Time Allowed: 3 hrs | Max. Marks: 60

Read the following instructions carefully before attempting the question paper.

1. Match the Paper Code shaded on the OMR Sheet with the Paper code mentioned on the question paper and ensure that both are the same.
2. This question paper contains 60 questions of 1 mark each. 0.25 marks will be deducted for each wrong answer.
3. All questions are compulsory.
4. Do not write or mark anything on the question paper except your registration no. on the designated space.
5. Submit the question paper and the rough sheet(s) along with the OMR sheet to the invigilator before leaving the examination hall.

Q 1 If $A=\begin{bmatrix}0 & 1 & -1\\ 4 & -3 & 4\\ 3 & -3 & 4\end{bmatrix}$, then $|9A|=$

(A) -9 (B) -729 (C) 81 (D) None of these CO_1_, L1__

Q 2 The rank of matrix $A=\begin{bmatrix}2 & -4 & 6\\ -1 & 2 & -3\\ 3 & -6 & 9\end{bmatrix}$ is

(A) 4 (B) 2 (C) 0 (D) 1 CO_1_, L4_

Q 3 $\begin{bmatrix}1\\2\\2\end{bmatrix}$ is an Eigen vector of $\begin{bmatrix}4 & -2 & 1\\ 2 & 0 & 1\\ 2 & -2 & 3\end{bmatrix}$ corresponding to Eigen value

(A) 3 (B) 2 (C) 5 (D) -3 CO_1_, L4__

Q 4 Let A be matrix of order 3×3 with characteristic equation $\lambda^3+\lambda^2+2\lambda+1=0$,

then $A^{-1}=$

(A) A^2+A+I (B) $-(A^2+A+2I)$

(C) $-(A^2+2A+I)$ (D) cannot be determined CO_1_, L2__

Q 5 Number of linearly independent vectors in

$\{(1,-1,0,0),(-3,3,0,0),(0,1,0,2),(0,0,3,0)\}$ is

(A) 2 (B) 3 (C) 1 (D) 4 CO_1_, L3__

Q 6 $\int_0^{\frac{\pi}{2}}\frac{10^{\sin x}}{10^{\sin x}+10^{\cos x}}\,dx=$

(A) 2 (B) π (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{2}$ CO_2, L3__

Q 7 If $x^4+2x^2y^2+y^3=0$, then $\frac{dy}{dx}=$

(A) $-\frac{x}{y}\left(\frac{x^2+y^2}{x^2+y}\right)$ (B) $-\left(\frac{x^2+2y}{x^2+xy}\right)$ (C) $-\frac{4x}{y}\left(\frac{x^2+y^2}{4x^2+3y}\right)$ (D) $\frac{x^2+xy}{2y}$ CO_2, L3__

Q 8 $\int_{-1}^{1} e^{|x|}\, dx =$

Reg No:________

(A) $2e-1$ (B) $2e+1$ (C) $2e$ (D) $2(e-1)$

CO_2, L4___

Q 9 If $y = (\log x)^{1/x}$, then $\frac{dy}{dx} =$

(A) $(\log x)^{1/x}\left(\frac{1-\log(\log x)}{x^2 \log x}\right)$ (B) $(\log x)^{1/x}\left(\frac{1-\log x}{x^2}\right)$

(C) $(\log x)^{1/x}(1+\log x)$ (D) $(\log x)^{1/x}\left(\frac{1-\log x \log(\log x)}{x^2 \log x}\right)$

CO_2, L2___

Q 10

$$\int \left(\frac{x^2+1}{x^4+5x^2+4}\right) dx =$$

(A) $\sin^{-1}\left(\frac{x}{2}\right)+C$ (B) $\cos^{-1}\left(\frac{x}{2}\right)+C$

(C) $\frac{1}{2}\tan^{-1}\left(\frac{x}{2}\right)+C$ (D) $\frac{1}{2}\operatorname{cosec}^{-1}\left(\frac{x}{2}\right)+C$

CO_2, L1___

Q 11 Coefficient of $(x-1)$ in the Taylor's series of $f(x)=\sqrt{1+3x}$ about the point $x=1$ is

(A) $\frac{3}{4}$ (B) $\frac{2}{3}$ (C) $\frac{1}{2}$ (D) $\frac{4}{5}$

CO_3, L1___

Q 12

$\lim_{x\to 2}(x-2)\sec\left(\frac{\pi x}{4}\right) =$

(A) $\frac{\pi}{2}$ (B) 0 (C) $-\frac{4}{\pi}$ (D) -1

CO_3, L3___

Q 13 All the stationary points of the function $f(x) = (x-3)^3(x+1)^2$ are

(A) $-1, 3, 3/5$ (B) $-1, -3, -3/5$

(C) $-1, 3, 5$ (D) $-1, 3, -3$

CO_3, L2___

Q 14 It is given that $f(x) = |x+3|$ does not satisfy Rolle's Theorem in $[-6, 0]$. Which of the following condition is true for given $f(x)$?

(A) $f(-6) \neq f(0)$ (B) $f(x)$ is not differentiable in $(-6, 0)$

(C) $f(x)$ is not continuous in $[-6, 0]$ (D) $\lim_{x\to -3} f(x)$ does not exist.

CO_3, L2___

Q 15

$\lim_{x\to 0}(\operatorname{cosec} x)^{\tan x} =$

(A) π (B) 0 (C) 1 (D) e

CO_3, L4___

Reg No:______

Q 16 If $f(x, y) = \sin xy + x^2 \log y$, then f_{yx} at $\left(0, \frac{\pi}{2}\right)$ is

(A) 33 (B) 0 (C) 3 (D) 1 CO_4, L2___

Q 17

$$\lim_{(x,y)\to(0,0)} \frac{3x-2y}{x+5y} =$$

(A) 3 (B) $-\frac{2}{5}$ (C) $\frac{2}{5}$ (D) does not exist CO_4, L2___

Q 18 Value of α, for which $f(x,y) = \begin{cases} \frac{\sec y}{x \operatorname{cosec} 2x}, & x \neq 0 \\ \alpha, & x = 0 \end{cases}$ is continuous at $(0,0)$, is

(A) 2 (B) 0 (C) $\frac{1}{3}$ (D) $\frac{1}{5}$ CO_4, L4___

Q 19 If $f(x,y) = x^3 + y^2, x = \log t + e^t, y = t^2 + \frac{1}{t}$, then $\frac{df}{dt}$ at $t = 1$ is

(A) 0 (B) $e^2 - e + 5$ (C) 4 (D) $3e^2(1+e) + 4$ CO_4, L3___

Q 20 If $x^2z + x^3y + xy^3z = 6$, then $\frac{\partial y}{\partial z} =$

(A) $-\left(\frac{2xy+yz^3}{x^3+3xyz^2}\right)$ (B) $-\left(\frac{x+y^3}{x^2+3y^2z}\right)$

(C) $-\left(\frac{x^2+3yz^2}{2xy+yz^3}\right)$ (D) $-\left(\frac{x^3+3xyz^2}{x^2+yz^3}\right)$ CO_4, L3___

Q 21 If $x = 3u - v^2, y = 5u + v^2$, then $\frac{\partial(x,y)}{\partial(u,v)} =$

(A) 0 (B) $2v$ (C) $16v$ (D) 2 CO_4, L3___

Q 22 If $z = f(u,v), u = xy, v = 3x - 2y$, then $\frac{\partial z}{\partial y} =$

(A) $x\frac{\partial z}{\partial u} - 2\frac{\partial z}{\partial v}$ (B) $y\frac{\partial z}{\partial u} + 3\frac{\partial z}{\partial v}$

(C) $x\frac{\partial u}{\partial z} - 2\frac{\partial v}{\partial x}$ (D) $y\frac{\partial u}{\partial z} + 3\frac{\partial v}{\partial z}$ CO_4, L2___

Q 23 If $f(x,y) = \cos\left(\frac{x}{y}\right)y^3 + xy^2$, then $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y} =$

(A) 0 (B) $f(x,y)$ (C) $2f(x,y)$ (D) $3f(x,y)$ CO_4, L4___

Q 24 No. of critical points for $f(x,y) = 4x - x^4 - 4y^3$

(A) 1 (B) 2 (C) 3 (D) 4 CO_4, L3___

Reg No:______

Q 25 $\lim_{(x,y)\to(0,0)} \frac{y^6 x^6}{(x^4+y^{12})^2}$ does not exist along the path

(A) $y^3 = mx$ (B) $y^2 = mx$ (C) $y = mx^3$ (D) $y = mx^2$ CO_4, L2___

Q 26 Nature of (1, 1) for $f(x,y) = 4 + x^3 + y^3 - 3xy$ is

(A) Relative minima (B) Relative maxima (C) Saddle point (D) None of these CO_4, L4___

Q 27 Which of the following is homogeneous?

(A) $\frac{x^3 - xy^2}{x-1}$ (B) $\sin\left(\frac{x^5}{x^2+y^2}\right)$

(C) $\tan\left[\frac{x^2-y^2}{x^2+y^2}\right]$ (D) $\frac{x^2-y}{y^2-xy}$ CO_4, L4___

Q 28 If $z = e^{\left(\frac{x^2+y^2}{x+y}\right)}$, then $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} =$

(A) 0 (B) $z^2 \ln z$ (C) $z \ln z$ (D) z CO_4, L4___

Q 29 Critical point of $f(x,y) = 2x^2 + 2xy + 2y^2 - 6x$ is

(A) (1, 2) (B) (0, 1) (C) $(-2, 3)$ (D) $(2, -1)$ CO_4, L3___

Q 30 If $x = u(1+v), y = v(1+u)$, then $\frac{\partial(x,y)}{\partial(u,v)} =$

(A) $2uv$ (B) $1-u-v$ (C) $1+u+v$ (D) 1 CO_4, L2___

Q 31 The limits of integration for the $\iint_R f(x,y)dx\,dy$ where R is in the second quadrant and bounded by $y + 2x = 0$ and $x^2 = 4y$ are

(A) $\left\{(x,y): \frac{x^2}{4} \le y \le -2x, -8 \le x \le 0\right\}$

(B) $\{(x,y): 0 \le y \le 16, -8 \le x \le 0\}$

(C) $\left\{(x,y): \frac{x^2}{4} < y < 16, -2\sqrt{y} < x < -\frac{y}{2}\right\}$

(D) $\left\{(x,y): 0 \le y \le -2x, -2\sqrt{y} \le x \le 0\right\}$ CO5, L2___

Q 32 After changing the order of integration $\int_0^{\frac{\pi}{2}} \int_x^{\frac{\pi}{2}} \frac{\sin y}{e^x}\, dy\, dx =$

(A) $\int_0^{\frac{\pi}{2}} \int_y^{\frac{\pi}{2}} \frac{\sin y}{e^x}\, dx\, dy$ (B) $\int_0^{\frac{\pi}{2}} \int_0^{\frac{\pi}{2}} \frac{\sin y}{e^x}\, dx\, dy$

(C) $\int_x^{\frac{\pi}{2}} \int_0^{\frac{\pi}{2}} \frac{\sin y}{e^x}\, dx\, dy$ (D) $\int_0^{\frac{\pi}{2}} \int_0^{y} \frac{\sin y}{e^x}\, dx\, dy$ CO5, L2___

Q 33 The area bounded by the lines $y = 0, x = 2$ and $y = 4x$ using double integral is

(A) 2 (B) 4 (C) 8 (D) 16 CO5, L3__

Q 34 Value of $\iint_R dx\,dy, R: 0 \leq y \leq \sqrt{16 - x^2}, 0 \leq x \leq 4$ is

(A) 4π (B) 16π (C) 8π (D) 12π CO5, L3__

Q 35

$$\int_0^1 \int_0^x \cos x^2 \; dx\, dy =$$

(A) $\frac{\pi}{4}$ (B) $\frac{\sin 1}{2}$ (C) $\frac{\sin 1 - 1}{2}$ (D) $\frac{\pi - 2}{4}$ CO5, L3__

Q 36 Volume of the region bounded by $z^2 = x^2 + y^2, z = 0, z = 4$ is given by

(A) $\frac{52\pi}{3}$ (B) 21π (C) $\frac{16\pi}{3}$ (D) $\frac{64\pi}{3}$ CO5, L3__

Q 37 The value of $\int_0^1 \int_0^1 \int_0^1 2^{y+z}\, dz\, dy\, dx =$

(A) $\frac{1}{\ln 2}$ (B) $\left(\frac{1}{\ln 2}\right)^2$ (C) $\ln 2$ (D) $(\ln 2)^2$ CO5, L2__

Q 38

$$\int_{-a}^{a} \int_0^{\sqrt{a^2-y^2}} f(x,y)\,dx\,dy =$$

(A) $\int_0^a \int_0^{\sqrt{a^2-x^2}} f(x,y)\,dy\,dx$

(B) $\int_0^a \int_{-\sqrt{a^2-x^2}}^{\sqrt{a^2-x^2}} f(x,y)\,dy\,dx$

(C) $\int_{-a}^a \int_{-\sqrt{a^2-x^2}}^{\sqrt{a^2-x^2}} f(x,y)\,dy\,dx$

(D) $\int_{-a}^a \int_0^{\sqrt{a^2-x^2}} f(x,y)\,dy\,dx$ CO 5, L4__

Q 39 In polar form, the equation of circle $x^2 + y^2 = 2x$ is given by

(A) $r = 4\sin\theta$ (B) $r = 2\sin\theta$ (C) $r = 4\cos\theta$ (D) $r = 2\cos\theta$ CO 5, L1__

Q 40

$$\int_0^1 \int_{\sqrt{x}}^1 dy\,dx =$$

(A) $\int_0^1 \int_0^{y^2} dx\,dy$ (B) $\int_0^1 \int_{y^2}^1 dx\,dy$ (C) $\int_0^1 \int_{\sqrt{y}}^1 dx\,dy$ (D) None of these CO 5, L4__

Q 41 T is the boundary of $x^2+y^2+z^2=16, y>0$, the limits of θ(angle of projection with x-axis) in spherical coordinates will be

(A) $0 \text{ to } 2\pi$ (B) $0 \text{ to } \pi$ (C) $0 \text{ to } \frac{\pi}{2}$ (D) $0 \text{ to } \frac{\pi}{4}$ CO 5, L4

Q 42 Polar form of $\int_0^\infty \int_0^\infty 2^{-(x^2+y^2)} dx\, dy =$

(A) $\int_0^\infty \int_0^\infty 2^{-r^2} dr\, d\theta$ (B) $\int_0^{\pi/2} \int_0^\infty 2^{-r^2} dr\, d\theta$

(C) $\int_0^{\pi/2} \int_0^\infty 2^{-r^2} r dr\, d\theta$ (D) $\int_0^{\pi} \int_0^\infty 2^{-r^2} r dr\, d\theta$ CO5, L1

Q 43 Volume of region bounded by $x^2+y^2+z^2 \le 1,\ z \ge 0$ is

(A) π (B) $\frac{2\pi}{3}$ (C) $\frac{4\pi}{3}$ (D) $\frac{\pi}{5}$ CO5, L4

Q 44 Value of $\int_0^{\pi} \int_0^{\sin\theta} dr d\theta$ is

(A) -2 (B) 2 (C) 0 (D) 1 CO5, L2

Q 45 For evaluating $\iiint_T f(x,y,z) dx\, dy\, dz$, where T is the boundary of $x^2+y^2=z^2, z=4$, if we transform Cartesian coordinates (x,y,z) into spherical polar coordinate (r,θ,ϕ), then the limits of ϕ (angle with z –axis) will be

(A) $0 \text{ to } 2\pi$ (B) $0 \text{ to } \pi$ (C) $0 \text{ to } \frac{\pi}{2}$ (D) $0 \text{ to } \frac{\pi}{4}$ CO5, L1

Q 46 For $f(x)=x$ in $(0,2\pi)$, value of a_0 is

(A) π (B) 4π (C) $4\pi^2$ (D) 2π CO6 , L3

Q 47 For $f(x)=1+|x|, -3<x<3,\ b_n=$

(A) $\frac{2(1-(-1)^n)}{n\pi}$ (B) $\frac{2(-1)^n}{n\pi}$ (C) $\frac{2}{n\pi}$ (D) 0 CO6 , L2

Q 48 For $f(x)=\begin{cases} 0 & -1<x<0 \\ -2x, & 0\le x<1 \end{cases}$, $b_2=$

(A) 0 (B) $\frac{2(-1)^n}{n\pi}$ (C) $\frac{1}{\pi}$ (D) $\frac{-1}{\pi}$ CO 6, L3

Q 49 For $f(x)=2, 0\le x\le 5$, a_0 in Fourier cosine series is

(A) 1 (B) 4 (C) 2 (D) 5 CO6, L1

Q 50 Let $\left[-\frac{1}{2}+\sum_{n=1}^{\infty} 2\left(\frac{1-\cos n\pi}{n^2\pi^2}\right)\cos n\pi x+\left(\frac{\cos n\pi}{n\pi}\right)\sin n\pi x\right]$ be the Fourier series representation of $f(x)$ in $(-1,1)$, then value of a_0 is

(A) $-\frac{1}{2}$ (B) -1 (C) $-\frac{1}{4}$ (D) Cannot be determined CO6, L4

Reg No:_______

Q 51 Let $\left[\frac{1}{4}+\sum_{n=1}^{\infty}\left(\frac{1-\cos n\pi}{n^2\pi^2}\right)\cos n\pi x+\left(\frac{-1}{n\pi}\right)\sin n\pi x\right]$ be the Fourier series representation of $f(x)$ in $(-1, 1)$, then value of a_3 is

(A) $\frac{2}{3\pi^2}$ (B) 0 (C) $\frac{2}{9\pi^2}$ (D) cannot be determined CO6, L4__

Q 52 For $f(x)=\begin{cases}0, & 0<x<l\\ 6, & l<x<2l\end{cases}$ value the Fourier coefficient C_1 in complex form of Fourier series is

(A) 0 (B) $-\frac{12}{i\pi}$ (C) $-\frac{6}{i\pi}$ (D) $-\frac{18}{i\pi}$ CO 6, L1__

Q 53 Let $f(x)$ be a 2π periodic function, defined as $f(x)=\begin{cases}-1, & -\pi<x<0\\ 1, & 0<x<\pi\end{cases}$, having Fourier coefficients as $a_0=a_n=0, b_n=\frac{2}{n\pi}(1-\cos n\pi)$, then using Parseval's identity, the series $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\cdots$ converges to

(A) $\frac{\pi^2}{4}$ (B) $\frac{\pi^2}{12}$ (C) $\frac{\pi^2}{6}$ (D) $\frac{\pi^2}{8}$ CO 6, L3__

Q 54 If $f(x)=\sin x$, $0\le x\le\pi$, then coefficient of $\cos 4x$ in Fourier sine series of $f(x)$ is

(A) $-\frac{4}{35\pi}$ (B) $-\frac{4}{15\pi}$ (C) 0 (D) $-\frac{4}{3\pi}$ CO6, L1__

Q 55 Which of the following is an even function in the given interval?

(A) $f(x)=x^3-x,\quad -\pi\le x\le\pi$ (B) $f(x)=\begin{cases}1, & -\pi\le x<0\\ 2, & 0\le x\le\pi\end{cases}$

(C) $f(x)=\begin{cases}2-x, & -\pi\le x\le 0\\ 2+x, & 0\le x\le\pi\end{cases}$ (D) $f(x)=e^{2x},\quad -\pi\le x\le\pi$ CO6, L4__

Q 56 For $f(x)=\cosh\left(\frac{x}{2}\right), 0\le x\le 2, a_0$ in Fourier cosine series =

(A) $\frac{e^2-1}{e}$ (B) $\frac{e^2-2e+1}{e}$ (C) $\frac{1-e^2-e}{e}$ (D) $-\left(\frac{e^2+2e+1}{e}\right)$ CO6, L3__

Q 57 For $f(x)=x-x^3$ in $(-\pi,\pi)$, value of a_5 is

(A) $-\frac{2}{25}$ (B) $\frac{2}{25\pi^2}$ (C) $\frac{4}{125}$ (D) 0 CO6, L1__

Q 58 If $f(x)=\sin x$, $0\le x\le\pi$, then coefficient of $\cos 4x$ in Fourier sine series of $f(x)$ is

(A) $-\frac{4}{35\pi}$ (B) $-\frac{4}{15\pi}$ (C) 0 (D) $-\frac{4}{3\pi}$ CO6. L1__

Q 59 For $f(x) = \pi + x$ in $(0, 2\pi)$, Constant term in Fourier series of $f(x)$ is

(A) π (B) 4π (C) $4\pi^2$ (D) 2π CO6, L3

Q 60 Let $\left[\frac{1}{4} + \frac{1}{\pi^2}\sum_{n=1}^{\infty}\left(\frac{1-\cos n\pi}{n^2}\right)\cos n\pi x - \frac{1}{\pi}\sum_{n=1}^{\infty}\left(\frac{1}{n}\right)\sin n\pi x\right]$ be the Fourier series representation of $f(x)$ in $(-1, 1)$, then value of b_4 is

(A) $\frac{1}{4}$ (B) $-\frac{1}{4\pi}$ (C) 0 (d) Cannot be determined CO6, L4

End of the Paper