Roll No. ☐☐☐☐☐☐☐☐☐☐

Total No. of Questions : 09

Total No. of Pages : 01

B.Tech. (AI&DS/AI&ML/Blockchain/CE/CSE/Cyber Security/IOT/CS&D/EEE/ECE/DS/EE/ECE(Industry Integrated)/ETE/ECS/FT/IT/ME/Robotics & AI/CSE (Internet of Things and Cyber Security including block Chain Technology)) (Sem.–2)

ENGINEERING MATHEMATICS-II

Subject Code : BTAM201-23

M.Code : 93811

Date of Examination : 06-05-2025

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C. have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.**
4. **Select at least TWO questions from SECTION - B & C.**

SECTION - A

1. **Write a short notes on :**

a) Determine whether the system of equations : $x - 3z = -1$ and $2x - z = 3$ is consistent or not? Justify.

b) Find the column rank of the matrix $A = \begin{pmatrix} 1 & 1 & 2 \\ 1 & 4 & 3 \\ 3 & 3 & 6 \end{pmatrix}$.

c) State Rank-Nullity theorem.

d) If λ is an eigenvalue of the matrix A, then prove that $\alpha\lambda$ is an eigenvalue of αA, where α is a scalar.

e) Let $T : V \to V$ be a Linear Transformation. Show that $T(O) = O$, where O is the zero element of vector space V.

f) Write down the ordinary differential equation for simple population decay model.

g) Find the particular integral of $(D^3 + 1)\, y = \cos(2x - 1)$.

h) Find the differential equation of all ellipses centered at the origin and foci on x-axis.

i) Construct the partial differential equation of $z = a(x + y) + b(x - y)$ by eliminating the arbitrary constants.

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j) Find the solution of the partial differential equation $(D^4 - 2D^2D'^2 + D'^4)\, z = 0$.

SECTION - B

2. Using Gauss Elimination method, solve the following system of linear equations :

$x + 3y - 2z = 0,\ 2x - y + 4z = 0,\ x - 11y + 14z = 0$.

3. Determine the all values of k such that the rank of the matrix A is 3, where

$$A = \begin{bmatrix} 1 & 1 & -1 & 0 \\ 4 & 4 & -3 & 1 \\ k & 2 & 2 & 2 \\ 9 & 9 & k & 3 \end{bmatrix}.$$

4. Diagonalize the matrix $\begin{pmatrix} 0 & 2 & 1 \\ 2 & 0 & 3 \\ 1 & -3 & 0 \end{pmatrix}$.

5. Find a Linear transformation $T : \mathbb{R}^4 \to \mathbb{R}^3$ whose null space is generated by (1, 2, 3, 4) and (0, 1, 1, 1).

SECTION - C

6. If $\log\left(\frac{dy}{dx}\right) = (x + y)$ and $y(1) = 1$, then find $y(-1)$.

7. Solve $\frac{d^2y}{dx^2} + a^2y = \tan ax,$, using the method of variation of parameters.

8. Find the general solution of the partial differential equation $(y + z)\, p + (2 + x)\, q = x + y$.

9. Solve $(p^2 + q^2)\, x = pz$ using Charpit's method.

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Total No. of Questions : 09

Total No. of Pages : 03

B.Tech. (AI&ML / AI&DS / Block Chain / CE / CSE / CS / DS / CSD / EE / ECE / EEE / ETE / IT / ME / Robotics & Artificial Intelligence / Internet of Things and Cyber Security including Block Chain Technology) (Sem.–2)

ENGINEERING MATHEMATICS-II

Subject Code : BTAM201-23

M.Code : 93811

Date of Examination : 10-01-2025

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.**
4. **Select atleast TWO questions from SECTION - B & C.**

SECTION-A

1. Answer the following :

a) Using Echelon form, find the rank of the matrix $A = \begin{pmatrix} 3 & 1 & 7 \\ 1 & 2 & 4 \\ 4 & -1 & 7 \\ 4 & -1 & 5 \end{pmatrix}$.

b) Determine the eigen values of the matrix $\begin{pmatrix} 1 & 4 \\ 3 & 2 \end{pmatrix}$.

c) Let V be a vector space in $\mathbb{R}^3$. Examine whether $W = \{(a, b, c) : a^2 + b^2 + c^2 \leq 1\}$ is a subspace of V.

d) Let V be a vector space over a field F. Show that any subset S of V containing zero vector is Linearly Dependent over F.

e) Determine the value of k for which the system of equations :

$x - ky + z = 0$; $kx + 3y - kz = 0$; $3x + y - z = 0$ has only trivial solution.

f) Verify if $y = \frac{x^2}{2} + C$ satisfies the differential equation $y' = x$.

g) Solve the initial value problem $\frac{dy}{dx} = x + 2$ given $y(0) = 1$.

h) Find an integrating factor for the differential equation $\frac{dy}{dx} + y \tan(x) = \sin(x)$.

i) Solve the nonlinear first-order PDE $\frac{\partial z}{\partial x} + z\frac{\partial z}{\partial y} = 0$.

j) Verify if the surfaces defined by $z = xy$ and $z = x^2 + y^2$ are orthogonal to each other at the point (1, 1, 1).

SECTION-B

2. Solve the following system of equations using Gauss Elimination method :

$x - y + z = 4$; $2x + y - 3z = 0$; $x + y + z = 2$.

3. Find a Linear transformation $T : \mathbb{R}^3 \to \mathbb{R}^4$ whose range is spanned by (1, 2, 0, –4) and (2, 0, –1, –3).

4. Verify Cayley-Hamilton theorem for the matrix $A = \begin{pmatrix} 1 & 1 & 2 \\ 1 & 3 & -1 \\ -2 & -1 & 1 \end{pmatrix}$. Find A^{-1}.

5. Find the inverse of the matrix using the Gauss-Jordan method : $\begin{pmatrix} 2 & -1 & 1 \\ 1 & 1 & -1 \\ 1 & -2 & 3 \end{pmatrix}$.

SECTION-C

6. Solve $y'' + y = \sin x$ using variation of parameters.

7. An electric RLC circuit has a resistance of 10 Ω, an inductance of 5 H, and a capacitance of 0.02 F. Form and solve the differential equation for the charge $Q(t)$ on the capacitor, given that $Q(0) = 0$ and $Q'(0) = 0$.

8. Solve the PDE $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} - z = 0$ using Lagrange's method, and verify your solution by checking if it satisfies the original equation.

9. Find the general solution of the linear PDE $u_{xx} + 3u_{xy} + 2u_{yy} = e^{x}$.

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Roll No. | | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (AI & DS / AI & ML / Block Chain / CE / CSE / CS / DS / CSD / EE / EEE / ETE / FT / IT / ME / Robotics & Artificial Intelligence / Internet of Things and Cyber Security including Block Chain Technology) (Sem.–2)

ENGINEERING MATHEMATICS-II

Subject Code : BTAM201/23

M.Code : 93811

Date of Examination : 09-06-2024

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

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SECTION-A

1. Write briefly :

(a) Reduce in echelon form : $A = \begin{pmatrix} 1 & 3 & 2 \\ 1 & 6 & 1 \\ 2 & 3 & 6 \end{pmatrix}$

(b) State Cayley-Hamilton theorem.

(c) Determine the value of k for which the homogeneous system of equations : $x - ky + z = 0;\ kx + 3y - kz = 0;\ 3x + y - z = 0$ has only trivial solution.

(d) Determine the eigen values of the matrix $\begin{pmatrix} 1 & 4 \\ 3 & 2 \end{pmatrix}$.

(e) $T : \mathbb{R} \to \mathbb{R}^2$ defined by $T(x) = (2x, 3x)$. Check whether T is a Linear Transformation or not.

(f) Check the exactness of the differential equation : $e^x(\cos y\, dx - \sin y\, dy) = 0$.

(g) Solve the following differential equation $\sin x \frac{dy}{dx} + y \cos x = \cos x \sin^2 x$.

(h) Check whether the Differential equation $y'' + yx^3 = 0$ is Linear and Non-linear?

(i) Solve the partial differential equation $(4D^3 - 3DD'^2 + D'^3)\, z = 0$.

(j) Eliminate the arbitrary constants a and b from $z = ax + by + a^2b^2$, to obtain the partial differential equation governing it.

SECTION-B

2. Solve the system of linear equations : $x + 2y - z = 3$, $3x - y + 2z = 1$, $2x - 2y + 3z = 2$, using inverse of a matrix.

3. Use Gauss-Jordon method to find the inverse of the matrix $A = \begin{bmatrix} 0 & 2 & 1 & 3 \\ 1 & 1 & -1 & -2 \\ 1 & 2 & 0 & 1 \\ -1 & 1 & 2 & 6 \end{bmatrix}$.

4. For the linear transformation $T : \mathbb{R}^2 \to \mathbb{R}^3$, defined by, $T(x, y) = (x + y, x - y, y)$, find a basis and dimension of (*i*) its range space and (*ii*) its null space. Hence verify rank-nullity theorem.

5. Let T be a linear operator on $\mathbb{R}^2$ defined by $T(x, y) = (4x - 2y, 2x + y)$.

   (a) Find the matrix T relative to basis $B = \{(1, 1), (-1, 0)\}$.

   (b) Also verify that $[T : B][v : B] = [T(v) : B]$ for any vector $v \in \mathbb{R}^2$.

SECTION-C

6. Solve the differential equation $(D^2 + D + 1)\, y = \sin x$ using method of undetermined coefficients.

7. Solve $y' + 4xy + xy^3 = 0$.

8. Find the general solution of the partial differential equation $xy^2p + y^3q = (zxy^2 - 4x^3)$.

9. Solve $p = (qy + z)^2$ using Charpit's method.

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Total No. of Questions : 09

Total No. of Pages : 03

B.Tech. (Automation & Robotics/Bio Technology/Civil Engineering/Computer Science & Engineering/Electrical & Electronics Engineering/Electrical Engineering/Electronics & Communication Engineering/Information Technology/Mechanical Engineering) (Sem.–2)

ENGINEERING MATHEMATICS – II

Subject Code : BTAM-102
M.Code : 54092
Date of Examination : 06-07-22

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

1. **Answer briefly :**

   a) Find the general value of $\log(-4)$.

   b) If $A = \begin{bmatrix} 1 & 4 \\ -3 & 5 \end{bmatrix}$. Hence find A^{-1}.

   c) Define similar matrices.

   d) Solve $(x-a)\frac{dy}{dx} + 3y = 12(x-a)^3$.

   e) Solve $\frac{dy}{dx} + \frac{1}{x}y = x^3 - 3$.

   f) Solve $(x + y - 10)dx + (x - y - 2)dy = 0$.

   g) Find the general solution of $\frac{d^3y}{dx^3} + y = 0$.

   h) Give an example of a matrix which is Skew symmetric but not skew Hermitian.

   i) Examine the vectors for Linear dependence $X_1 = (1, -1, 1)$, $X_2 = (2, 1, 1)$, $X_3 = (3, 0, 2)$

   j) State Gauss test.

SECTION-B

2. a) Solve $(1+x)^2\frac{d^2y}{dx^2} = (1+x)\frac{dy}{dx} + y = 4\cos[\log(1+x)]$.

   b) Solve the following differential equations $(y^2 - 2x^2y)\,dx + (2xy^2 - x^3)\,dy = 0$.

3. a) Solve $y'' + y = \operatorname{cosec} x$ by method of variation of parameters.

   b) Solve the differential equation $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = \sin e^x$.

4. The damped LCR circuit is governed by the equation $\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{C} = 0$, where L, C, R are positive constants. Find the condition under which the circuit is over damped, under damped and critically damped. Find also the critical resistance.

5. a) Solve the Clairaut's equation $y = xy' + \frac{1}{y'}$.

   b) Solve $[1 + \log(xy)]dx + \left[1 + \frac{x}{y}\right]dy = 0$.

SECTION-C

6. a) Separate into real and imaginary parts $\tan^{-1}(e^{i\theta})$.

   b) Find modulus and argument of $(1-i)^{1+i}$

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7. a) Expand $\sin^8\theta$.

b) Show that the Matrix $A=\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ is similar to the diagonal Matrix. Also, find the Transforming Matrix and the Diagonal Matrix.

8. a) Discuss the convergence or divergence of the series $\sum \frac{n^p}{(n+1)^q}$.

b) Test the convergence of $\frac{x}{1.2}+\frac{x^2}{3.4}+\frac{x^3}{5.6}=\ldots\ldots\ldots$.

9. a) If $A=\begin{bmatrix} -1 & 1 & 2 \\ 3 & -1 & 1 \\ -1 & 3 & 4 \end{bmatrix}$, Find A^{-1} by Gauss Jordan Method.

b) Find all the Eigen values and Eigen vectors of the matrix $A=\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$.

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Total No. of Questions : 08

Total No. of Pages : 02

B.Tech. (Aeronautical Engg./Aerospace Engg./ Automation & Robotics/Automobile Engg./BT/CE/CSE/Electrical & Electronics Engg./EE/ECE/Electronics & Electrical Engg./IT/ICE/Marine Engg./Mechanical Engg./Petroleum Refinary Engg./Textile Engg.) (2012 to 2017) (Sem.–2)

ENGINEERING MATHEMATICS – II

Subject Code : BTAM-102

M.Code : 54092

Time : 2 Hrs.

Max. Marks : 30

INSTRUCTIONS TO CANDIDATES :

1. **Attempt any FIVE question(s), each question carries 6 marks.**

1. Sum the series $e^{\alpha}\cos\beta - \frac{e^{3\alpha}}{3}\cos 2\beta + \frac{e^{5\alpha}}{5}\cos 5\beta - \ldots\ldots \infty$

2. Verify Cayley's Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}$ and hence obtain the inverse of the given matrix.

3. Test the convergence of the following series :

$$1 + \frac{2}{2!}x + \frac{3^2}{3!}x^2 + \frac{4^3}{4!}x^3 + \ldots\ldots$$

4. a) Prove $Log_i^i = \frac{4m+1}{4n+1}$ where m, n are integers.

   b) Discuss the convergence of $\sum ne^{-n^2}$.

5. Solve $(2x^2y - 3y^4)\,dx + (3x^3 + 2xy^3)\,dy = 0$

6. a) Solve : $(1 + y^2)\,dx = (\tan^{-1} y - x)\,dy$

   b) Solve $y'' - 6y' + 9y = \frac{e^{3x}}{x^2}$ by variation of parameter method

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

8. A constant electromotive force E volts is applied to a circuit containing a constant resistance R ohms in series and a constant inductance L henries. If the initial current is zero, show that the current builds up to half its theoretical maximum in (Llog2)/R seconds.

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Total No. of Questions : 08

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B.Tech. (Aeronautical Engg./Aerospace Engg./ Automation & Robotics/Automobile Engg./BT/CE/CSE/Electrical & Electronics Engg./EE/ECE/Electronics & Electrical Engg./IT/ICE/Marine Engg./Mechanical Engg./Petroleum Refinary Engg./Textile Engg.) (2012 to 2017) (Sem.–2)

ENGINEERING MATHEMATICS – II

Subject Code : BTAM-102

M.Code : 54092

Time : 2 Hrs.

Max. Marks : 30

INSTRUCTIONS TO CANDIDATES :

1. **Attempt any FIVE question(s), each question carries 6 marks.**

1. Sum the series $e^{\alpha}\cos\beta - \frac{e^{3\alpha}}{3}\cos 2\beta + \frac{e^{5\alpha}}{5}\cos 5\beta - \ldots\ldots \infty$

2. Verify Cayley's Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}$ and hence obtain the inverse of the given matrix.

3. Test the convergence of the following series :

$$1 + \frac{2}{2!}x + \frac{3^2}{3!}x^2 + \frac{4^3}{4!}x^3 + \ldots\ldots$$

4. a) Prove $L\log_i^i = \frac{4m+1}{4n+1}$ where m, n are integers.

   b) Discuss the convergence of $\sum ne^{-n^2}$.

5. Solve $(2x^2y - 3y^4)\,dx + (3x^3 + 2xy^3)\,dy = 0$

6. a) Solve : $(1 + y^2)\,dx = (\tan^{-1} y - x)\,dy$

   b) Solve $y'' - 6y' + 9y = \frac{e^{3x}}{x^2}$ by variation of parameter method

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

8. A constant electromotive force E volts is applied to a circuit containing a constant resistance R ohms in series and a constant inductance L henries. If the initial current is zero, show that the current builds up to half its theoretical maximum in (Llog2)/R seconds.

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Total No. of Questions : 09

Total No. of Pages : 02

B.Tech. (2011 to 2017) (Sem.–2)

ENGINEERING MATHEMATICS – II

Subject Code : BTAM-102

M.Code : 54092

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C. have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.**
4. **Select atleast TWO questions from SECTION - B & C.**

SECTION-A

1. Answer briefly :

a) Check whether the given equation is exact and obtain the general solution of $(2x + e^y)dx + x e^y dy = 0$.

b) Solve the differential equation $x\frac{dy}{dx} = 2y + x^4 + 6x^2 + 2x, x \neq 0$.

c) Find general solution of $4y'' + 8y' - 5y = 0$.

d) Solve the differential equation $y^{iv} + 32y'' + 256y = 0$.

e) Determine whether the set {(2, 2, 1), (1, –1, 1), (1, 0, 1)} of vectors is linearly independent.

f) Find the Eigen values and corresponding Eigen vectors for $\begin{bmatrix} 1 & 1 \\ -1 & 1 \end{bmatrix}$.

g) Show that the p-series $\sum_{n=1}^{\infty} \frac{1}{n^p}$, $p > 0$ is convergent if $p > 1$ and divergent if $p \leq 1$.

h) Solve the boundary value problem $y'' + 25y = 0, y(0) = 1, y(\pi) = -1$.

i) Expand cos 7θ in descending powers of cos θ.

j) Prove that $\sin h^{-1} x = \log(x + \sqrt{x^2 + 1})$. (10×2 = 20)

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SECTION-B

2. i) Find integrating factor and hence solve $y(1 + xy^2)dx + 2(x^2y^2 + x + y^4)dy = 0$. (4)

   ii) Find the solution of Bernoulli equation $xy' + 3y = x^3y^2$. (4)

3. i) Find a homogeneous linear differential equation with real coefficients of lowest order which has the $x^2e^{2x} + 2e^{-2x}$ as the particular solution. (4)

   ii) Find the general solution of $(D^2 - D - 6)y = xe^{-2x}$. (4)

4. Find the general solution of the equation $y'' + 4y = \cos 2x$, using the method of variation of parameters. (8)

5. i) Find the general solution of the equation $x^2y'' - 2xy' - 4y = 6x^2 + 4\ln x$. (4)

   ii) A second's pendulum which gains 10 seconds per day at one place losses 10 seconds per day at another place. Compare the acceleration due to gravity at the two places. (4)

SECTION-C

6. i) Using Gauss-Jordan method, find the inverse of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 3 & 4 \end{bmatrix}$. (4)

   ii) Determine the system $2x - 3y + z = -2$, $x - y + 2z = 3$, $2x + y - 3z = -2$ is consistent and find the solution, if the system is consistent. (4)

7. i) State and Prove Cayley Hamilton Theorem. (4)

   ii) Discuss the convergence of the series $\sum\left[\frac{\sqrt{n^4+1} - n^2}{\sqrt[4]{n^4+1} + n}\right]$. (4)

8. i) Discuss the convergence of the series $\sum\left[\frac{nx^n}{(n+1)^n}\right]$. (4)

   ii) Discuss the convergence of the series $\sum\frac{(-1)^{n-1}}{(2n-2)!}$ (4)

9. i) If $x + \frac{1}{x} = 2\cos\theta, y + \frac{1}{y} = 2\cos\varphi$ then prove that $\frac{x^m}{y^n} + \frac{y^n}{x^m} = 2\cos(m\theta - n\varphi)$. (4)

   ii) Sum the series $1 + x\cos\alpha + x^2\cos 2\alpha + x^3\cos 3\alpha + \ldots\ldots$ to n terms where x is less than unity. Also find the sum to infinity. (4)

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Total No. of Questions : 09 Total No. of Pages : 02

B.Tech. (2011 Onwards) (Sem.–2)

ENGINEERING MATHEMATICS – II

Subject Code : BTAM-102

Paper ID : [A1111]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

1. **Write briefly :**

a. Check whether the given equation is exact and obtain the general solution $(1+x^2)dy + 2xy\,dx = 0$.

b. Solve the differential equation $(x-a)\frac{dy}{dx} + 3y = 12(x-a)^3, x > a > 0$.

c. Find the solution of the differential equation $y''+2y'+2y = 0$.

d. Find a differential equation of the form $ay''+by'+cy = 0$, for which e^{-x} and xe^{-x} are solutions.

e. Solve the differential equation $y''''+32y''+256y = 0$.

f. Determine whether the set {(3, 2, 4), (1, 0, 2), (1,–1,–1)} of vectors is linearly independent.

g. Find the eigen values and corresponding eigen vectors for $\begin{bmatrix} 1 & 4 \\ 3 & 2 \end{bmatrix}$.

h. Discuss the convergence of the harmonic series $\sum_{n=1}^{\infty} \frac{1}{n}$.

i. Express $\sin^8\theta$ in a series of cosines of multiples of θ.

j. Express Log (Log i) in the form of $a + ib$.

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SECTION-B

2. i) Find the integrating factor and hence solve $(5x^3 + 12x^2 + 6y^2)dx + 6xy\,dy = 0$

ii) Solve the differential equation $\frac{dy}{dx} - y = y^2(\sin x + \cos x)$.

3. i) Find a homogeneous linear differential equation with real coefficients of lowest order which has the $xe^{-x} + e^{2x}$ as the particular solution.

ii) Using differential operator, find general solution of $(D^2 + 9)y = x\,e^{2x}\cos x$.

4. Find the general solution of the equation $y''+16y = 32\sec 2x$, using the method of variation of parameters.

5. i) Find the general solution of the equation $x^2y'' + 5xy' - 5y = 24x\ln x$.

ii) A particle is executing simple harmonic motion with amplitude 20cm and time 4 seconds. Find the time required by the particle in passing between points which are at distances 15cm and 5cm from the centre of force and are on the same side of it.

SECTION-C

6. i) Using Gauss-Jordan method, find the inverse of the matrix $\begin{bmatrix} -1 & 1 & 2 \\ 3 & -1 & 1 \\ -1 & 3 & 4 \end{bmatrix}$

ii) Determine the system $x + y + z = 3$, $3x - 9y + 2z = -4$, $5x - 3y + 4z = 6$ is consistent and find the solution, if the system is consistent.

7. i) State and Prove Cayley Hamilton Theorem.

ii) Discuss the convergence of the series $\sum\left[\frac{\sqrt{n+1}-\sqrt{n}}{n^p}\right], p > 0$.

8. i) Discuss the convergence of the series $\sum\left[\frac{x^{n+1}}{(n+1)\sqrt{n}}\right]$.

ii) Discuss the convergence of the series $\sum\frac{(-1)^{n-1}n}{5n+1}$

9. i) Prove that $\left(\frac{1+\sin\theta+i\cos\theta}{1+\sin\theta-i\cos\theta}\right)^n = \cos\left(\frac{n\pi}{2}-n\theta\right) + i\sin\left(\frac{n\pi}{2}-n\theta\right)$.

ii) Sum the series $\sin\alpha - \frac{\sin(\alpha+2\beta)}{2!} + \frac{\sin(\alpha+4\beta)}{4!} - \ldots\ldots\infty$

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Total No. of Questions : 09 Total No. of Pages : 03

B.Tech. (2011 to 2017) (Sem.–2)

ENGINEERING MATHEMATICS – II

Subject Code : BTAM-102

Paper ID : [A1111]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C. have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.**
4. **Select atleast TWO questions from SECTION - B & C.**

SECTION-A

1. a) Solve the differential equation: $ydx - xdy = y^2x^4dx$

   b) Solve the differential equation $\frac{dy}{dx} + y = x^3y^6$

   c) Solve the differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx} + y = 0$

   d) Write down the general Cauchy's homogeneous equation and explain the transformation to solve this differential equation.

   e) A particle is executing simple harmonic motion with amplitude 5 meters and time period 4 seconds. Find the time required by the particle in passing between points which are at distances 4 and 2 meters from the centre of force and are on the same side of it.

   f) Find the rank of the matrix $\begin{bmatrix} 2 & 0 & 1 \\ 5 & 1 & 0 \\ -1 & 1 & -3 \end{bmatrix}$

   g) Define Hermitian matrix.

   h) Discuss the convergence of a geometric series.

   i) What is meant by conditionally convergent series? Give example.

   j) Find real and imaginary parts of coshz.

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SECTION-B

Q2. a) Solve the Differential equation by finding an integrating factor:

$$(y^2 + x^2 + 2x)dx + 2ydy = 0$$

b) Solve the differential equation : $y = 2px + y^2p^3$, where $p = \frac{dy}{dx}$

Q3. a) Solve the differential equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x \sin x$

b) Solve by using variation of parameter method: $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = e^x \tan x$

Q4. If an e.m.f Esinωt is applied to a circuit containing a resistance R , an inductance L and a condenser of Capacity C. The charge on the condenser at time t satisfies the equation $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{c} = E\sin\omega t$.

If $R = 2\sqrt{LC}$, solve the differential equation for q.

Q5. Solve the following system of equations :

$$\frac{d^2x}{dt^2} - 3x - 4y = 0$$

$$\frac{d^2y}{dt^2} + x + y = 0$$

SECTION-C

Q6. a) For what values of λ and μ do the system of equations :

$2x+3y+5z=9$, $7x+3y-2z=8$, $2x+3y+\lambda z=\mu$ have

(i) no solution

(ii) unique solution

(iii) infinite many solutions

b) Find the eigen values and eigen vectors of the following matrix : $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$

Q7. a) Discuss the convergence or divergence of the series $\sum_{n=1}^{\infty} \frac{1}{n^p}, p > 0$

b) For what values of x does the following series converge $\sum_{n=1}^{\infty} \frac{x^n}{n}$

Q8. a) solve the equation $(1 + x)^n = (1 - x)^n$, n is any positive integer.

b) If x + iy = cosh(u + iv) then show that $\frac{x^2}{\cosh^2 u} + \frac{y^2}{\sinh^2 v}$

Q9. Find the sum of the trigonometric series

$$\sin\alpha + x\sin(\alpha + \beta) + \frac{1}{2.1} x^2 \sin(\alpha + 2\beta) + \dots \infty$$

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Total No. of Questions: 09

Total No. of Pages: 03

B.Tech. (2011 Onwards) (Sem. – 2)

ENGINEERING MATHEMATICS – II

M Code: 54092

Subject Code: BTAM-102

Paper ID: [A1111]

Time: 3 Hrs. **Max. Marks: 60**

INSTRUCTIONS TO CANDIDATES:

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.**
4. **Select at least TWO questions from each SECTION - B & C.**

SECTION A

1. a) Find the general value of $\log i^i$.

   b) Solve the the differential equation $p = \sin(y - xp)$, where p has its usual meaning

   c) Test whether the differential equation $(5x^3 + 12x^2 + 6y^2)dx + 6xydy = 0$ is exact or not? Give reasons. If not. Find its integrating factor which will make it exact.

   d) Show that e^z is a periodic function. Find its fundamental period.

   e) Test whether the set of vectors {(1,0,0), (1,1,1), (1,2,3)}is linearly independent or dependent.

   f) Examine the convergence / divergence of the series $\sum_{n=1}^{\infty} \frac{1}{n}\sin\frac{1}{n}$

   g) Test the absolute convergence of the series $\sum_{n=1}^{\infty} \frac{\cos n\pi}{n\sqrt{n}}$

   h) If λ is an eigen value or a matrix A then prove that λ^{-1} is an eigen value of A^{-1}.

   i) For what values of 'k' the system of equation

   $$x + y + z = 6;\ x + 2y + 3z = 10;\ x + 2y + kz = \lambda,$$

   has uniue solution.

   j) If $x^2 - 2x\cos\theta + 1 = 0$, then show that $x^{2n} - 2x^n \cos n\theta + 1 = 0$

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SECTION B

2. a) Solve the differential equation:

   $$y - 2px = \tan^{-1}(xp^2)$$

   b). Use method of variation of parameters to find the general solution of the differential equation: $y'' - 2y' + y = e^x \log x$

3. a) Find the solution of the differential equation:

   $$xy(1+xy^2)dy = dx$$

   b) Find the particular solution of the differential equation:

   $$x^2y'' + xy' + y = \log x \sin(\log x).$$

   by using operator method.

4. a) Solve the simultaneous linear differential equation:

   $$\frac{dx}{dt} + 2y + \sin t = 0,\ \frac{dy}{dt} - 2x - \cos t = 0$$

   b) Find the particular solution of the differential equation:

   $$y''' - 7y'' + 10y' = e^{2x}\sin x$$

5. An L-C-R circuit, the charge q on a plate of the condensor is given by the equation: $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{C} = E\sin pt$, *where* $\frac{dq}{dt} = i$ The circuit is tuned to resonance so that $p^2 = \frac{1}{LC}$. If $q = i = 0$ when $t = 0$, show that for small values of R/L, the current in the circuit at time t is given by (Et /2L) sinpt.

SECTION C

6. a) Find the eigen values and the corresponding eigen vectors of the matrix:

$$\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$$

   b) Test the conditional convergence of the series. $\sum_{n=1}^{\infty} \frac{(-1)^{n-1}n}{n^2+1}$

7. a) Test the consistency of the system of equations:

$x + 2y - z = 1$; $3x - 2y + 2z = 2$; $7x - 2y + 3z = 5$,

and if consistent then solve it completely.

b) Reduce the matrix $\begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 0 & -1 & -1 \end{bmatrix}$ to normal form and hence find its rank.

8. a) Test for what values of 'x' for which the series

$$\frac{1}{1.2}x + \frac{1}{3.4}x^2 + \frac{1}{5.6}x^3 + \frac{1}{7.8}x^4 + \cdots \infty$$

Converges / diverges.

b) Examine the convergence / diverge of the series:

$$\frac{\sqrt{2}-1}{3^3-1} + \frac{\sqrt{3}-1}{4^3-1} + \frac{\sqrt{4}-1}{5^3-1} + \cdots \infty$$

9. a) If α, β, γ are the roots of the equation $x^3 + px^2 + qx + p = 0$, then prove that $\tan^{-1}\alpha + \tan^{-1}\beta + \tan^{-1}\gamma = n\pi$ radians except in one particular case. Mention this case.

b) If $\sin^{-1}(u + iv) = \alpha + i\beta$, then prove that $\sin^2\alpha$ and $\cosh^2\beta$ are the roots of the equation $x^2 - x(1 + u^2 + v^2) + u^2 = 0$

Roll No. _____

Total No. of Questions: 09

Total No. of Pages: 02

B. Tech. (Sem. 2)
ENGINEERING MATHEMATICS-II
Subject Code: BTAM-102
Paper ID: A1111

Time: 3 Hrs.

Max. Marks: 60

INSTRUCTIONS TO CANDIDATES:

1. **Section A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **Attempt FIVE questions from Section B & C selecting at least two from each section. All questions carry EIGHT marks.**

SECTION A

1. (a) Find the value of a so that the differential equation $xy^3\,dx + ax^2y^2\,dy = 0$ is exact.
   (b) Find the solution of the differential equation $y''' - 3y' - 2y = 0$.
   (c) Write the differential equation describing the motion of bob of a simple pendulum.
   (d) Solve the differential equation $x^2y'' + 2xy' - 2y = 0$.
   (e) Find the value of Z for which e^z is real.
   (f) Examine whether the vectors are linearly independent (2, 2, l) (l,-1,l) (l,0, l).
   (g) State integral test for convergence of infinite series.
   (h) Define unitary matrix.
   (i) Write Bernoulli's equation.
   (j) Sow that the geometric series $\sum_{n=0}^{\infty} r^n$. where r is any real number is convergent For $|r| < 1$.

SECTION B

2. (a) Find the solution of the differential equation $(3x^2y^3e^y + y3 + y2)\,dx + (x^3y^2e^y - cy)\,dy = 0$.
   (b) 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 $iR + L\frac{di}{dt} = t$, $t \geq 0$, $i(0) = 0$.

3. Find the general solution of the equation $y'' + 16y = 32\sec 2x$, using the method of variation of parameters.

4. A simple pendulum of length l is oscillating through a small angle θ in a medium in which the resistance is proportional to velocity. Find the differential equation of its motion. Discuss the motion and find its period of oscillation.

5. (a) Find the general solution of the equation $x^2y'' + 5xy' + 3y = \ln x$, $x > 0$.
   (b) Solve $y = 2xp + y^2p^3$, where $p = \frac{dy}{dx}$.

SECTION C

6. (a) Examine whether the following matrix is diagonalizable. If so, obtain the matrix P such that $P^{-1}AP$ is a diagonal matrix

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

   (b) Let T be a linear transformation defined by

$$T\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}, T\begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} = \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}, T\begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix} = \begin{pmatrix} 1 \\ -2 \\ -3 \end{pmatrix}, T\begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix} = \begin{pmatrix} -1 \\ 2 \\ 3 \end{pmatrix},$$

   Find $T\begin{bmatrix} 4 & 5 \\ 3 & 8 \end{bmatrix}$

7. (a) Discuss the convergence of the series $\sum \frac{1.4.7.....(3n-2}{2.5.8.....(3n-1}$
   (b) Discuss the convergence of the series $\sum a_n$, where $a_n = \left(1+\frac{1}{n^p}\right)-n^{p+1}$, $p>0$, using Cauchy's root test.

8. (a) Using De Moivre's theorem, show that $\cos^4\theta = \frac{1}{8}(\cos 4\theta + 4\cos 2\theta + 3)$.
   (b) Write $\tan^{-1} z$ in the form $u+iv$.

9. (a) Find the Eigen values and corresponding Eigen vector of the matrix $A\begin{bmatrix} 1 & 4 \\ 3 & 2 \end{bmatrix}$
   (b) Find all values of Z, such that $e^z = 1 + i$.

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Total No. of Questions: 09

Total No. of Pages: 02

B. Tech. (Sem. 2)
ENGINEERING MATHEMATICS-II
Subject Code: BTAM-102
Paper ID: A1111

Time: 3 Hrs.

Max. Marks: 60

INSTRUCTIONS TO CANDIDATES:

1. **Section A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **Attempt FIVE questions from Section B & C selecting at least two from each section. All questions carry EIGHT marks.**

SECTION A

1. (a) Find the value of a so that the differential equation $xy^3\,dx + ax^2y^2\,dy = 0$ is exact.
   (b) Find the solution of the differential equation $y''' - 3y' - 2y = 0$.
   (c) Write the differential equation describing the motion of bob of a simple pendulum.
   (d) Solve the differential equation $x^2y'' + 2xy' - 2y = 0$.
   (e) Find the value of Z for which e^z is real.
   (f) Examine whether the vectors are linearly independent (2, 2, 1) (1,-1,1) (1,0, 1).
   (g) State integral test for convergence of infinite series.
   (h) Define unitary matrix.
   (i) Write Bernoulli's equation.
   (j) Sow that the geometric series $\sum_{n=0}^{\infty} r^n$. where r is any real number is convergent For $|r| < 1$.

SECTION B

2. (a) Find the solution of the differential equation $(3x^2y^3e^y + y3 + y2)\,dx + (x^3y^3e^y - xy)\,dy = 0$.
   (b) 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 $iR + L\frac{di}{dt} = t$, $t \geq 0$, $i(0) = 0$.
3. Find the general solution of the equation $y'' + 16y = 32\sec 2x$. using the method of variation of parameters

4. A simple pendulum of length l is oscillating through a small angle Θ in a medium in which the resistance is proportional to velocity. Find the differential equation of its motion. Discuss the motion and find its period of oscillation.
5. (a) Find the general solution of the equation $x^2y'' + 5xy' + 3y = \ln x$, $x > 0$.
   (b) Solve $y = 2xp + y^2p^3$, where $p = \frac{dy}{dx}$.

SECTION C

6. (a) Examine whether the following matrix is diagonalizable. If so, obtain the matrix P such that $P^{-1}AP$ is a diagonal matrix

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

   (b) Let T be a linear transformation defined by

$$T\left[\begin{pmatrix}1 & 1\\ 1 & 1\end{pmatrix}\right] = \begin{pmatrix}1\\2\\3\end{pmatrix}, T\left[\begin{pmatrix}0 & 1\\ 1 & 1\end{pmatrix}\right] = \begin{pmatrix}1\\-2\\3\end{pmatrix}, T\begin{pmatrix}0 & 0\\ 1 & 1\end{pmatrix} = \begin{pmatrix}1\\-2\\-3\end{pmatrix}, Ti\left[\begin{pmatrix}0 & 0\\ 0 & 1\end{pmatrix}\right] = \begin{pmatrix}-1\\2\\3\end{pmatrix}.$$

   Find $T\left[\begin{pmatrix}4 & 5\\ 3 & 8\end{pmatrix}\right]$

7. (a) Discuss the convergence of the series $\sum \frac{1.4.7.....(3n-2}{2.5.8.....(3n-1}$
   (b) Discuss the convergence of the series $\sum a_n$, where $a_n = \left(1+\frac{1}{n^p}\right) - n^{p+1}$, $p>0$, using Cauchy's root test.
8. (a) Using De Moivre's theorem, show that $\cos^4\Theta = \frac{1}{8}(\cos 4\Theta + 4\cos 2\Theta + 3)$.
   (b) Write $\tan^{-1} z$ in the form $u+iv$.
9. (a) Find the Eigen values and corresponding Eigen vector of the matrix $A\begin{bmatrix}1 & 4\\ 3 & 2\end{bmatrix}$
   (b) Find all values of Z, such that $e^z = 1 + i$.

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B.Tech. (2011 Onwards) (Sem.–2)

ENGINEERING MATHEMATICS-II

Subject Code : BTAM-102

Paper ID : [A1111]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTION TO CANDIDATES :

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2. **SECTION - B & C. have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.**
4. **Select atleast TWO questions from SECTION - B & C.**

SECTION-A

1. **Write briefly :**

(a) Determine for what values of a and b, the differential equation :

$(y + x^3)dx + (ax + by^3dy = 0)$ is exact ?

(b) Solve the differential equation : $y' + 4xy + xy^3 = 0$.

(c) Factorizing the differential operator, reducing it into first order equations, solve the differential equation : $y'' - 4y' - 5y = 0$.

(d) Find the general solution of the equation : $4y'' - 4y' + y = e^{\frac{x}{2}}$.

(e) On putting $x = e^z$, find the transformed differential equation of $x^2y'' + xy' + y = x$.

(f) Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 4 \\ 3 & 2 \end{bmatrix}$ and find its inverse.

(g) Define orthogonal and unitary matrices with suitable examples.

(h) State different forms of comparison test.

(i) Prove that the series : $1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\ldots\ldots\ldots$ is convergent but not absolutely convergent.

(j) Prove that $w = \cos z$ is not a bounded function.

SECTION-B

2. Solve the differential equation : $(5x^3 + 12x^2 + 6y^2)dx + 6xydy = 0$.

3. Find the general solution of the equation : $y'' + 16y = 32\sec 2x$, using the method of variation of parameters.

4. Solve : $(1+x)^2\frac{d^2y}{dx^2}+(1+x)\frac{dy}{dx}+y=4\cos\log(1+x)$.

5. An inductance of 2 Heneries and a resistance of 20 Ohms are connected in series with e.m.f. E volts. If the current is zero when t = 0, find the current at the end of 0.01 *second* if E=100 volts.

SECTION-C

6. Using Gauss-Jordan method, find the inverse of the matrix, $A = \begin{bmatrix} 2 & 3 & 1 \\ 1 & 3 & 3 \\ 0 & 1 & 2 \end{bmatrix}$.

7. (i) Find the eigen-values and the corresponding eigen-vectors of the matrix

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

(ii) Does the series : $\sum_{n=1}^{\infty}\frac{\ln n}{n^{\frac{3}{2}}}$ converge? Justify.

8. Examine the convergence or divergence of the following series :

(i) $\sum_{n=1}^{\infty}\frac{n+1}{n}$, (ii) $\sum_{n=1}^{\infty}\frac{4^n n!n!}{(2n)!}$, (iii) $\sum_{n=0}^{\infty}\frac{n^2}{2^n}$, (iv) $\sum_{n=1}^{\infty}(-1)^{n+1}\frac{1}{n^2}$,

9. (i) Find all values of which satisfy, $e^z = 1 + i$.

(ii) Find real and imaginary parts of $\text{Log}[(1 + i)\text{Log } i]$.

(iii) If $\tan(x + iy) = i$, where x and y are real, prove that x is indeterminate and y is infinite.

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Total No. of Pages : 03

B.Tech. (2011 Onwards) (Sem.–2)

ENGINEERING MATHEMATICS – II

Subject Code : BTAM-102

Paper ID : [A1111]

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C. have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.**
4. **Select atleast TWO questions from SECTION - B & C.**

SECTION A

1. **Write briefly :**

a) Define Linear independent and dependent vectors.

b) Find the characteristic equation of the matrix $\begin{pmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{pmatrix}$.

c) Test whether the matrix $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 3 & -1 \\ 0 & -1 & 3 \end{pmatrix}$ is diagonalisable or not?

d) Express $\sin^5\theta$ in terms of the sines of multiples of θ.

e) Find the general and principle value of i^i.

f) Examine the convergence / divergence of the series $\sum_{n=1}^{\infty} \frac{1}{(1+\frac{1}{n})^{n^2}}$.

g) Define the term absolute convergence and use this concept to test the convergence of the series $\sum_{n=1}^{\infty} \frac{\sin n}{n^2}$.

h) Find the degree and order of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}} = \frac{d^2y}{dx^2}$

i) For what value of k the equation $xy^3dx + k(x^2y^2)dy = 0$ is a exact equation.

j) Find the complete solution of the equation :

$$\frac{d^2x}{dt^2} + 5\frac{dx}{dt} + 6x = 0, \text{ given } x(0) = 0, \frac{dx}{dt}(\text{at } t = 0) = 15.$$

SECTION-B

2. a) Use method of variation of parameters to find the general solution of the differential equation $y'' + y = \text{cosec } x$.

b) Find the complete solution of the differential $y'' - 2y' + y = x\sin x$.

3. a) Solve the following simultaneous differential equation

$$\frac{dx}{dt} + y + 5x = e^t, \frac{dy}{dt} + x + 5y = e^{5t}$$

b) Find the complete solution of the differential equation $x^2y'' - 3xy' + 5y = x\log x$ by using operator method.

4. a) Solve the differential equation : $\frac{dy}{dx} = \frac{y+1}{(y+2)e^x - x}$.

b) Find the particular solution of the differential equation $y'' - 2y' + 2y = e^x \tan x$

5. An electric circuit consists of an inductance 0.1 henry, a resistance of 20 ohms, and a condenser of capacitance 25 microfarads. Find the charge q and the current i at time t, given the initial conditions $q = 0.05$ coulombs, $i = 0$ when $t = 0$.

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SECTION-C

6. a) Use the rank method to test the consistency of the system of equations

$x + 2y + z = 2$; $3x + y - 2z = 1$; $4x - 3y - z = 3$; $2x + 4y + 2z = 4$, if consistent, then solve it completely.

b) Use Gauss-Jordan method to find the inverse of the matrix

$$\begin{pmatrix} 1 & 0 & 2 \\ 2 & -1 & 3 \\ 4 & 1 & 5 \end{pmatrix}$$

7. a) Verify Cayley-Hamilton theorem for the matrix

$$\begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$$

and hence find its inverse.

b) Prove that eigen values of Hermetian matrix are real.

8. a) Test the convergence of the series

$$\frac{x}{1.2}+\frac{x^2}{3.4}+\frac{x^3}{5.6}+.....\infty (x>0)$$

b) Test for what values of x does the series convergence/diverge?

$$\sum_{n=1}^{\infty}\frac{(n+1)^n}{n^{n+1}}x^n$$

9. a) Use Demoivre's theorem to prove that

$$\left(\frac{1+\sin\alpha+i\cos\alpha}{1+\sin\alpha-i\cos\alpha}\right)^n=\cos\left(\frac{n\pi}{2}-n\alpha\right)+i\sin\left(\frac{n\pi}{2}-n\alpha\right)$$

b) Separate $\tan^{-1}(e^{i\theta})$ into real and imaginary parts.