ using Laplace transform.

## PART – B (4x15=60 Marks)

11 (a) Test for consistency and hence solve the following system of equations.

$$x_1 + 2x_2 + x_3 = 2, \quad 3x_1 + x_2 - 2x_3 = 1, \quad 4x_1 - 3x_2 - x_3 = 3, \quad 2x_1 + 4x_2 + 2x_3 = 4$$

(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 $P_{2n}(0) = (-1)^n \frac{1.3.5......(2n-1)}{2.4.6.......2n}$ and $P_{2n+1}(0)=0$.



https://www.osmaniaonline.com
https://www.osmaniaonline.com
https://www.osmaniaonline.com
OU - 1605

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

(b) Apply Laplace transforms to solve $y'' + y = 3\cos 2x$, $y'(0) = 0 = y(0)$.

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

*****

https://www.osmaniaonline.com

https://www.osmaniaonline.com

https://www.osmaniaonline.com
Whatsapp @ 9300930012
Send your old paper & get 10/-
अपने पुराने पेपर्स भेजे और 10 रुपये पायें,
Paytm or Google Pay से

https://www.osmaniaonline.com

Code No. 15265/AICTE

# 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.** (4x4=16 Marks)

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 $\int_0^\infty e^{-4x}(1-e^{-x})^3 dx$ in terms of beta function.

e Find $L\{t^3e^t + \sin^2 t\}$.

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

g Evaluate $6P_3(x) + 4P_2(x) - 16P_1(x)$ as a polynomial of $x$.

OU - 1603

(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.

..2..

https://www.osmanianonline.com

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

6 (a) Find $L\left\{\int_0^t ue^{-u}\sin 4u\, du\right\}$.

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

7 (a) Find the orthogonal trajectories of the family of curves $y' + 3x'$ [illegible] where $c$ is arbitrary constant.

(b) Solve $x^2y'' - xy' - 3y = x^2 \log x$.

****

https://www.osmaniaonline.com
Whatsapp @ 9300930012
Send your old paper & get 10/-
अपने पुराने पेपर्स भेजे और 10 रुपये पायें,
Paytm or Google Pay से

https://www.osmaniaonline.com

Code No. D-2333/N/BL/AICTE

# 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 $\lambda$ 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*.

(e) Find $L\left\{(\cos t - \sin t)^2\right\}$.

(f) Find the matrix of the quadratic form $Q = 2\left(x^2 + xy + y^2\right)$.

(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 $\left(x^3 + y^3\right) dx - xy^2 dy = 0$.

(b) Solve the differential equation $xy\left(1 + xy^2\right)\frac{dy}{dx} = 1$.



https://www.osmaniaonline.com

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

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

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 $\left(1-x^2\right)y'' - 2xy' + 2y = 0$ 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 $L^{-1}\left\{\dfrac{1}{s\left(s^2-1\right)}\right\}$.

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 $\dfrac{x^2}{a^2+\lambda} + \dfrac{y^2}{b^2+\lambda} = 1$, where $\lambda$ is a parameter .

**

https://www.osmaniaonline.com

Code No. E-5612/N/BL/AICTE

# 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.**

1. (a) If the sum of the eigen values of $A = \begin{bmatrix} 5 & 7 & 3 \\ -2 & k & 5 \\ 0 & 3 & 2 \end{bmatrix}$ is $-10$, then find $k$.

(b) Define an exact differential equation.

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

(d) Evaluate $\int_0^{\pi/2} \sin^7\theta \cos^5\theta \, d\theta$ using Gamma and Beta functions.

(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 $(0,-2)$.



OU - 1603
OU - 1603
https://www.osmaniaonline.com

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 $\beta(m,n) = \dfrac{\Gamma(m)\,\Gamma(n)}{\Gamma(m+n)}$.

(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) $L\{e^{-t}\sin^2 t\}$

(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 $\lambda$ and $\mu$ 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 $L^{-1}\left\{\frac{1}{s(s^2+4)}\right\}$.

**

OU - 1603 OU 1603

Code No: F-13612/N/AICTE

# 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.

1. a) Find the symmetric matrix A for the quadratic form $x_1^2 + 2ix_1x_2 - 8x_1x_3 + 4i\,x_2x_3 + 4x_3^2$.
   b) Solve $cos^2x\frac{dy}{dx} + y = tanx$
   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 $x$.
   f) Write Cayley -Hamilton theorem and verify it for the matrix $A = \begin{bmatrix}1 & 4\\3 & 2\end{bmatrix}$.
   g) Find $L^{-1}\left\{\frac{s+3}{(s-1)(s+2)}\right\}$

2. a) Find the rank of the matrix $A = \begin{bmatrix}1 & 3 & -4\\ -[illegible] & -3 & 4\\ 2 & [illegible] & -5\end{bmatrix}$ using elementary row operations.
   b) Find Eigen values and Eigen vectors for the matrix
   $A= \begin{bmatrix}1 & 1 & 1\\1 & 1 & 1\\1 & -1 & 1\end{bmatrix}$.

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

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 $(1 - x^2)y'' - 2xy' + n(n + 1)y = 0, n \in Z^+$ 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..

https://www.osmanianline.com

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

$$y''' - 3y'' + 3y' - y = t^2e^t$$
$$y(0) = 1, y'(0) = 0, y''(0) = \text{[illegible]}$$

1603

**

https://www.osmaniaonline.com