Total No. of Questions : 9]

SEAT No. :

P6485

[Total No. of Pages : 4

[5868]-101

F.E. (Semester- I & II)

ENGINEERING MATHEMATICS - I

(2019 Pattern) (107001)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Q. 1 is compulsory.*
2) *Attempt Q2 or Q3, Q4 or Q5,Q6 or Q7, Q8 or Q9.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Use of electronic pocket calculator is allowed.*
6) *Assume suitable data, if necessary.*

Q1) Write the correct option for the following multiple choice questions.

a) If eigen value of a square matrix A is zero then. **[1]**

i) A is non-singular ii) A is orthogonal

iii) A is singular iv) None of these

b) If u = y^x then $\frac{\partial u}{\partial x}$ is equal to **[1]**

i) 0 ii) xy^{x-1}

iii) $y^x \log y$ iv) None of these

c) The orthogonal transformation x = py transforms the quadratic form $Q = x_1^2 + 3x_2^2 + 3x_3^2 - 2x_2x_3$ to the canonical form $Q' = y_1^2 + 2y_2^2 + y_3^2$. The rank of quadratic from is **[2]**

i) 2 ii) 3

iii) 1 iv) 0

d) $u = \sec^{-1}\left[\frac{x^2 + y^2}{xy^2}\right]$. Find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ **[2]**

i) –tan u ii) –cot u

iii) tan u iv) cot u

P.T.O.

e) If u = $x^2–y^2$ and v = $2xy$ then the value of $\frac{\partial(u,v)}{\partial(x,y)}$ is **[2]**

i) $4(x^2 + y^2)$
ii) $-4(x^2 + y^2)$
iii) $4(x^2–y^2)$
iv) 0

f) A system of linear equations Ax = B, where B is a null (zero) matrix is **[2]**

i) Always consistent
ii) Consistent only if |A| = 0
iii) Consistent only if |A| ≠ 0
iv) In consistent if ρ (A) < No. of variables

Q2) a) If $z = \tan(y + ax) + (y - ax)^{3/2}$ find value of $\frac{\partial^2 z}{\partial x^2} - a^2 \frac{\partial^2 z}{\partial y^2}$. **[5]**

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

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = \left(1 - 4\sin^2 u\right)\sin 2u$$ **[5]**

c) If $u = f\left(x^2 - y^2; y^2 - z^2; z^2 - x^2\right)$ find value of $\frac{1}{x}\frac{\partial u}{\partial x} + \frac{1}{y}\frac{\partial u}{\partial y} + \frac{1}{z}\frac{\partial u}{\partial z}$ **[5]**

OR

Q3) a) If $u = ax + by\,; v = bx - ay$ find value of $\left(\frac{\partial u}{\partial x}\right)_y \left(\frac{\partial x}{\partial u}\right)_v \left(\frac{\partial y}{\partial v}\right)_x \left(\frac{\partial v}{\partial y}\right)_u$ **[5]**

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

c) If $u = f(r,s)$ where $r = x^2 + y^2$; $S = x^2 - y^2$ then show that

$$y\frac{\partial u}{\partial x} + x\frac{\partial u}{\partial y} = 4xy\frac{\partial u}{\partial r}.$$ **[5]**

Q4) a) If $x = uv$ and $y = \frac{u+v}{u-v}$, find $\frac{\partial(u,v)}{x,y}$. **[5]**

b) Examine for functional dependence $u = \frac{x-y}{1+xy}, v = \tan^{-1}x - \tan^{-1}y$ and if depedent find the relation between them. **[5]**

c) Discuss maxima and minima of $f(x,y) = x^2 + y^2 + 6x + 12$ **[5]**

OR

Q5) a) Prove JJ' = 1 for $x = u \cos v$, $y = u \sin v$. **[5]**

b) In calculating the volume of a right circular cone, errors of 2% and 1% are made in measuring the height and radius of base respectively find the error in the calculated volume. **[5]**

c) Find maximum value of $u = x^2y^3z^4$ such that $2x + 3y + 4z = a$ by Langrange's method. **[5]**

Q6) a) Investigate for what values of μ & λ the equations $x+y+z = 6$, $x+2y+3z = 10$, $x+2y+\lambda z = \mu$ have i) No solution ii) Infinitely many solutions. **[5]**

b) Examine for linear dependence and independence the vectros (1,1,3), (1,2,4), (1,0,2). If dependent, find the relation between them. **[5]**

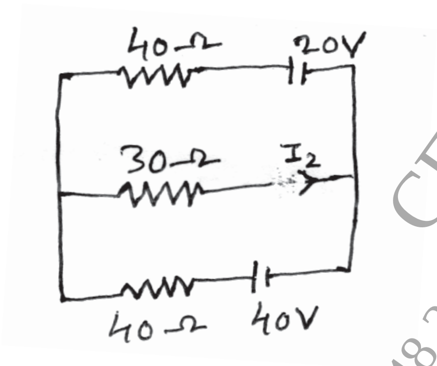
c) Verify whether matrix $A = \begin{bmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{bmatrix}$ is orthogonal or not. **[5]**

OR

Q7) a) Solve the system of equations $x+y+2z = 0$, $x+2y+3z=0$, $x+3y+4z=0$. **[5]**

b) Examine following vectors for linear dependence and independence (1,–1,1), (2,1,1), (3,0,2). If dependent, find the relation between them. **[5]**

c) Determine the currents in the network given in the figure . **[5]**



Q8) a) Find the eigen values of the matrix $A=\begin{bmatrix}1 & -2\\ -5 & 4\end{bmatrix}$. **[5]**

Find eigen vector corresponding to the highest eigen value.

b) Verify cayley-Hamilton theorem for $A=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$. Hence find A^{-1} if it exists. **[5]**

c) Find the modal matrix p which diagonalises $A=\begin{bmatrix}5 & 3\\ 3 & 5\end{bmatrix}$. **[5]**

OR

Q9) a) Find the eigen values of $A=\begin{bmatrix}1 & 2 & 3\\ 0 & 3 & 2\\ 0 & 0 & -2\end{bmatrix}$. **[5]**

Find eigen vector corresponding to the highest eigen value.

b) Verify cayley-Hamilton theorem for $A=\begin{bmatrix}1 & 0 & 0\\ 1 & 0 & 1\\ 0 & 1 & 0\end{bmatrix}$ **[5]**

c) Reduce the quadratic form $Q=x_1^2+2x_2^2+x_3^2+2x_2x_3-2x_3x_1+2x_1x_2$ to canonical form by congruent transformations. **[5]**

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Total No. of Questions : 9]

SEAT No. :

P-3926

[Total No. of Pages : 5

[6001]-4001
F.E.
ENGINEERING MATHEMATICS - I
(2019 Pattern) (Semester - I) (107001)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Question No. 1 is compulsory.***
2) ***Solve Q. No. 2 or Q. No. 3, Q. No. 4 or Q. No. 5, Q. No. 6 or Q. No. 7, Q. No. 8 or Q. No. 9.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) Write the correct option for the following multiple choice questions :

a) If $u = \frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{x^2 + y^2}$ then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ is equal to **[2]**

i) 2u   ii) –2u

iii) 0   iv) None

b) If $u = x^y$ then $\frac{\partial u}{\partial y}$ is equal to **[1]**

i) 0   ii) yx^{y-1}

iii) $x^y \log x$ iv) x^{y-1}

c) If $x = uv$, $y = \frac{u}{v}$ then the value of $\frac{\partial(u,v)}{\partial(x,y)}$ is **[2]**

i) $\frac{-2u}{v}$ ii) uv

iii) $\frac{v}{2u}$ iv) $\frac{-v}{2u}$

P.T.O.

d) A is orthogonal matrix then A^{-1} equal to **[1]**

i) A   ii) A^T

iii) A^2 iv) 1

e) For what value of K the homogeneous system $x + 2y - z = 0$, $3x + 8y - 3z = 0$; $2x + 4y + (k-3)z = 0$ has infinitely many solution. **[2]**

i) K = 0   ii) K = 1

iii) K = 2   iv) K = 3

f) Using Cayley Hamilton theorem A^{-1} for the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ is calculated from **[2]**

i) $\frac{1}{5}(-A - 4I)$ ii) $\frac{1}{5}(A - 4I)$

iii) $\frac{1}{5}(A + 4I)$ iv) $\frac{1}{5}(4I - A)$

Q2) a) If $u = ln(x^2 + y^2)$, show that $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$. **[5]**

b) If $e^{2u} = y^2 - x^2$, $\cos ec\, v = \frac{y}{x}$ then find the value of **[5]**

$$\left(x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}\right) \cdot \left(x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}\right)$$

c) If $u = f(x - y, y - z, z - x)$ then find the value of $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z}$. **[5]**

OR

Q3) a) If $u = ax + by$, $v = bx - ay$ find the value of $\left(\frac{\partial u}{\partial x}\right)_y \cdot \left(\frac{\partial x}{\partial u}\right)_v$. **[5]**

b) If $T = \sin\left(\frac{xy}{x^2 + y^2}\right) + \sqrt{x^2 + y^2}$, find the value of $x\frac{\partial T}{\partial x} + y\frac{\partial T}{\partial y}$. **[5]**

c) If $u = f(r, s)$ where $r = x^2 + y^2$, $s = x^2 - y^2$ then show that $y\frac{\partial u}{\partial x} + x\frac{\partial u}{\partial y} = 4xy\frac{\partial u}{\partial r}$. **[5]**

Q4) a) If $x = u + v$, $y = v^2 + w^2$, $z = u^3 + w^3$ then find $\dfrac{\partial u}{\partial x}$. **[5]**

b) In calculating resistance R of a circuit by using the formula :

$$R = \frac{V}{I}$$

errors of 3% and 1% are made in measuring Voltage V and current I respectively. Find the % error in the calculated resistance. **[5]**

c) Discuss the maxima and minima of : **[5]**

$f(x, y) = x^2 + y^2 + xy + x - 4y + 5$

OR

Q5) a) If $u + v^2 = x$, $v + w^2 = y$, $w + u^2 = z$ find $\dfrac{\partial(u,v,w)}{\partial(x,y,z)}$. **[5]**

b) Examine for functional dependence : **[5]**

$u = y + z$, $v = x + 2z^2$, $w = x - 4yz - 2y^2$

c) A space probe in the shape of the ellipsoid $4x^2 + y^2 + 4z^2 = 16$ enters the earth's atmosphere and it's surface begins to heat. After one hour, the temperature at the point (x, y, z) on the surface of the probe is

$T(x, y, z) = 8x^2 + 4yz - 16z + 600$.

Find the hottest point on the surface of the probe, by using Lagrange's method. **[5]**

Q6) a) Examine for consistency and if consistent then solve it **[5]**

$2x + 3y + 5z = 1$; $3x + y - z = 2$; $x + 4y - 6z = 1$

b) Examine whether the vectors **[5]**

$X_1 = (1, 1, -1, 1)$; $X_2 = (1, -1, 2, -1)$; $X_3 = (3, 1, 0, 1)$

are linearly independent or dependent. If dependent find relation between them.

c) If $A = \begin{bmatrix} 1/3 & 2/3 & a \\ 2/3 & 1/3 & b \\ 2/3 & -2/3 & c \end{bmatrix}$ is orthogonal **[5]**

Find a, b, c.

OR

Q7) a) Investigate for what values of k, the equations **[5]**

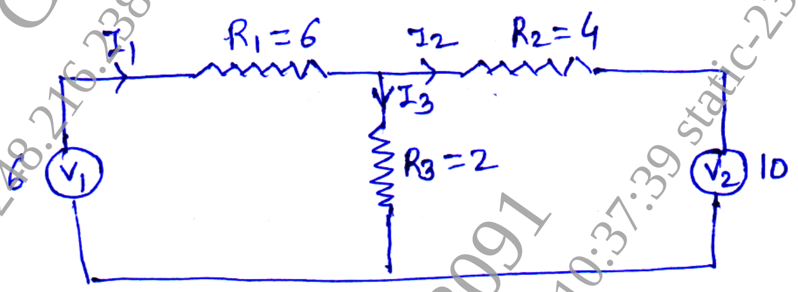
$x + y + z = 1$; $2x + y + 4z = k$; $4x + y + 10z = k^2$ have infinite number of solution? Hence find solution.

b) Examine whether the vectors. **[5]**

$X_1 = (2, 3, 4, -2)$; $X_2 = (-1, -2, -2, 1)$; $X_3 = (1, 1, 2, -1)$

are linearly independent or dependent. If dependent find relation between them.

c) Find the current I_1; I_2; I_3 in the circuit shown in the figure **[5]**



Q8) a) Find eigen values and eigen vectors of the following matrix **[5]**

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

b) Verify Cayley-Hamilton theorem for $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ and use it to find A^{-1}. **[5]**

c) Find the modal matrix p which transform the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ to the diagonal form. **[5]**

OR

Q9) a) Find eigen values and eigen vectors of the following matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$. **[5]**

b) Verify Cayley-Hamilton theorem for $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$ and use it to find A^{-1}. **[5]**

c) Reduce the following quadratic form to the "sum of the squares form". **[5]**

$Q(x) = 2x^2 + 9y^2 + 6z^2 + 8xy + 8yz + 6xz$

□□□

Total No. of Questions—**8**] [Total No. of Printed Pages—**4+1**

Seat No.	

[5667]-1001

F.E. (I Semester) EXAMINATION, 2019

ENGINEERING MATHEMATICS—I

(Phase–II)

(2019 PATTERN)

Time : 2½ Hours **Maximum Marks : 70**

***N.B.* :—** (*i*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Use of electronic pocket calculator is allowed.

(*iii*) Assume suitable data, if necessary.

(*iv*) Neat diagrams must be drawn wherever necessary.

(*v*) Figures to the right indicate full marks.

1. (*a*) If $z = \tan(y + ax) + (y - ax)^{3/2}$, find the value of

$$\frac{\partial^2 z}{\partial x^2} - a^2 \frac{\partial^2 z}{\partial y^2}.$$ [6]

(*b*) If $T = \sin\left(\frac{xy}{x^2 + y^2}\right) + \sqrt{x^2 + y^2}$, by using Euler's theorem find $x\frac{\partial T}{\partial x} + y\frac{\partial T}{\partial y}$. [6]

(*c*) If $u = x^2 - y^2$, $v = 2xy$ and $z = f(u, v)$, then show that

$$x\frac{\partial z}{\partial x} - y\frac{\partial z}{\partial y} = 2\sqrt{u^2 + v^2}\,\frac{\partial z}{\partial u}.$$ [6]

Or

2. (*a*) If $x = u \tan v$, $y = u \sec v$, prove that : [6]

$$\left(\frac{\partial u}{\partial x}\right)_y \left(\frac{\partial v}{\partial x}\right)_y = \left(\frac{\partial u}{\partial y}\right)_x \left(\frac{\partial v}{\partial y}\right)_x.$$

(*b*) If $u = \sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, by using Euler's theorem.

prove that : [6]

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

(*c*) If $x = \frac{\cos\theta}{u}$, $y = \frac{\sin\theta}{u}$ and $z = f(x, y)$, then show that : [6]

$$u\frac{\partial z}{\partial u} - \frac{\partial z}{\partial \theta} = (y - x)\frac{\partial z}{\partial x} - (y + x)\frac{\partial z}{\partial y}.$$

3. (*a*) If $u = x + y + z$, $v = x^2 + y^2 + z^2$, $w = xy + yz + zx$ find $\frac{\partial(u, v, w)}{\partial(x, y, z)}$. [6]

(*b*) Examine whether $u = \frac{x - y}{1 + xy}$, $v = \tan^{-1} x - \tan^{-1} y$ are functionally dependent, if so find the relation between them. [5]

(*c*) Find the extreme values of $x^2 + y^2 + \frac{2}{x} + \frac{2}{y}$. [6]

Or

4. (*a*) If $u = x + y^2$, $v = y + z^2$, $w = z + x^2$, using Jacobian find $\frac{\partial x}{\partial u}$. [6]

(*b*) A power dissipated in a resistor is given by $P = \frac{\varepsilon^2}{R}\cdot$ If errors of 3% and 2% are found in ε and R respectively, find the percentage error in P. [5]

(*c*) Using Lagrange's method find extreme value of xyz if $x + y + z = a$. [6]

5. (*a*) Examine for consistency of the system of linear equations and solve if consistent : [6]

$$x_1 + x_2 + x_3 = 0$$
$$-2x_1 + 5x_2 + 2x_3 = 1$$
$$8x_1 + x_2 + 4x_3 = -1$$

(*b*) Examine for linear dependence or independence the vectors (1, 1, 1, 3), (1, 2, 3, 4), (2, 3, 4, 7). Find the relation between them if dependent. [6]

(*c*) Determine the values of a, b, c when A is orthogonal where : [5]

$$A = \begin{bmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{bmatrix}\cdot$$

Or

6. (*a*) Investigate for what values of a and b, the system of equations $2x - y + 3z = 2$, $x + y + 2z = 2$, $5x - y + az = b$ have :

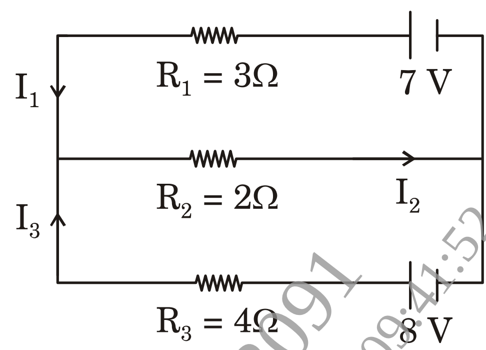
(1) No solution

(2) A unique solution

(3) An infinite number of solutions. [6]

(*b*) Examine for linear dependence or independence the vectors $x_1 = (2, 3, 4, -2)$, $x_2 = (1, 1, 2, -1)$, $x_3 = \left(\frac{-1}{2}, -1, -1, \frac{1}{2}\right)$. Find the relation between them if dependent. [6]

(*c*) Determine the currents in the network given in figure below : [5]



7. (*a*) Find the eigen values and the corresponding eigen vectors for the following matrix : [6]

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

(*b*) Verify Cayley-Hemilton theorem for $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & -2 \\ -2 & 0 & 1 \end{bmatrix}$ and use it to find A^{-1}. [6]

(*c*) Find a matrix P that diagonalizes the matrix

$$A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}.$$ [6]

Or

8. (*a*) Find the eigen values and the corresponding eigen vectors for the following matrix : [6]

$$A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}.$$

(*b*) Verify Cayley-Hamilton theorem for $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & -3 & 3 \end{bmatrix}$ and use it to find A^{-1}. [6]

(*c*) Reduce the following quadratic form to the sum of the squares form : [6]

$$Q = 2x^2 + 9y^2 + 6z^2 + 8xy + 8yz + 6xz.$$

Total No. of Questions : 4]

SEAT No. :

P1268

[Total No. of Pages : 2

OCT/FE/INSEM-1
F.E. (Phase - I)
ENGINEERING MATHEMATICS - I
(2019 Pattern)

Time : 1 Hour] ***[Max. Marks : 30***

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2 and Q.3 or Q.4.***
2) ***Use of electronic pocket calculator is allowed.***
3) ***Assume suitable data, if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Figures to the right indicate full marks.***

Q1) a) For 0 < a < b, show that **[5]**

$$\left(\frac{b-a}{b}\right) < \log\left(\frac{b}{a}\right) < \left(\frac{b-a}{a}\right)$$

Hence show that $\frac{1}{4} < \log\left(\frac{4}{3}\right) < \frac{1}{3}$

b) By using Taylor's theorem, expand $f(x) = e^x$ in powers of $(x-2)$. **[5]**

c) Evaluate $\lim\limits_{x\to 0}\left(\frac{a^x + b^x}{2}\right)^{1/x}$ **[5]**

OR

Q2) a) Prove that $\log(1+\tan x) = x - \frac{x^2}{2} + \frac{2}{3}x^3 - - -$ **[5]**

b) Expand $7+(x+1)+3(x+1)^3+(x+1)^4$ in ascending powers of x by using Taylor's theorem. **[5]**

c) Find a and b if

$$\lim_{x\to 0}\left[\frac{a\cos x - a + bx^2}{x^4}\right] = \frac{1}{12}$$ **[5]**

P.T.O.

Q3) a) Find fourier series to represent the function

$f(x) = x$ for $-\pi < x < \pi$ and $f(x) = f(x + 2\pi)$. **[5]**

b) Find half range cosine series for $f(x) = x^2$, $0 < x < 2$. **[5]**

c) Obtain constant term and coefficients of the first sine and cosine terms in the Fourier expansion of y as given in the following table. **[5]**

(Given $f(x) = f(x + 2\pi)$)

x	0	$\frac{\Pi}{3}$	$\frac{2\Pi}{3}$	Π	$\frac{4\Pi}{3}$	$\frac{5\Pi}{3}$
y	1.0	1.4	1.9	1.7	1.5	1.2

OR

Q4) a) Find Fourier series for the function $f(x) = x^2 - 2, -2 \le x \le 2$ and $f(x) = f(x + 4)$. **[5]**

b) Find half-range sine series for $f(x) = \Pi x - x^2$ where $0 < x < \Pi$. **[5]**

c) Find first three terms in cosine series to represent y as given in the following table. **[5]**

x	0	1	2	3	4	5
y	4	8	15	7	6	2

Total No. of Questions : 4]

SEAT No. :

PA-1678

[Total No. of Pages : 2

[5931]-1001

F.E.

ENGINEERING MATHEMATICS-I

(2019 Pattern) (Semester-I) (107001)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) *Attempt Q1 or Q2 and Q3 or Q4.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data wherever necessary.*
4) *Use of electronic pocket calculator is allowed.*

Q1) a) If $f(x)=\sin^{-1}x$ then show that $\frac{b-a}{\sqrt{1-a^2}} < \text{Sin}^{-1} b - \sin^{-1} a < \frac{b-a}{\sqrt{1-b^2}}$ where $0<a<b<1$. **[5]**

b) Using Taylor's theorem, expand $1+2x+3x^2+4x^3$ in powers of $x+1$ **[5]**

c) Evaluate $\lim_{x\to\frac{\pi}{2}} (\text{Cos}\, x)^{\cos x}$ **[5]**

OR

Q2) a) Expand $\sqrt{1+\sin x}$ upto x^4 in ascending powers of x **[5]**

b) Expand logcosx in ascending powers of $\left(x-\frac{\pi}{3}\right)$ upto the term in $\left(x-\frac{\pi}{3}\right)^2$ by using Taylor's theorem. **[5]**

c) Find the values of a and b if $\lim_{x\to 0}\frac{\sin x + ax + bx^3}{x^3} = 0$ **[5]**

Q3) a) Find Fourier series for $f(x)=\left(\frac{\pi - x}{2}\right)^2, 0<x<2\pi$ and $f(x)=f(x+2\pi)$ **[5]**

b) Find half-range sine series for **[5]**

$f(x)=2x-1,\ 0<x<1$

P.T.O.

c) Obtain the constant term and the coefficients of the first sine and cosine term in the fourier series of $f(x)$ as given in the following table. **[5]**

x	0	1	2	3	4	5
y	9	18	24	28	26	20

OR

Q4) a) Find the fourier series to represent **[5]**

$$f(x) = \begin{cases} -3, & -1 < x < 0 \\ 3, & 0 < x, < 1 \end{cases}, \quad f(x) = f(x+2)$$

b) Find half-range consine series for $f(x) = x^2, 0 < x < \pi$ **[5]**

c) Find half-range sine series for $f(x) = 1, 0 < x < \pi$. Hence using parsevals identify, deduce that **[5]**

$$\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + ...$$

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