Seat No.	

Set P

F.Y. (B.Tech.) (Semester - I) (New) (NEP CBCS) Examination: March/April - 2025
Engineering Mathematics – I (BTCE0103) /(BTCSE0103)/ (BTETE0103)/ (BTEE0103)/ (BTME0103)/(BTECE0103)

Day & Date: Saturday 17-05-2025 Max. Marks: 70
Time: 10:00 AM To 01:00 PM

Instructions: 1) Q. No. 1 is compulsory. It should be solved in the first 30 minutes in Answer Book Page no 03 (Starting page of the Answer Book). Each question carries one mark.
2) Don't forget to Mention question paper set (P/Q/R/S) on top of page.
3) Figures to the right indicates full marks.
4) Use of non-programable calculator is allowed.

MCQ/Objective Type Questions

Duration: 30 Minutes Marks:14

Q.1 Choose the Correct Alternatives. **14**

1) If $L = \lim_{x\to\infty} x^2e^{-x}$ then $L =$ ______.

a) 0 b) 1
c) 2 d) -2

2) If $y = cos^2x$ then $y_n =$ ______.

a) $-2^{n-1}\cos\left(2x+\frac{n\pi}{2}\right)$ b) $2^{n-1}\cos\left(2x+\frac{n\pi}{2}\right)$
c) $2^{n-1}\sin\left(2x+\frac{n\pi}{2}\right)$ d) $2^{n+1}\sin\left(\frac{n\pi}{2}\right)$

3) If $y = (2x-5)^n$ then $y_n =$ _______.

a) 0 b) $2^nn!$
c) 2^n d) $2^n(n-1)!$

4) If $y = \log(3x-7)$ then $y_n =$ _______.

a) $\frac{(-1)^n(n)!}{(3x-7)^n}$ b) $\frac{(-1)^n(n-1)!}{(3x-7)^n}$
c) $\frac{(-1)^{n-1}(n)!}{(3x-7)^{n+1}}$ d) $\frac{(-1)^{n-1}(n-1)!\,3^n}{(3x-7)^n}$

5) The expansion of $f(x)$ in powers of $(x-a)$ is _____.

a) $f(a)+(x-a)f'(a)+\frac{(x-a)^2}{2!}f''(a)+\cdots$

b) $f(-a)+(x-a)f'(-a)+\frac{(x-a)^2}{2!}f''(-a)+\cdots$

c) $f(x)+(x-a)f'(x)+\frac{(x-a)^2}{2!}f''(x)+\cdots$

d) $f(x)-af'(x)+\frac{a^2}{2!}f''(x)-\cdots$

6) If $2,-2,3$ are eigen values of matrix A, then eigen values of A^{-1} are _______.

a) $2,-2,3$ b) $\frac{-1}{2},\frac{-1}{2},\frac{1}{3}$

c) $\frac{-1}{2},\frac{1}{2},\frac{-1}{3}$ d) $\frac{1}{2},\frac{-1}{2},\frac{1}{3}$

7) If $0,2,7$ are are eigen values and $1,3,K$ are diagonal elements of matrix $[A]_{3\times3}$, then the value of K equals _____.

a) 0 b) 1

c) 2 d) 6

8) $\nabla\cdot\bar{r}=?$

a) $i+j+k$ b) 0

c) 3 d) $\sqrt{3}$

9) If $\bar{a}$ is constant vector and $\bar{r}=xi+yj+zk$ then grad $(\bar{a}\cdot\bar{r})=$ _____.

a) $2\bar{a}$ b) $\bar{a}$

c) $\bar{r}$ d) $2\bar{r}$

10) Directional derivative is maximum along _____.

a) Any unit vector b) Co-ordinate axes

c) Tangent to the surface d) Normal to the surface

11) If $z=\tan^{-1}\left(\frac{y}{x}\right)$ then the value of $\frac{\partial z}{\partial y}=$ _______.

a) $\frac{x}{x^2+y^2}$ b) $\frac{x}{\sqrt{x^2-y^2}}$

c) $\frac{y}{x^2+y^2}$ d) $-\frac{x}{x^2+y^2}$

12) If $u=xy, v=x+y$ then the value of $J\left(\frac{u,v}{x,y}\right)=$ _____.

a) $x-y$ b) $x+y$

c) 1 d) 0

13) If $z = f(x, y)$, then the error δz in z is ______.

a) $\frac{\partial z}{\partial x} dx + \frac{\partial z}{\partial y} dy$

b) $\frac{\partial z}{\partial x} dx - \frac{\partial z}{\partial y} dy$

c) $\frac{\partial z}{\partial x} \delta x - \frac{\partial z}{\partial y} \delta y$

d) $\frac{\partial z}{\partial x} \delta x + \frac{\partial z}{\partial y} \delta y$

14) If $f(x, y) = 0$ then $\frac{dy}{dx} =$ _____.

a) $\frac{f_x}{f_y}$

b) $-\frac{f_x}{f_y}$

c) $\frac{f_y}{f_x}$

d) $-\frac{f_y}{f_x}$

Seat No.	

Set P

F.Y. (B.Tech.) (Semester - I) (New) (NEP CBCS) Examination: March/April – 2025
Engineering Mathematics – I (BTCE0103) /(BTCSE0103)/ (BTETE0103)/ (BTEE0103)/ (BTME0103)/(BTECE0103)

Day & Date: Saturday 17-05-2025 Max. Marks: 56
Time: 10:00 AM To 01:00 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of non-programmable calculator is allowed.

Section – I

Q.2 Attempt any THREE questions from the following. **09**

a) Find the rank of the matrix by reducing it to Normal form
$$\begin{pmatrix} 8 & 1 & 3 & 6 \\ 0 & 3 & 2 & 2 \\ -8 & -1 & -3 & 4 \end{pmatrix}$$

b) Find the nth derivative of $y = \sin x \cos 3x$

c) Investigate for what value of a and b the equations
$x + 2y + 3z = 4, x + 3y + 4z = 5, x + 3y + az = b$ will have
i) no solution,
ii) infinite solutions
iii) Unique solution

d) Expand $2x^3 + 3x^2 - 8x + 7$ in powers of $(x - 2)$.

e) Expand $e^x \sin x$ in powers of x up to x^3.

Q.3 Attempt any THREE questions from the following. **09**

a) Verify Cayley Hamilton theorem for A where $A = \begin{pmatrix} 1 & 2 & 3 \\ 3 & 1 & 1 \\ 0 & 1 & 2 \end{pmatrix}$

b) Find the nth derivative of $y = \frac{x^3}{x^2-1}$

c) Prove that $\cos^{-1}\left(\frac{x-x^{-1}}{x+x^{-1}}\right) = \pi - 2\left[x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \cdots\right]$

d) Find the nth derivative of $y = e^x . x^2 . \sin x$

e) Examine the vector for Linear Dependance and Independence
$[1, 1, 1], [1, 2, 3], [2, 3, 8]$

Q.4 Attempt any TWO questions from the following. **10**

a) Find the Eigen Values and Eigen Vector for the largest Eigen Value for $A = \begin{pmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{pmatrix}$

b) Find the values of a, b, c such that $\lim_{x \to 0} \frac{ae^x - be^{-x} + cx}{x - \sin x} = 4$

c) If $y = \sin(m \sin^{-1} x)$ then prove that $(1 - x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y_n = 0$

Section – II

Q.5 Attempt any THREE questions from the following. **09**

a) Find magnitude of velocity and acceleration of a particle which moves along the curve $x = t^3 + 2t, y = -3e^{-t}, z = 2\sin 5t$ at $t = 0$.

b) Find the directional derivative of $\emptyset = x^2 y \cos z$ at $(1, 2, \pi/2)$ in the direction of $2i + 3j + 2k$

c) If $u = e^{xyz}$ find $\frac{\partial^3 u}{\partial x \partial y \partial z}$

d) If $z = f(x, y), x = u + v, y = uv$, prove that
$$\frac{\partial^2 z}{\partial x^2} - y\frac{\partial^2 z}{\partial y^2} = \frac{1}{u - v}\left(u\frac{\partial^2 z}{\partial u^2} - v\frac{\partial^2 z}{\partial v^2}\right)$$

e) Find the percentage error in s where $s = kp^{\frac{1}{2}}v^2$ if the percentage errors in p and v are respectively 2 and 1.5.

Q.6 Attempt any THREE questions from the following. **09**

a) If $u = F(e^{x-y}, e^{y-z}, e^{z-x})$ prove that $u_x + u_y + u_z = 0$

b) If $x = a \cosh u \cos v, y = a \sinh u \sin v$ find $\frac{\partial(x,y)}{\partial(u,v)}$ (Note: Derivative of $\cosh x$ is $\sinh x$, derivative of $\sinh x$ is $\cosh x$ w.r.t. x)

c) Find the angle between the normal to the surfaces $x^2 y + z = 3$ and $x \log z - y^2 + 4 = 0$ at $(-1,2,1)$

d) A particle moves along the curve $\bar{r} = (t^3 - 4t)i + (t^2 + 4t)j + (8t^2 - 3t^2)k$ where t denotes time. Show that the magnitudes of acceleration along the tangent and normal at $t = 2$ are 16 and $2\sqrt{73}$ respectively.

e) Prove that $\nabla \frac{1}{r^3} = \frac{-3\vec{r}}{r^5}$

Q.7 Attempt any TWO questions from the following. **10**

a) Prove that $\bar{F} = (x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$ is irrotational. Find the function $\emptyset$ such that $\bar{F} = \nabla\emptyset$

b) Find the stationary value of $x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$

c) If $u = \sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$

Prove that

i) $$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{1}{2}\tan u$$

ii) $$x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = \frac{1}{4}(\tan^3 u - \tan u)$$

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Set P

F.Y. (B.Tech.) (Sem - I) (New) (CBCS) Examination: March/April-2024
Engineering Mathematics – I (BTCE0103)/(BTCSE0103)/ (BTETE0103)/ (BTEE0103)/ (BTME0103)

Day & Date: Monday, 13-05-2024 Max. Marks: 70
Time: 10:00 AM To 01:00 PM

Instructions: 1) Q. No. 1 is compulsory. It should be solved in the first 30 minutes in answer book Page no 03 (Starting page of the Answer Book). Each question carries one mark.
2) Don't forget to Mention question paper set (P/Q/R/S) on top of page.
3) Figures to the right indicates full marks.

MCQ/Objective Type Questions

Duration: 30 Minutes Marks:14

Q.1 Choose the correct alternatives from the given options. **14**

1) If $y = \log(3x+2)$ then y_n = ________.

a) $\frac{(-1)^n n!\, 3^n}{(3x+2)^n}$ b) $\frac{(-1)^{n-1}(n-1)!\, 3^n}{(3x+2)^n}$

c) $\frac{(-1)^{n-1}(n-1)!\, 3^n}{(3x+2)^{n+1}}$ d) none of these

2) The value of $\lim_{x\to 0}\left(\frac{1-\cos x}{x^2}\right)$ = ______.

a) $\frac{1}{2}$ b) -2

c) $\frac{-1}{2}$ d) 2

3) Expansion of $4x^2+5x+12$ in powers of $(x-1)$ is ______.

a) $21+13(x-1)+4(x-1)^2$ b) $21-3(x-1)+8(x-1)^2$

c) $21+13(x-1)+8(x-1)^2$ d) None of these

4) If $y = \cos^2 x$, then y_n = ________.

a) $2^n \cos\left(2x+n\frac{\pi}{2}\right)$ b) $2^{n-1}\cos\left(2x+n\frac{\pi}{2}\right)$

c) $2^{n-1}\sin\left(2x+n\frac{\pi}{2}\right)$ d) None of these

5) The expansion of $\log(1-x)$ =_______.

a) $x-\frac{x^2}{2}+\frac{x^3}{3}-\frac{x^4}{4}+\ldots$ b) $x-\frac{x^2}{2!}-\frac{x^3}{3!}-\frac{x^4}{4!}-\cdots$

c) $x-\frac{x^2}{2!}+\frac{x^3}{3!}-\frac{x^4}{4!}+\cdots$ d) $-x-\frac{x^2}{2}-\frac{x^3}{3}-\frac{x^4}{4}-\cdots$

6) The eigen values of the matrix $\begin{bmatrix}1 & 3 & -1\\ 0 & 2 & 4\\ 0 & 0 & 5\end{bmatrix}$ are ______.

a) $0, 2, 5$ b) $1, 2, 5$

c) $1, -2, -5$ d) $-1, -2, -5$

7) The rank of the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ -1 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ is _____.

a) 0 b) 1
c) 2 d) 3

8) If $u = \sin^{-1}\left(\frac{x}{y} + \frac{y}{z} + \frac{z}{x}\right)$ then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}$ = _______.

a) u b) $-u$
c) 0 d) 1

9) For a vector function $\bar{F}$ is called solenoidal if _____.

a) curl $\bar{F} = 0$ b) div $\bar{F} = 0$
c) grad $\bar{F} = 0$ d) div $\bar{F} \neq 0$

10) If $u = x - y$, and $v = xy$, then $\frac{\partial(u,v)}{\partial(x,y)}$ =?

a) $x + y$ b) 0
c) $y - x$ d) None of these

11) If $z = x^y$ then $\frac{\partial z}{\partial y}$ = _____

a) yx^{y-1} b) xy^{x-1}
c) $y^x \log x$ d) $x^y \log x$

12) With usual notation $f(x, y)$ has a saddle point if _____.

a) $rt - s^2 < 0$ b) $rt - s^2 > 0$
c) $rt - s^2 \neq 0$ d) $rt - s^2 = 0$

13) If $\bar{F} = (x + 3y)i + (y - 2z)j + (x + az)k$ is solenoidal then $a =$ _____.

a) 2 b) -2
c) 1 d) 0

14) If δx is error in x, then $\frac{\delta x}{x}$ is called _____

a) Absolute error in x b) Percentage error in x
c) Relative error in x d) Approximate error in x

SLR-JE-701

Seat No.	

Set P

F.Y. (B.Tech.) (Sem - I) (New) (CBCS) Examination: March/April-2024
Engineering Mathematics – I (BTCE0103)/(BTCSE0103)/ (BTETE0103)/ (BTEE0103)/ (BTME0103)

Day & Date: Monday, 13-05-2024 Max. Marks: 56
Time: 10:00 AM To 01:00 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of non-programmable calculator is allowed.

Section – I

Q.2 Solve any three of the following questions. **09**

a) Reduce the following matrix into normal form and find their rank

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

b) Examine for linear independence or dependence the following set of vectors $(3\ 2\ 4), (1\ 0\ 2), (1\ -1\ -1)$

c) Expand $2x^3 + 3x^2 - 8x + 7$ in terms of $(x - 2)$.

d) Evaluate $\lim_{x\to 0} \frac{x^2 + 2\cos x - 2}{x \sin^3 x}$

e) Find the n-th derivative of $y = \frac{1}{(x-1)(x-2)(x-3)}$

Q.3 Solve any three of the following questions. **09**

a) Solve: $3x - y - z = 0,\ x + y + 2z = 0,\ 5x + y + 3z = 0$

b) Verify Cayley Hamilton theorem for the matrix A

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

c) Evaluate $\lim_{x\to\frac{\pi}{2}} (\sin x)^{\tan x}$

d) Expand $\tan^{-1} x$ in ascending powers of x by using differentiation and integration method.

e) Find the n-th derivative of $y = \sin x \sin 2x \sin 3x$

Q.4 Solve any two of the following questions. **10**

a) Find Eigen values & the Eigen vectors corresponding to Eigen values of the of matrix

$$\begin{bmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$$

b) If $y = \sin(m \sin^{-1} x)$ prove that

$$(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} + (m^2 - n^2)y_n = 0$$

c) Prove that $\log(1 + \sin x) = x - \frac{x^2}{2} + \frac{x^3}{6} - \cdots$

Section – II

Q.5 Attempt any three of the following. **09**

a) If $u = 2(ax+by)^2 - (x^2+y^2)$ where $a^2+b^2=4$, then find $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$

b) Show that $JJ' = 1$, if $u = x^2, v = y^2$

c) If $u = ax+by, v = bx-ay$, then prove that $\left(\frac{\partial u}{\partial x}\right)_y . \left(\frac{\partial x}{\partial u}\right)_v . \left(\frac{\partial y}{\partial v}\right)_x . \left(\frac{\partial v}{\partial y}\right)_u = 1$

d) A particle moves along the curve $x = 2\sin 3t, y = 2\cos 3t, z = 8t$, then calculate the velocity and acceleration vectors and their magnitudes.

e) The sum of three positive numbers is 1. Determine the maximum value of their product.

Q.6 Attempt any three of the following. **09**

a) If $z = \sin^{-1}(x-y)$ and $x = 3t, y = 4t^3$ then show that $\frac{dz}{dt} = \frac{3}{\sqrt{1-t^2}}$

b) Calculate the percentage error in s where $s = kp^{1/2}v^2$, if percentage errors in p & v are respectively 2 & 1.5

c) Determine the directional derivative of $\emptyset\ x^2y + y^2z + z^2x^2$ at the point $(1,2,1)$ in the direction of vector $\bar{a} = i + 2j - 2k$.

d) If $u = f(x-y, y-z, z-x)$, then show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$

e) Prove that $\nabla(r^n) = nr^{n-2}\bar{r}$

Q.7 Attempt any two of the following. **10**

a) If $u = \sin^{-1}\left(\frac{x^{1/4} + y^{1/4}}{x^{1/6} + y^{1/6}}\right)$ then prove that

$$x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = \frac{\tan u}{144}(\tan^2 u - 11).$$

b) Find the maximum and minimum values of $f(x,y) = x^3 + y^3 - 3axy$

c) Show that a vector field $\overline{f}$ is given by $\overline{f} = (6xy + z^3)i + (3x^2 - z)j + (3x\,z^2 - y)k$ is irrotational and hence find its scalar potential such that $\overline{f} = \nabla\phi$

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Seat No.	

Set P

F.Y. (B. Tech) (Sem - I) (New) (CBCS) Examination: Oct/Nov-2023
Engineering Mathematics - I (BTCE0103) / (BTCSE0103) / (BTETE0103) / (BTEE0103) / (BTME0103)

Day & Date: Friday, 05-01-2024 Max. Marks: 70
Time: 03:00 PM To 06:00 PM

Instructions: 1) Q. No. 1 is compulsory. It should be solved in the first 30 minutes in answer book Page no 03 (Starting page of the Answer Book). Each question carries one mark.
2) Don't forget to Mention question paper set (P/Q/R/S) on top of page.
3) Figures to the right indicates full marks.

MCQ/Objective Type Questions

Duration: 30 Minutes Marks:14

Q.1 Choose the correct alternatives from the given options. **14**

1) If $y = \log(2x-3)$ then y_n = ________.
- a) $\dfrac{(-1)^n(n)!}{(2x-3)^n}$
- b) $\dfrac{(-1)^{n-1}(n-1)!}{(2x-3)^n}2^n$
- c) $\dfrac{(-1)^n(n-1)!}{(2x-3)^n}2^n$
- d) $\dfrac{(-1)^{n+1}(n-1)!}{(2x+3)^n}2^n$

2) The expansion of $\log(1+x)$ =_______.
- a) $1+x+\frac{x^2}{2!}+\ldots$
- b) $x-\frac{x^2}{2}+\frac{x^3}{3}-\frac{x^4}{4}+\ldots$
- c) $x+\frac{x^2}{2}+\frac{x^3}{3}+\frac{x^4}{4}+\ldots$
- d) $x-\frac{x^2}{2!}+\frac{x^3}{3!}-\frac{x^4}{4!}+\ldots$

3) The system of equations $AX = B$ is inconsistent if _______.
- a) rank of $A <$ rank of $[A{:}B]$
- b) rank of $A =$ rank of $[A{:}B]$
- c) rank of A is less than the number of unknows
- d) rank of $A =$ rank of B

4) If $y = (3x+4)^{100}$ then y_{101} = ________.
- a) $3^{100}.100!$
- b) 0
- c) 3^{100}
- d) None of these

5) The Rank of the Matrix $\begin{bmatrix} 201 & 304 & 607 \\ 201 & 304 & 607 \\ 201 & 304 & 607 \end{bmatrix}$ is ______.
- a) 3
- b) 2
- c) 1
- d) 0

6) The value of $\lim_{x\to 0}\left(\frac{1-\cos x}{x^2}\right)$ = ______.
- a) 2
- b) $-1/2$
- c) -2
- d) $1/2$

7) If zero is one of the Eigen values of matrix A, then A is ______.

a) Singular matrix
b) Non-singular matrix
c) Symmetric matrix
d) Non-symmetric matrix

8) If $u = \frac{x^{1/4} + y^{1/4}}{x^{1/5} + y^{1/5}}$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ = ______.

a) $4u$
b) $20u$
c) $\frac{1}{20}u$
d) $5u$

9) For a vector function $\bar{F}$ there exist a scalar potential when _______.

a) div $\bar{F} = 0$
b) grad $(\text{div}\,\bar{F}) = 0$
c) curl $\bar{F} = 0$
d) $\bar{F} \cdot$ curl $\bar{F} = 0$

10) If $\bar{r} = ae^{3t} + be^{2t}$, then at $t = 0, \frac{d\bar{r}}{dt} =$ ______.

a) a
b) b
c) $2b + 3a$
d) $2a + 3b$

11) If $u = x - y, v = y - x$, then $\frac{\partial(u,v)}{\partial(x,y)}$ _____.

a) 0
b) 1
c) -1
d) 2

12) If $\Phi = \frac{1}{2}(x^2 + y^2 + z^2)$, then at $x = 1, y = 1, z = 1, \nabla\Phi =$ ______.

a) $i + j - k$
b) $i + j + k$
c) $i - j + k$
d) $-i + j + k$

13) The function $f(x, y) = 0$ has a saddle point if _______.

a) $rt - s^2 > 0$
b) $rt - s^2 < 0$
c) $rt - s^2 = 0$
d) None of these

14) If δx is an error in x, then $\frac{\delta x}{x}$ is called _____

a) absolute error in x
b) percentage error in x
c) relative error in x
d) None of these

SLR-GF-701

Seat No.	

Set P

F.Y. (B. Tech) (Sem - I) (New) (CBCS) Examination: Oct/Nov-2023
Engineering Mathematics - I (BTCE0103) / (BTCSE0103) / (BTETE0103) / (BTEE0103) / (BTME0103)

Day & Date: Friday, 05-01-2024 Max. Marks: 56
Time: 03:00 PM To 06:00 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Section – I

Q.2 Attempt any three of the following question. **09**

a) Find n^{th} derivative of $y = \frac{x}{(x+1)^5}$

b) Expand $x^5 - x^4 + x^3 - x^2 + x - 1$ in power of $(x-1)$ and hence find $f\left(\frac{11}{10}\right)$.

c) Evaluate $\lim\limits_{x\to 0} \dfrac{x^2 + 2\cos x - 2}{x \sin x}$

d) Change the given matrix into normal form and hence find its rank

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

e) Verify Cayley Hamilton theorem for the matrix A and hence find A^{-1} where

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

Q.3 Attempt any three of the following question. **09**

a) Evaluate $\lim\limits_{x\to 0}(a^x + x)^{1/x}$

b) Expand $\log(1+e^x)$ in powers of x by using Maclaurin's series.

c) Solve the system of equations $2x + y + z = 3,\ x - y + 2z = 4,\ x + z = 2$

d) Examine whether the vectors $X1 = [2\ -1\ 3\ 2]$, $X2 = [1\ 3\ 4\ 2]$, $X3 = [3\ -5\ 2\ 2]$ are linearly dependent or independent?

e) Calculate n^{th} derivative of $y = e^{2x}\sin\left(\frac{x}{2}\right)\cos\left(\frac{x}{2}\right)$

Q.4 Attempt any two of the following. **10**

a) Determine the eigen values and corresponding eigen vectors of the matrix

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

b) If $y = \cos(m\, sin^{-1}x)$ then show that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y_n = 0$. Hence obtain $y_n(0)$

c) Show that $e^x \log(1+x) = x + \frac{x^2}{2} + \frac{x^3}{3} + \cdots$

Section – II

Q.5 Attempt any three of the following question. **09**

a) Prove that $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}=0$ if $u=f(x-y,y-z,z-x)$

b) If $u=ax+by, v=bx-ay$, find the value of $\left(\frac{\partial u}{\partial x}\right)_y \cdot \left(\frac{\partial x}{\partial u}\right)_v \cdot \left(\frac{\partial y}{\partial v}\right)_x \cdot \left(\frac{\partial v}{\partial y}\right)_u$

c) If $u=x^2, v=y^2$ then P.T. $J.J'=1$

d) A particle moves along the curve $x=t^3+1, y=t^2, z=2t+3$ where t is the time. Find the components of its velocity and acceleration at $t=1$ in the direction $i+j+3k$.

e) Find the angle between the surfaces $x^2+y^2+z^2=12$ and $x^2+y^2-z=6$ at $(-1,2,1)$.

Q.6 Attempt any three of the following question. **09**

a) If $u=\log(x^2+y^2)$ then prove that $\frac{\partial^2 u}{\partial x\,\partial y}=\frac{\partial^2 u}{\partial y\,\partial x}$

b) If $u=2(ax+by)^2-(x^2+y^2)$ and $(a^2+b^2)=4$ Show that $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=12$

c) Divide 24 into three parts such that the continued product of the first, square of second & cube of the third may be maximum.

d) Find the directional derivatives of $\phi=4xz^3-3x^2y^2z$ at $(2,-1,2)$ in the direction from this point towards the point $(4,-4,8)$.

e) Find the percentage error in the area of ellipse due to 2% error each in measuring major and minor axes of ellipse.

Q.7 Attempt any two of the following question. **10**

a) If $u=\tan^{-1}(x^2+2y^2)$, then prove that

$$x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x.\partial y}+y^2\frac{\partial^2 u}{\partial y^2}=2\sin u.\cos 3u$$

b) Find extreme values of $f(x,y)=x^3+y^3-3axy,\ a>0$

c) Show that the vector $\overline{F}=(6xy+z^3)i+(3x^2-z)j+(3x\,z^2-y)k$ is irrotational. Find the function ϕ such that $\overline{F}=-\nabla\phi$

SLR-WF-490

Seat No.	

Set P

F. Y. (B. Tech) (Sem - I) (New) (CBCS) Examination: March/April-2023

Engineering Mathematics-I (BTN10103)

Day & Date: Monday, 10-07-2023 Max. Marks: 70
Time: 10:00 AM To 01:00 PM

Instructions: 1) Q. No. 1 is compulsory. It should be solved in the first 30 minutes in answer book. Page no 03 (Starting page of the Answer Book). Each question carries one mark.
2) Don't forget to Mention question paper set (P/Q/R/S) on top of page.
3) Figures to the right indicates full marks.
4) Use of non-programmable calculator is allowed.

MCQ/Objective Type Questions

Duration: 30 Minutes Marks:14

Q.1 Choose the correct alternatives from the given options. **14**

1) If $y = \log(3x+2)$ then $y_n =$ _______.

a) $\dfrac{(-1)^n (n)!}{(3x+2)^n}$ b) $\dfrac{(-1)^{n-1}(n-1)!}{(3x+2)^n}3^n$

c) $\dfrac{(-1)^n (n-1)!}{(3x+2)^n}3^n$ d) $\dfrac{(-1)^{n+1}(n-1)!}{(3x+2)^n}3^n$

2) The expansion of e^x in powers of x is ______.

a) $1 + \dfrac{x}{1!} + \dfrac{x^2}{2!} + \dfrac{x^3}{3!} + \cdots$ b) $1 - \dfrac{x}{1!} + \dfrac{x^2}{2!} + \dfrac{x^3}{3!} + \cdots$

c) $e\left(1 + (x-1) + \dfrac{(x-1)^2}{2!} + \cdots\right)$ d) $\left(1 - (x-1) + \dfrac{(x-1)^2}{2!} - \cdots\right)$

3) The system of equations AX=B is inconsistent if ______.

a) rank of A < rank of [A, B]
b) rank of A = rank of [A, B]
c) rank of A is less than the number of unknowns
d) rank of A = rank of B

4) If $y = xe^{2x}$ then $y_n =$ ______.

a) $2n!\,xe^{2x}$ b) $2^n.\,xe^{2x}$

c) $2^n.\,e^{2x}.\,x^2 + n2^{n-2}.\,e^x$ d) $2^n.\,e^{2x}.\,x + n2^{n-1}.\,e^{2x}$

5) $\lim\limits_{x\to\infty}(e^{-x}x^2) =$ ______.

a) 2 b) 1
c) 0 d) -1

6) The rank of a matrix in echelon form is _____ the number of rows containing non-zero elements.

a) less than b) greater than
c) equal to d) the reciprocal of

7) If zero is one of the Eigen values of matrix A, then A is ______.
a) Non-singular matrix
b) Singular matrix
c) Symmetric matrix
d) Non-Symmetric matrix

8) A vector function $\bar{F}$ is called solenoidal if ______.
a) $div\, \bar{F} = 0$
b) $curl\, \bar{F} = 0$
c) $grad\, \bar{F} = 0$
d) $\nabla^2\, \bar{F} = 0$

9) If $u = x - y$ and $V = xy$ then $\frac{\partial(u,V)}{\partial(x,y)} =$ ______.
a) $x - y$
b) 0
c) $y - x$
d) $x + y$

10) If ∂x is the error in x, then $\frac{\partial x}{x}$ is called ______.
a) positive error
b) percentage error
c) relative error
d) None of these

11) If $\bar{r} = xi + yj + zk,$ then $curl\, \bar{r} =$ ______.
a) 3
b) $\frac{1}{3}$
c) 0
d) Does not exists

12) The stationary points of $f(x, y) = x^2 + xy^2 + y^4$ is _____.
a) $(1,0)$
b) $(0,1)$
c) $(0,0)$
d) $(1,1)$

13) If $u = f\left(\frac{x}{y}\right)$ then ______.
a) $x\frac{\partial u}{\partial x} - y\frac{\partial u}{\partial y} = 0$
b) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 0$
c) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = u$
d) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 1$

14) If $\bar{r} = ae^{3t} + be^{2t}$ then at $t = 0, \frac{d\bar{r}}{dt} =$ _____.
a) a
b) b
c) $2b + 3a$
d) $2a + 3b$

SLR-WF-490

Seat No.	

Set P

F. Y. (B. Tech) (Sem - I) (New) (CBCS) Examination: March/April-2023
Engineering Mathematics-I (BTN10103)

Day & Date: Monday, 10-07-2023 Max. Marks: 56
Time: 10:00 AM To 01:00 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of Non-programmable calculator is allowed.

Section – I

Q.2 Attempt any three of the following. **09**

a) Find nth derivative of $y = \frac{x}{(x-1)(x-2)(x-3)}$

b) Expand $x^5 - 5x^4 + 6x^3 - 7x^2 + 8x - 9$ in powers of $(x-1)$.

c) Evaluate $\lim_{x\to\infty} \frac{1+2+3+\cdots+x}{x^2}$

d) Change the given matrix into normal form and hence find its rank

$$A = \begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$$

e) Verify Cayley Hamilton theorem for the matrix *A* and hence find *A*$^{-1}$ where

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

Q.3 Attempt any three of the following. **09**

a) Expand $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$

b) Derive the equation for i/p resistance, output resistance for inverting amplifier in voltage in voltage feries feedback amplifier configuration.

c) Solve the system of equations
$3x + y - 5z = 0, 5x + 3y - 6z = 0,$
$x + y - 2z = 0, x - 5y + z = 0$

d) Examine whether the vectors $X1 = [3\ 1\ 1], X2 = [2\ 0\ -1], X3 = [4\ 2\ 1]$ are linearly dependent or independent?

e) Verify Lagrange's Mean Value Theorem for the given function
$f(x) = x - x^3$ in the interval $-2 \le x \le 1$

Q.4 Attempt any two of the following. **10**

a) Determine the eigen values and corresponding eigen vectors of the matrix

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

b) If $y = \sin(m \sin^{-1} x)$ then prove that
$(1-x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y_n = 0.$
Hence deduce that $y_n(0) = 0$ if n is even and
$y_n(0) = [(n-2)^2 - m^2] \ldots (3^2 - m^2)(1^2 - m^2)m,$ if in is odd.

c) Explain 4- bit ring counter

Section – II

Q.5 Solve any three of the following questions **09**

a) If $z = x^2 + y^2, x = \cos t\,, y = \sin t,$ find $\frac{dz}{dt}$ at $t = \pi$

b) If $x = e^u \cos v\,, y = e^u \sin v,$ prove that $JJ' = 1.$

c) A particle moves along the curve $x = e^{-t}, y = 2\cos 2t\,, z = 2\sin 3t$. Find the velocity and acceleration vectors and the magnitudes of velocity and acceleration at $t = 0$.

d) Find the maximum value of $f = x^2y^3z^4$, subject to the condition $x + y + z = 5$

e) If $u = \log(x^2 + y^2)$ then prove that $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$

Q.6 Solve any three of the following questions **09**

a) The torsional rigidity N of length l of a wire is obtained from the formula $N = \frac{8\pi l}{r^4 t^2}$ Find the percentage error in N the percentage error in N due to -2% error in l, +2% error in r and +1.5% error in t.

b) If $u = ax + by, V = bx - ay,$ find the value of
$\left(\frac{\partial u}{\partial x}\right)_y \cdot \left(\frac{\partial x}{\partial u}\right)_v \cdot \left(\frac{\partial y}{\partial v}\right)_x \cdot \left(\frac{\partial v}{\partial y}\right)_u$

c) Find the directional derivatives of $\phi = 4xz^3 - 3x^2y^2z$ at $(2, -1, 2)$ in the direction from this point towards the point $(4, -4, 8)$.

d) Find the angle between two surfaces $x^2 + y^2 + az^2 = 6$ and $z = 4 - y^2 + bxy$ at $P(1,1,2)$.
(Take a=1 and b=1)

e) If $u = f(x - y, y - z, z - x)$, then prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$

Q.7 Attempt any two of the following. **10**

a) Show that the vector $\bar{F} = (y^2 \cos x + z^3)i + (2y \sin x - 4)j + (3xz^2 + z)k$ is irrotational and find its scalar potential.

b) If $u = sin^{-1}\left[\frac{x^{1/4} + y^{1/4}}{x^{1/5} + y^{1/5}}\right]$ then find the value of
$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ and $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2}$

c) Find the maxima and minima of $x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$

SLR-HL-401

Seat No.	

Set P

F.Y (B. Tech) (Sem-I) (New) (CBCS) Examination: Oct/Nov-2022
Engineering Mathematics – I

Day & Date: Monday, 13-03-2023 Max. Marks: 70
Time: 10:00 AM To 01:00 PM

Instructions: 1) Q. No. 1 is compulsory. It should be solved in the first 30 minutes in answer book. Page no 03 (Starting page of the Answer Book). Each question carries one mark.
2) Don't forget to Mention question paper set (P/Q/R/S) on top of page.
3) Figures to the right indicates full marks.
4) Use of Non-programable calculator is allowed.

MCQ/Objective Type Questions

Duration: 30 Minutes Marks: 14

Q.1 Choose the correct alternatives. **14**

1) If $y = \frac{x^n-1}{x-1}$ then y_n= ______.
- a) 0
- b) $n!$
- c) 1
- d) $(n-1)!$

2) If $y = \cos^2 x$ then y_n= ______.
- a) $-2^{n-1}\cos\left(2x + \frac{n\pi}{2}\right)$
- b) $2^{n-1}\cos\left(2x + \frac{n\pi}{2}\right)$
- c) $2^{n-1}\sin\left(2x + \frac{n\pi}{2}\right)$
- d) $2^{n+1}\sin\left(\frac{n\pi}{2}\right)$

3) If $L = \lim_{n\to\infty} x^2\, e^{-x}$ then $L =$ ______.
- a) 0
- b) 1
- c) 2
- d) -2

4) If $y = \log x$ then y_n= ______.
- a) $\frac{(-1)^n(n)!}{x^n}$
- b) $\frac{(-1)^n(n-1)!}{x^n}$
- c) $\frac{(-1)^{n-1}(n)!}{x^{n+1}}$
- d) $\frac{(-1)^{n-1}(n-1)!}{x^n}$

5) The expansion of $y(x+h)$ in powers of x is _____.
- a) $y(x) + hy'(x) + \frac{h^2}{2!}y''(x) + \cdots$
- b) $y(h) + xy'(h) + \frac{x^2}{2!}y''(h) + \cdots$
- c) $y(h) - xy'(h) + \frac{x^2}{2!}y''(h) - \cdots$
- d) $y(x) - hy'(x) + \frac{h^2}{2!}y''(x) - \cdots$

6) If $a \neq 0$ then the rank of matrix A is where $A = \begin{pmatrix} a & a & a \\ a & a & a \\ a & a & a \end{pmatrix}$
- a) 2
- b) a
- c) 0
- d) 1

7) If $1, 1, 8$ are eigen values and $5, 2, K$ are diagonal elements of matrix $[A]_{3\times3}$, then the value of K equals ______
- a) 0
- b) 1
- c) 2
- d) 3

8) $\nabla \times \bar{r} = ?$

a) $i + j + k$
b) 0
c) 3
d) $\sqrt{3}$

9) If $\bar{a}$ is constant vector and $\bar{r} = xi + yj + zk$ then grad $(\bar{a}.\bar{r}) =$ ________.

a) $2\bar{a}$
b) $\bar{a}$
c) $\bar{r}$
d) $2\bar{r}$

10) If $u = e^{xy^2 z^3}$ then $\frac{\partial u}{\partial z} =$ ________.

a) $e^{xy^2 z^3}\ xy^2 z^3$
b) $e^{xy^2 z^3}\ y^2 z^3$
c) $e^{xy^2 z^3} 3xy^2 z^2$
d) $e^{xy^2 z^3}\ 2xyz^3$

11) If $g(x, y, z) = 0$ then the value of $\frac{\partial z}{\partial x} =$ ________.

a) $\frac{g_x}{g_z}$
b) $\frac{g_z}{g_x}$
c) $-\frac{g_z}{g_x}$
d) $-\frac{g_x}{g_z}$

12) If $u = \sin x, . v = \cos y$ then the value of _______.

a) $-\sin y \cos x$
b) $-\sin x\ \cos y$
c) $-\sin x \sin y$
d) $-\cos x \cos y$

13) The percentage error in the area of a square when an error of 1% is made in measuring its length is ______

a) 1
b) 2
c) 3
d) 0

14) Directional derivative is maximum along _______

a) Any unit vector
b) Co-ordinate axes
c) Tangent to the surface
d) Normal to the surface

SLR-HL-401

Seat No.	

Set P

F.Y (B. Tech) (Sem-I) (New) (CBCS) Examination: Oct/Nov-2022
Engineering Mathematics – I

Day & Date: Monday, 13-03-2023 Max. Marks: 56
Time: 10:00 AM To 01:00 PM

Instructions: 1) All question are compulsory.
2) Use of non-programable calculator is allowed.
3) Figures to right indicate full marks.

Section – I

Q.2 Attempt any Three question from the following. **09**

a) Find the nth derivative of $y = \sin x \cos x \cos 2x$

b) Verify Cayley Hamilton theorem for A where $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & -1 \end{pmatrix}$

c) Investigate for what value of μ and λ the equations.
$2x + 3y + 5z = 9,\ 7x + 3y - 2z = 8,\ 2x + 3y + \lambda z = \mu$ will have
(a) no solution, (b) infinite solution, (c) unique solution

d) Expand $x^5 - 5x^4 + 6x^3 - 7x^2 + 8x - 9$ in powers of $(x - 1)$.

e) Expand $\log \sec x$ in powers of x up to x^4

Q.3 Attempt any Three question from the following. **09**

a) Find the nth derivative of $y = \frac{x-1}{x+1}$

b) Prove that $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right) = \frac{1}{2}\left[x + \frac{x^3}{3} + \frac{x^5}{5} + \cdots\right]$

c) Find the nth derivative of $y = e^{-x}.x.\cos x$

d) Examine the vector for Linear Dependence and Independence
$[1,\ 1,\ 1], [1,\ 2,\ 3], [2,\ 3,\ 8]$

e) Find the rank of the matrix by reducing and it to Normal from
$\begin{pmatrix} 3 & 2 & 1 & 4 \\ -1 & 3 & 2 & 2 \\ 2 & 5 & 3 & 6 \\ 5 & 7 & 4 & 10 \end{pmatrix}$

Q.4 Attempt any Two questions from the following. **10**

a) If $\cos^{-1}\left(\frac{y}{b}\right) = \log\left(\frac{x}{n}\right)^n$ then prove that
$x^2 y_{n+2} + (2n+1)xy_{n+1} + 2n^2 y_n = 0$

b) Find the Eigen values and Eigen vector for the smallest Eigen value for
$A = \begin{pmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{pmatrix}$

c) Find the value of a, b, c if
$$\lim_{x \to 0} \frac{x(a + b\cos x) - c\sin x}{x^5} = 1$$

Section – II

Q.5 Attempt any three questions from the following. **09**

a) Prove that $curl\ (\vec{a} \times \vec{r}) = 2\vec{a}$

b) Find the directional derivative of $\phi = x^2 y \cos z$ at $(1, 2, \pi/2)$ in the direction of $2i + 3j + 2k$.

c) If $u = \log(\tan x + \tan y + \tan z)$
Find the value of $\sin 2x \frac{\partial u}{\partial x} + \sin 2y \frac{\partial u}{\partial y} + \sin 2z \frac{\partial u}{\partial z}$

d) If $x^y = y^x$ find $\frac{dy}{dx}$

e) Find the percentage error in g if the percentage errors in l and T are both -1 for case of simple pendulum and the relation $T = \frac{1}{2\pi}\sqrt{\frac{l}{g}}$

Q.6 Attempt any three questions from the following. **09**

a) If $u = F(e^{x-y}, e^{y-z}, e^{z-x})$ Prove that $u_x + u_y + u_z = 0$

b) If $x = a \cosh u \cos v, y = a \sinh u \sin v$ find $\frac{\partial(x,y)}{\partial(u,v)}$
(Note: Derivative of $\cosh x$ is $\sinh x$, derivative of $\sinh x$ is $\cosh x$ w.r.t. x)

c) Find the angle between the normal to the surfaces $x^2 y + z = 3$ and $x \log z - y^2 + 4 = 0$ at $(-1, 2, 1)$.

d) A particle moves along the curve $\bar{r} = (t^3 - 4t)i + (t^2 + 4t)j + (8t^2 - 3t^3)k$ where t denotes time. Show that the magnitudes of acceleration along the tangent and normal at $t = 2$ are 16 and $2\sqrt{73}$ respectively.

e) Prove that $\nabla \frac{1}{r^3} = \frac{-3\vec{r}}{r^5}$

Q.7 Attempt any two questions from the following. **10**

a) If $u = \sin^{-1}\left[\frac{x^{1/4} + y^{1/4}}{x^{1/5} + y^{1/5}}\right]$ then find the values of
$x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ and $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2}$

b) Find the stationary value of $xy(1 - x - y)$

c) Prove that $\bar{F} = (x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$ is irrotational. Find the function ϕ such that $\bar{F} = \nabla\phi$.

SLR-FR-1

Seat No.	

Set P

F.Y. (B.Tech.) (Part – I) (New) (CBCS) Examination Nov/Dec-2019
ENGINEERING MATHEMATICS – I

Day & Date: Friday,06-12-2019 Max. Marks: 70
Time: 10:00 AM To 01:00 PM

Instructions: 1) Q. No. 1 is compulsory and should be solved in first 30 minutes in answer book.
2) Figures to the right indicate full marks.
4) Use of calculator is allowed.

MCQ/Objective Type Questions

Duration: 30 Minutes Marks: 14

Q.1 Choose the correct alternatives from the options and rewrite the sentence. **14**

1) If $y = \log(3x+2)$, then $y_n =$ _______.
 a) $\frac{(-1)^n n!3^n}{(3x+2)^n}$ b) $\frac{(-1)^{n-1}(n-1)!3^n}{(3x+2)^n}$
 c) $\frac{(-1)^{n-1}(n-1)!3^n}{(3x+2)^{n+1}}$ d) None of these

2) The co-efficient of $f'''(0)$ in Maclaurin's series is ________.
 a) $\frac{x^2}{2!}$ b) $\frac{-x^2}{2!}$
 c) $\frac{-x^3}{3!}$ d) $\frac{x^3}{3!}$

3) If $y = x\, e^{2x}$, then $y_n =$ ______.
 a) $(2n)!\, x\, e^{2x}$ b) $2^n x\, e^{2x}$
 c) $2^n\, e^{2x}x + n\, 2^{n-1}e^{2x}$ d) $2^n\, e^{2x}x^2 + n\, 2^{n-2}e^{2x}$

4) Expansion of $4x^2 + 5x + 12$ in powers of $(x-1)$ is _______.
 a) $21 + 13(x-1) + 8(x-1)^2$
 b) $21 + 13(x-1) + 4(x-1)^2$
 c) $21 - 3(x-1) + 8(x-1)^2$
 d) None of these

5) If A is a non-zero matrix of order 4×3, then the rank of the matrix A is ____.
 a) equal to 4 b) greater than 4
 c) less than 3 or equal to 3 d) None of these

6) If A is a square matrix of order 'n' and $\mathrm{AX} = 0$, where X is a $n \times 1$ matrix of unknown and $r < n$, Then the system has _______.
 a) r independent solution b) $(n-r)$ independent solutions
 c) $(2n-r)$ independent solution d) no solution

7) If 2,2,8 are the eigen values of a matrix $A_{3\times 3}$ and $6,3,k$ are the diagonal elements, then K is equal to _______.
 a) 0 b) 1
 c) 2 d) 3

8) If $u = f\left(\frac{x}{y}\right)$ then _______.

a) $x\frac{\partial u}{\partial x} - y\frac{\partial u}{\partial y} = 0$
b) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 0$
c) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = u$
d) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 1$

9) If $u = x - y$ and $V = xy$ then $\frac{\partial(u,V)}{\partial(x,y)} =$ ______.

a) $x - y$
b) 0
c) $y - x$
d) $x + y$

10) The percentage error in area of ellipse when an error of 1% is made in measuring the major and minor axes is _______.

a) 1%
b) 2%
c) 0.5%
d) 4%

11) The stationary points of $f(x, y) = x^2 + xy^2 + y^4$ is _______.

a) (1,0)
b) (0,1)
c) (0,0)
d) (1,1)

12) Vector $\bar{A} = (bx^2y + yz)i + (xy^2 - xz^2)j + (2xyz - 2x^2y^2)k$ is solenoidal for b _______.

a) -2
b) 2
c) 0.5
d) -0.5

13) If $\bar{r} = \bar{a}\sin ht + \bar{b}\cos ht$ then $\frac{d^2\bar{r}}{dt^2} =$ ______.

a) $\bar{r}$
b) $-\bar{r}$
c) $\bar{0}$
d) None of these

14) If $\bar{a}$ is a constant vector then curl $\bar{a} =$ ________.

a) $\bar{a}$
b) a^2
c) 0
d) None of these

SLR-FR-1

Seat No.	

Set P

F.Y. (B.Tech.) (Part – I) (New) (CBCS) Examination Nov/Dec-2019
ENGINEERING MATHEMATICS – I

Day & Date: Friday,06-12-2019 Max. Marks: 56
Time: 10:00 AM To 01:00 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
4) Use of calculator is allowed.

Section – I

Q.2 Solve any three of the following questions. **09**

a) Find the n^{th} derivative of $\frac{1}{6x^2-5x+1}$.

b) Expand $2x^3+3x^2-8x+7$ in terms of $(x-2)$.

c) Evaluate $\lim_{x\to\frac{\pi}{2}} (\sin x)^{\tan x}$

d) Find the rank of the matrix by reducing to normal form.

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

e) Verify the Cayley-Hamilton theorem for the matrix A where

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

Q.3 Solve any three of the following questions. **09**

a) By Maclaurin's series expand $\log(1+e^x)$ in powers of upto x^4.

b) Evaluate
$$\lim_{x\to 0}\left(\frac{\sin x}{x}\right)^{\frac{1}{x^2}}$$

c) Find the values of λ for which
$x+y+z=1; x+2y+4z=\lambda; x+4y+10z=\lambda^2$ has a solution. Solve it in each.

d) Are the vectors $X_1=[1,3,4,2], X_2=[3,-5,2,6], X_3=[2,-1,3,4]$ Linearly dependent? It so express X_2 as a Linear combination of others.

e) verify the Rolle's Theorem for the function $f(x)=x^2(1-x)^2$ in $0\le x\le 1$.

Q.4 Solve any two of the following questions. **10**

a) Find the eigen values and the corresponding eigen vector of the matrix A. where

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

b) If $y=\left[x+\sqrt{1+x^2}\right]^m$, prove that

$$(1+x^2)y_{n+2}+(2n+1)xy_{n+1}+(n^2-m^2)y_n=0$$

c) Prove that $\log(1+\sin x)=x-\frac{x^2}{2}+\frac{x^3}{6}\cdots\cdots$

Section – II

Q.5 Solve any three of the following questions. **09**

a) If $u = ax + by, V = bx - ay,$ find the value of
$\left(\frac{\partial u}{\partial x}\right)_y \cdot \left(\frac{\partial x}{\partial u}\right)_v \cdot \left(\frac{\partial y}{\partial v}\right)_x \cdot \left(\frac{\partial v}{\partial y}\right)_u$

b) if $z = f(u, v), u = \log(x^2 + y^2), v = \frac{y}{x}$, show that $x\frac{\partial z}{\partial y} - y\frac{\partial z}{\partial x} = (1 + v^2)\frac{\partial z}{\partial x}$.

c) If $x = a\cos hu \cos v,\ y = a\sin hu \sin v$ find $\frac{\partial(x,y)}{\partial(u,v)}$

d) Find the maximum value of $f = x^2y^3z^4$, subject to the condition $x + y + z = 5$

e) Find the directional derivatives of $\phi = 4xz^3 - 3x^2y^2z$ at $(2, -1,2)$ in the direction from this point towards the point $(4, -4,8)$.

Q.6 Solve any three of the following questions. **09**

a) If $u = \log(1 + x^n + y^n)$ then find the value of $\frac{\partial^2 u}{\partial x\,\partial y} + \frac{\partial u}{\partial x}\frac{\partial u}{\partial y}$

b) If $z = f(u, v), u = x^2 - y^2, v = y^2 - x^2,$ prove that $x\frac{\partial z}{\partial y} + y\frac{\partial z}{\partial x} = 0$

c) Find $[(2.92)^3 + (5.87)^3]^{1/5}$ approximately by using the theory of approximation.

d) Find the angle between two surfaces $x^2 + y^2 + az^2 = 6$ and $z = 4 - y^2 + bxy$ at $P(1,1,2)$.

e) A particle moves on the curve $x = 2t^2, y = t^2 - 4t, z = 3t - 5$. Find the velocity and acceleration at $t = 1$ in the direction of $i - 3j + 2k$.

Q.7 Solve any two of the following questions. **10**

a) If $u = cosec^{-1}\sqrt{\frac{x^{1/2}+y^{1/2}}{x^{1/3}+y^{1/3}}}$ then find the values of

1) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$

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

b) Find the minimum and maximum values of $x^3y^2(1 - x - y)$

c) Prove that $\nabla.\left(r\,\nabla\frac{1}{\mathrm{r}^3}\right) = \frac{3}{r^4}$