QP Code: 6721QP

Seat No.	

Total No. of Pages: 3

Summer Examination March - 2023

Subject Name: B.Tech. CBCS_71810 _ Engineering Mathematics _ I_14.08.2023_10.30 AM To 01.00 PM

Subject Code: 71810

Day and Date: - Monday, 14-08-2023 **Total Marks: 70**

Time: - 10:30 am to 01:00 pm

Instructions.:

1) Figures to the right indicate full marks

Special Instruction.:

1) Attempt any three questions from each section. 2) Use of non-programmable calculator is allowed.

Q.1. Solve the following **[12]**

SECTION-I

a) Reduce to Normal form and find the rank of matrix $\begin{bmatrix} 8 & 1 & 3 & 6 \\ 0 & 3 & 2 & 2 \\ -8 & -1 & -3 & 4 \end{bmatrix}$ [6]

b) Test for consistency and if possible, solve the equations [6]

$$2x - y + z = 9, \quad 3x - y + z = 6, \quad 4x - y + 2z = 7, \quad -x + y - z = 4$$

Q.2. Solve the following **[11]**

a) Find Eigen values of the matrix $\begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -4 & -3 \end{bmatrix}$ [5]

b) Verify Cayley-Hamilton Theorem for the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$ [6]

Q.3. Solve the following **[11]**

a) Simplify $\left[\frac{1+cos\left(\frac{\pi}{9}\right)+isin\left(\frac{\pi}{9}\right)}{1+cos\left(\frac{\pi}{9}\right)-isin\left(\frac{\pi}{9}\right)}\right]^{18}$ [5]

b) Using De Moivre's Theorem Prove that [6]

$$\frac{sin6\theta}{sin2\theta} = 16cos^4\theta - 16cos^2\theta + 3$$

Q.4. **Solve the following** **[12]**

Attempt any two of the following.

a) Solve the following equations [6]

$x_1 + x_2 - x_3 + x_4 = 0, \quad x_1 - x_2 + 2x_3 - x_4 = 0, \quad 3x_1 + x_2 + x_4 = 0$

b) Find the Eigen values and Eigen vector of the smallest Eigen value of the [6]

matrix $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$

c) Solve $x^5 = 1 + i$ and find the continued product of the roots. [6]

Q.5. **Solve the following** **[12]**

SECTION-II

a) Use Gauss Elimination method to solve the equations [6]

$x + 3y - 2z = 5, \quad 2x + y - 3z = 1, \quad 3x + 2y - z = 6$

b) Use Gauss-Seidel method to solve the equations [6]

$83x + 11y - 4z = 95, \; 7x + 52y + 13z = 104, \; 3x + 8y + 29z = 71$

Q.6. **Solve the following** **[11]**

a) Evaluate $\lim_{x \to 0} \frac{e^{2x} - (1+x)^2}{x \log(1+x)}$ [5]

b) Expand $\sin\left(\frac{\pi}{6} + x\right)$ *up to* x^4 *and find* $\sin(30^0, 30')$ [6]

Q.7. **Solve the following** **[11]**

a) If $u = \frac{x+y}{1-xy}$, $v = \tan^{-1}x + \tan^{-1}y$ then find $\frac{\partial(u, v)}{\partial(x, y)}$ [5]

b) If $u = x^3 e^{\left(-\frac{x}{y}\right)}$ then find i) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ [6]

ii) $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2}$

Q.8. Solve the following **[12]**

Attempt any two of the following.

a) Apply Gauss-Jordan method to solve the equations [6]

$x + y + z = 5,\ 2x + 3y + z = 10,\ 3x - 2y + 2z = 3$

b) Using Maclaurin's series prove that [6]

$$logcox = -\frac{x^2}{2} - \frac{x^4}{12} - \frac{x^6}{45} - -----------$$

c) Determine extreme values of the function f(x, y) $= x^2 + y^2 + 6x + 12.$ [6]

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Seat No.	

F.Y. B.Tech (All Branches) (Semester - I) (CBCS) Examination, May - 2019

Engineering Mathematics - I

Sub. Code : 71810

Day and Date : Tuesday, 21 - 05 - 2019 **Total Marks : 70**

Time : 10.00 a.m. to 12.30 p.m.

Instructions :
1) Attempt any three questions from each section.
2) Figures to right indicate full marks.
3) Use of non - Programmable calculator is allowed.

SECTION - I

Q1) a) Reduce the following matrix to normal form and find its rank. **[6]**

$$\begin{bmatrix} 1 & 3 & 4 & 5 \\ 1 & 2 & 6 & 7 \\ 1 & 5 & 0 & 10 \end{bmatrix}$$

b) Test for consistency the following equations and if possible solve them $x + y + 4z = 1,\ 3x + 3y + 6z = 4,\ 2x + 2y + 3z = 5.$ **[6]**

Q2) a) Find the eigen values of A and $\frac{1}{2}$A. **[6]**

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

b) Verify Caley Hamilton theorem for the matrix. **[5]**

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

P.T.O.

Q3) a) Express $\frac{(1+i\sqrt{3})^{16}}{(\sqrt{3}-i)^{17}}$ in terms of a + ib. **[6]**

b) Find all values of $(1+i)^{\frac{1}{5}}$ Also find their continued product. **[5]**

Q4) Attempt any two of the following :

a) Show that characteristics equations of A and transpose of A are equal

for $A=\begin{bmatrix} 2 & 3 & 4 \\ 0 & 4 & 2 \\ 0 & 0 & 3 \end{bmatrix}$. **[6]**

b) For what value of λ equations posses a non trivial solution. **[6]**

$3x - 2y + \lambda z = 0$, $2x + y + z = 0$, $x + 2y - \lambda z = 0$ Also find the solution for the value of λ.

c) Prove that $\frac{\sin 7\theta}{\sin\theta} = 7 - 56\sin^2\theta + 112\sin^4\theta - 64\sin^6\theta$. **[6]**

SECTION - II

Q5) a) Solve $5x - 2y - 3z + 1 = 0$, $3x - 9y - z + 2 = 0$, $2x - y - 7z = 3$ by Gauss Seidel method correct upto four decimal places. **[6]**

b) Using Jacobi's method find the solution of following equations correct upto five iterations **[6]**

$8x_1 + 2x_2 - 2x_3 = 8$, $x_1 - 8x_2 + 3x_3 + 4 = 0$, $2x_1 + x_2 + 9x_3 = 12$.

Q6) a) Evaluate $\lim_{x\to 2} \sqrt{\frac{2+x}{2-x}} \tan^{-1}\sqrt{4-x^2}$. **[5]**

b) Expand $(x + 2)^5 - 5(x + 2)^4 + 4(x + 2)^3 - 3(x + 2)^2$. **[6]**

Q7) a) If $u = x^y$ prove that $\frac{\partial^3 u}{\partial x^2 \partial y} = \frac{\partial^3 u}{\partial x \partial y \partial x}$. **[5]**

b) If $u = \tan^{-1}\left(\frac{x^3 + y^3}{x + y}\right)$ then prove that

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = 2 \sin u \cos 3u$$ **[6]**

Q8) Attempt any two of the following : **[12]**

a) Find the solution of $2x - 3y - 4z + 4 = 0$, $3x - 4y - 2z = 5$, $4x - 2y - 3z + 1 = 0$ by Gauss elimination method.

b) Evaluate $\lim_{x \to 0} \left[\frac{\pi x - 1}{2x^2} + \frac{\pi}{x(e^{2\pi x} - 1)}\right]$.

c) Find the maximum and minimum value of $\sin x + \sin y + \sin(x + y)$.

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Seat No.	

F.Y. B. Tech. (All Branches) (Semester - I) Examination, November - 2018
ENGINEERING MATHEMATICS - I (CBCS)
Sub. Code : 71810

Day and Date : Wednesday, 28 - 11 - 2018 **Total Marks : 70**

Time : 02.30 p.m. to 05.00 p.m.

Instructions :
1) **Attempt any three questions from each section.**
2) **Figures to the right indicate full marks.**
3) **Use of non-programmable calculator is allowed.**

SECTION-I

Q1) a) Test for consistancy and if consistant what is type of solution and find the solution of $x_1 + 2x_2 - x_3 = 3$, $3x_1 - x_2 + 2x_3 = 1$, $2x_1 - 2x_2 + 3x_3 = 2$, $x_1 - x_2 + x_3 + 1 = 0$ **[6]**

b) Find the value of k for which the following system of equations have non-trivial solution and find the solutions for these values of k

$3x + y - kz = 0$, $4x - 2y - 3z = 0$, $2kx + 4y + kz = 0$ **[6]**

Q2) a) Obtain the eigen values of the following matrix and find the eigen vector corresponding to largest eigen value $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ **[6]**

b) Verify Cayley Hamilton's theorem for the following matrix $\begin{pmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{pmatrix}$ **[5]**

Q3) a) Prove that $\left[\dfrac{1+\cos\pi/9 + i\sin\pi/9}{1+\cos\pi/9 - i\sin\pi/9}\right]^{18} = 1$ **[5]**

b) Prove that the continued product of all the values of $(1 + i)^{1/5}$ is $1 + i$ **[6]**

P.T.O.

Q4) Attempt any two from the following **[12]**

a) Reduce the following matrix to normal form and hence find its rank

$$\begin{pmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{pmatrix}$$

b) Obtain the eigen values of A, A^2 and A^{-1} where $A = \begin{pmatrix} 2 & 1 & 1 \\ 1 & 5 & 1 \\ 0 & 0 & 1 \end{pmatrix}$

c) Find all the roots of $x^4 - x^3 + x^2 - x + 1 = 0$

SECTION - II

Q5) a) Solve the following equations by Gauss elimination method $2x + 2y + z = 12,\ 3x + 2y + 2z = 8,\ 5x + 10y - 8z = 10$ **[6]**

b) Solve the following equations up to third iteration by Jacobi iteration method $2x - 3y + 20z = 25,\ 20x + y - 2z = 17,\ 3x + 20y - z = -18$ **[6]**

Q6) a) Expand $7x^4 + 3x^3 - 5x + 10$ in powers of $(x - 1)$ by using Taylors series. **[5]**

b) Evaluate $\lim\limits_{x\to 0} \dfrac{e^x \sin x - x - x^2}{x^2 + x\log(1-x)}$ **[6]**

Q7) a) If $z = \dfrac{x^2 + y^2}{(x+y)}$ Prove that $\left(\dfrac{\partial z}{\partial x} - \dfrac{\partial z}{\partial y}\right)^2 = 4\left(1 - \dfrac{\partial z}{\partial x} - \dfrac{\partial z}{\partial y}\right)$ **[6]**

b) Find the extreme value of the function $2x^3 + xy^2 + 5x^2 + y^2$ **[5]**

Q8) Attempt any two of the following

a) Solve the following equations up to third iteration by Gauss Seidel method $25x + 2y + z = 69,\ 2x + 10y + z = 63,\ x + y + z = 43$ **[6]**

b) If $u = \sin^{-1}\left[\dfrac{x^{\frac{1}{4}} + y^{\frac{1}{4}}}{x^{\frac{1}{5}} + y^{\frac{1}{5}}}\right]$ prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = \dfrac{1}{20}$ tanu **[6]**

c) Expand $e^{x\cos x}$ in powers of x by using Maclaurin's series. **[6]**

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Seat No.	

F.Y.B.Tech. (All Branches) (Semester-I & II) (CBCS)
Examination, November-2019

ENGINEERING MATHEMATICS-I

Sub. Code :71810

Day and Date : Friday, 29 - 11 - 2019 **Total Marks : 70**

Time : 2.30 p.m. to 5.00 p.m.

Instructions :
1) Attempt any three questions from each section.
2) Figures to the right indicate full marks.
3) Use of non- programmable calculator is allowed.

SECTION-I

Q1) a) Reduce the following matrix to normal form and find its rank **[6]**

$$\begin{bmatrix} 1 & 2 & 3 & 1 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 6 \end{bmatrix}$$

b) Test for consistency the following equations and if possible solve them
$2x - y + 3z = 1, \quad 3x + 2y + z = 3, \quad x - 4y + 5z = -1.$ **[6]**

Q2) a) Find the eigen values and eigen vector for smallest eigen value of the following matrix $\begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$. **[6]**

b) Verify Caley - Hamilton theorem for the matrix **[5]**

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

P.T.O.

Q3) a) Evaluate **[5]**

$$\frac{(\cos 2\theta - i\sin 2\theta)^7 (\cos 3\theta + i\sin 3\theta)^5}{(\cos 3\theta + i\sin 3\theta)^{12} (\cos 5\theta - i\sin 5\theta)^7}$$

b) Find all values of $(1+i)^{\frac{4}{5}}$ Also find their continued product. **[6]**

Q4) Attempt any two of the following.

a) Find the eigen values of A and A^3 and transpose of A for the following **[6]**

matrix $A = \begin{bmatrix} 2 & 3 & 4 \\ 0 & 4 & 2 \\ 0 & 0 & 3 \end{bmatrix}$.

b) Solve the following homogeneous simultaneous linear equations **[6]**

$6x+2y+3z=0$, $2x+3y+z=0$, $4x+5y+4z=0$, $x+2y-2z=0$

c) Expand $\cos^7\theta$ in a series of cosines of multiples of θ **[6]**

SECTION-II

Q5) a) Solve $2x + 5y - 3z + 17 = 0$, $5x - 3y + 2z = 17$, $3x + 2y + 5z = 4$ by Gauss Elimination method. **[6]**

b) Using Jacobi's method find the solution of following equations correct upto three decimal places

$15x_1 + x_2 - x_3 = 14$, $x_1 + 20x_2 + x_3 = 23$, $2x_1 - 3x_2 + 18x_3 = 37$ **[6]**

Q6) a) Evaluate $\lim_{x\to 0} \frac{\tan x - \sin x}{\sinh^3 x}$ **[5]**

b) Expand $(x+1)^5 - 2(x+1)^4 + 3(x+1)^3 - 4(x+1)^2$ **[6]**

Q7) a) If u = log (tan x + tan y + tan z) then prove that

$$\sin 2x\frac{\partial u}{\partial x}+\sin 2y\frac{\partial u}{\partial y}+\sin 2z\frac{\partial u}{\partial z}=2$$ **[5]**

b) If $u = x^2 \log\left(\frac{\sqrt[3]{y}-\sqrt[3]{x}}{\sqrt[3]{y}+\sqrt[3]{x}}\right)$ find

$$x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial x}\ and\ \ x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial u}{\partial x^2}$$ **[6]**

Q8) Attempt any two of the following. **[12]**

a) Find the solution of 83x + 11y – 4z = 95, 7x + 52y + 13z = 104,3x + 8y +29 z = 71 by Gauss Seidel method correct upto four decimal places.

b) Find the expansion of log (1+ sin x) at least upto the term of x^4

c) If $x = \sqrt{vw}, y = \sqrt{wu}, z = \sqrt{uv}$ then prove that $JJ' = 1$

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Seat No.	

January - February (Winter) Examination - 2023

Subject Name: B.Tech. CBCS_71810_Engineering Mathematics - I_03.04.2023_10.30 AM To 01.00 PM

Subject Code: 71810

Day and Date: Monday, 03-04-2023
Time: 10:30 am to 01:00 pm

Total Marks: 70

Instructions.:

1) Figures to the right indicate full marks

Special Instruction.:

1) Attempt any three questions from each section. 2) Use of non-programmable calculator is allowed.

SECTION-I

Q.1. Solve the following. **[12]**

a) Reduce to Normal form and find the rank of matrix $\begin{bmatrix} 1 & 1 & 1 & -1 \\ 1 & 2 & 3 & 4 \\ 3 & 4 & 5 & 2 \end{bmatrix}$ [6]

b) Test for consistency and if possible, solve the equations [6]

$x + y + z = 2, \quad 2x + 2y - z = 1, \quad 3x + 4y + z = 9$

Q.2. Solve the following **[11]**

a) Find Eigen values of the matrix $\begin{bmatrix} 9 & -1 & 9 \\ 3 & -1 & 3 \\ -7 & 1 & -7 \end{bmatrix}$ [5]

b) Verify Cayley-Hamilton Theorem for the matrix $\begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$ [6]

Q.3. Solve the following **[11]**

a) Simplify $\dfrac{(cos2\theta - isin2\theta)^5 (cos3\theta + isin3\theta)^6}{(cos4\theta + isin4\theta)^7 (cos\theta - isin\theta)^8}$ [5]

b) Find all values of the $\left(\frac{1}{2} + i\frac{\sqrt{3}}{2}\right)^{\frac{3}{4}}$ [6]

Q.4. **Attempt any two of the following.** **[12]**

a) Solve the following equations [6]

$2x_1 - x_2 + 3x_3 = 0,\ 3x_1 + 2x_2 + x_3 = 0,\ x_1 - 4x_2 + 3x_3 = 0$

b) Find the Eigen values and Eigen vector of the greatest Eigen value of the [6]

matrix $\begin{bmatrix} 2 & -1 & 1 \\ 1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$

c) Using De Moivre's Theorem Prove that [6]

$\frac{sin5\theta}{sin\theta} = 16cos^4\theta - 12cos^2\theta + 1$

Q.5. **SECTION-II** **[12]**

Solve the following.

a) Apply Gauss-Jordan method to solve the equations [6]

$x - y + 2z = 5,\ 3x + 2y + z = 10,\ 2x - 3y - 2z = -10$

b) Use Jacobi's iteration method to solve the equations [6]

$15x + 2y + z = 18,\ 2x + 20y - 3z = 19,\ 3x - 6y + 25z = 22$

Q.6. **Solve the following** **[11]**

a) Using Maclaurin's series prove that [6]

$\log(1 + tanx) = x - \frac{x^2}{2} + \frac{2x^3}{3} - - - - - - - - - - -$

b) Expand $of(x) = x^4 - 3x^3 + 2x^2 - x + 1$ in powers of (x-3) using Taylor's series. [5]

Q.7. **Solve the following** **[11]**

a) If $z = x^y$, prove that $\frac{\partial^2 z}{\partial x \partial y} = \frac{\partial^2 z}{\partial y \partial x}$ [6]

b) If $u = \log\left(\frac{\sqrt{x^2+y^2}}{x+y}\right)$ then find $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2}$ [5]

Q.8. Attempt any two of the following. **[12]**

a) Use Gauss-Seidel method to solve the equations [6]

$10x + 2y + z = 9, \quad 2x + 20y - 2z = -44, \quad -2x + 3y + 10z = 22$

b) Evaluate $\lim_{x \to 1} (x^2 - 1) \tan\left(\frac{\pi x}{2}\right)$ [6]

c) Determine extreme values of the function $f(x, y) = x^3 + y^3 - 3xy$. [6]