SL.NO:1355 **SUBJECT CODE:17MABS09**

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
COMMON TO CSE, CYBER SECURITY AND ARTIFICAL INTELLIGENCE

MATHEMATICS FOR COMPUTER ENGINEERS
(Candidates admitted under 2017 Regulations-SCBCS)

Time : Three Hours Maximum Marks:100 Marks

Answer **ALL** questions

Part-A (10 x 2 =20 Marks)

1 Find the complete solution of $(D^2+1)y=0$

2 Find the particular integral of $\frac{d^2y}{dx^2}+4y=x^4$

3 State any two properties of Laplace Transform

4 Prove that $L[k]=\frac{k}{s}, s>0$ where k is a constant

5 State initial value and final value theorems

6 Using Convolution theorem, find $L^{-1}\left[\frac{1}{s(s^2+1)}\right]$

7 Define Convolution of two functions

8 Prove that $F(\overline{f(x)})=\overline{F(-s)}$

9 Find $Z[4.3^n+2(-1)^n]$

10 Find $Z\left[e^{-iat}\right]$

P.T.O

Answer **Any FIVE** questions

Part-B (5 x10 =50 Marks)

11 a.

Solve the equation $(D^3+2D^2+D)y=e^{2x}+\sin x$

OR

b.

(i). Solve $(D^2+2D+1)y=e^{-x}+3$

(ii). Solve $(D^2+4)y=x\sin x$

12 a.

Solve $\left(x^2D^2+3xD+1\right)y=\frac{\sin\left(\log x\right)}{x^2}$

OR

b.

(i). Find $L\left[\cosh t\cdot\sin 2t\right]$

(ii). Find $L\left[e^{t}(\cosh 2t+\frac{1}{2}\sinh 2t)\right]$

13 a.

(i). Find the Laplace transform of $e^{-t}\int_0^t t\cos t\,dt$

(ii). Find the Laplace transform of $\int_0^t te^{-t}\sin t\,dt$

OR

b.

(i). Find $L\left[t^2e^{3t}\sinh t\right]$

(ii).Find $L\left[\frac{1-\cos t}{t}\right]$

14 a.

(i) Find $L^{-1}\left[\frac{2s+3}{s^2-4s+13}\right]$

(ii) Find $L^{-1}\left[\frac{1}{\left(s^2+a^2\right)\left(s^2+b^2\right)}\right]$

OR

b.

(i). Find $L^{-1}\left[\frac{s+3}{(s^2+6s+13)^2}\right]$

(ii) Find $L^{-1}\left[\frac{1}{s(s+1)(s+2)}\right]$

15 a.

Solve $y'' + y = 2e^t$ Where $y(0) = 1$, $y'(0) = 2$ using Laplace transform.

OR

b.

Find the Fourier Transform of f(x) given by $f(x)=\begin{cases}1, & |x|<a\\ 0, & |x|>a>0\end{cases}$

Hence, evaluate the value of the integral $\int_0^\infty \frac{\sin x}{x}dx$

16 a.

Find the Fourier cosine transform of e^{-x^2}

OR

b.

Find the Fourier Cosine transform of the function $f(x) = \frac{e^{-ax}}{x}$

17 a.

(i). Find $Z[\cosh at \sin bt]$

(ii). Find $Z\left[\sin^2 \frac{n\pi}{4}\right]$ and $Z[\sin(3n+5)]$

OR

P.T.O

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b.

Find $Z^{-1}\left[\frac{3z^2+2}{(5z-1)(5z+2)}\right]$

18 a.

Using Power series technique, find the inverse Z-transform of

$F(z)=\frac{z}{2z^2-3z+1}, |z|>1.$

OR

b.

Find the Fourier Cosine transform of the function $f(x)=\frac{e^{-ax}}{x}$

Answer ALL questions
PART-C (2 x 15 = 30)

19 a.

(i). Solve $\frac{d^2y}{dx^2}+4\frac{dy}{dx}+4y=e^{-x}\sin 2x$

(ii). Solve $(D^3-3D^2+3D-1)y=x^2e^x$

OR

b.

Find the Laplace transform of $f(t)=\begin{cases}1, & 0<t<\frac{a}{2}\\ -1, & \frac{a}{2}<t<a\end{cases}$ with

$f(t+a)=f(t)$

P.T.O

SL.NO:1355

20 a.

Find the Fourier transform of the function *f(x)* defined by

$$f(x)=\begin{cases}1-x^2 & if\ |x|<1\\ 0 & if\ |x|\geq 1\end{cases}$$

Hence prove that $\int_0^\infty \frac{\sin s - s\cos s}{s^3}\cos\left(\frac{s}{2}\right)ds=\frac{3\pi}{16}$

OR

b.

Evaluate $Z^{-1}\left[\frac{z^2}{(z-1)(z-3)}\right]$ using convolution theorem

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SL.NO:1353 **SUBJECT CODE:17MABS06**

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
COMMON TO BME ,ECE & EEE

DIFFERENTIAL EQUATIONS AND TRANSFORMS

Time : Three Hours Maximum Marks:100 Marks

Answer **ALL** questions

Part-A (10 x 2 =20 Marks)

1 Solve $(D^2-1)(D+2)y=0$

2 Find y given $\frac{d^2y}{dx^2}-4y=6e^{5x}$

3 Define the Laplace transform of Periodic function

4 Find $L^{-1}\left[\frac{1}{s-3}+\frac{1}{s}+\frac{s}{s^2-4}\right]$

5 Find the constant a_0 of the Fourier series for function $f(x)=x$ in $0\le x\le 2\pi$

6 If $f(x)=|x|$ expanded as a Fourier series in $-\pi<x<\pi$. Find a_0

7 State Parseval's identity for Fourier transforms

8 Find the Fourier sine transform of $\frac{1}{x}$

9 Define Unit impulsive function of Z transforms

10 Find $Z\left[\frac{a^n}{n!}\right]$

Answer **Any FIVE** questions

Part-B (5 x10 =50 Marks)

11 a. Solve $(D^3 + 3D^2 + 3D + 1)y = 5 + \cos 2x$

OR

b. Solve $\left(x^2D^2 + 3xD + 1\right)y = \frac{\sin(\log x)}{x^2}$

12 a. (i) Find $L\left(t\cos^3 t\right)$

(ii) Find the Laplace transform of $\frac{\sin at}{t}$

OR

b.

(i) Find $L^{-1}\left[\log \frac{s-a}{s^2+a^2}\right]$

(ii) Find $L^{-1}\left[\frac{s}{\left(s^2-a^2\right)^2}\right]$

13 a. Solve $y'' + y = 2e^t$ Where $y(0) = 1$, $y'(0) = 2$ using Laplace transform

OR

b. Express $f(x) = (\pi - x)^2$ as a Fourier series of period 2π in the Interval $0 < x < 2\pi$

14 a. Obtain the cosine series for the function f(x) $= \cos x$ in $(0, \pi)$.

OR

b.

Find the Fourier Sine series for the function $f(x) = x$ in $0 < x < \pi$ and hence deduce that $\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$

15 a.

Find the Fourier Transform of $f(x)$ given by

$$f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a > 0 \end{cases},$$

Hence evaluate the value of the integral $\int_0^{\infty} \frac{\sin x}{x} dx$

OR

b.

(i) Find Fourier cosine transform of $f(x) = \begin{cases} \cos x & \text{if } 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$

(ii) Find the Fourier sine transform of $3e^{-4x} + 4e^{-3x}$

16 a. Find the Fourier Sine transform of the function $f(x) = \frac{e^{-ax}}{x}$

OR

b.

(i) Find the inverse Z-transform of $F(z) = \frac{1}{1 - az^{-1}}, |z| > |a|$

using power series method.

(ii) Find $Z^{-1}\left[\frac{Z-4}{(Z+2)(Z+3)}\right]$

17 a.

Find $Z^{-1}\left[\frac{z^2}{z^2+4}\right]$ using Residue theorem

OR

b. Find $Z^{-1}\left[\dfrac{3z^2-18z+26}{(z-2)(z-3)(z-4)}\right]$ by the method of partial fraction.

18 a. Solve the equation $(D^3+2D^2+D)y = e^{2x}+\sin x$

OR

b. (i) Find $L\left[t^2e^{3t}\sinh t\right]$ (ii) Find $L\left[\dfrac{1-\cos t}{t}\right]$

Answer ALL questions

PART-C (2 x 15 = 30)

19 a. (i) Solve $\dfrac{d^2y}{dx^2}+4\dfrac{dy}{dx}+4y = e^{-x}\sin 2x$

(ii) Solve $(D^3-3D^2+3D-1)y = x^2e^x$

OR

b. Find the Laplace transform of $f(t)=\begin{cases}\sin \omega t, & 0<t<\dfrac{\pi}{\omega}\\ 0, & \dfrac{\pi}{\omega}<t<\dfrac{2\pi}{\omega}\end{cases}$

with $f\left(t+\dfrac{2\pi}{\omega}\right)=f(t)$

20 a. Find the Fourier series expansion of period 2π for the function $y=f(x)$ which is defined in $(0, 2\pi)$ by means of the table of value given below. Find the series up to the third harmonic

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

OR

b.

Using Parseval's identity calculate

(i) $\int_0^\infty \frac{dx}{\left(x^2+a^2\right)^2}$

(ii) $\int_0^\infty \frac{x^2 dx}{\left(x^2+a^2\right)^2}$ if $a>0$

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SL.NO:1353

SL.NO:1356 **SUBJECT CODE:17MABS12**

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
BIO MEDICAL ENGINEERING

STOCHASTIC PROCESS AND NUMERICAL METHODS

(Candidates admitted under 2017 Regulations-SCBCS)

Time : Three Hours Maximum Marks:100 Marks

Answer **ALL** questions

Part-A (10 x 2 =20 Marks)

1 State Newton's Forward Interpolation Formula.

2 State the second order divided difference formula.

3 State Taylor series algorithm for the first order differential equation.

4 What is the error term in Milne's corrector formula?

5 Define covariance.

6 When a die is thrown, 'X' denotes the number that turns up. Find E(X).

7 What is a stochastic matrix? When it will be regular?

8 When a Poisson process is said to be homogenous?

9 List any two properties of cross power spectrum.

10 The auto correlation function of the random telegraph signal process is given by $R(\tau) = a^2 e^{-2\gamma|\tau|}$. Determine the power spectral density.

Answer **Any FIVE** questions

Part-B (5 x10 =50 Marks)

11 a. Apply Newton's Forward Interpolation Formula, find the value of Sin 47° given that Sin 45° = 0.7071; Sin 50° = 0.7660; Sin 55° = 0.8192; and Sin 60° = 0.8660.

OR

b. Find the value of y(5) by applying Bessel's formula.

x	0	4	8	12
f(x)	143	158	177	199

P.T.O

12 a. Apply Lagrange's formula to find $f(x)$ from the following data:

x	0	1	4	5
$f(x)$	4	3	24	39

OR

b. Using Euler's method find $y(0.2)$, $y(0.4)$ and $y(0.6)$ from $\frac{dy}{dx} = x + y$, $y(0) = 1, h = 0.2$

13 a. Solve $\frac{dy}{dx} = x + y$, given $y(1) = 0$, Find $y(1.1)$ *and* $y(1.2)$ by Taylor's Series method.

OR

b. Apply Runge – Kutta method of order 4 find y for $x = 0.1, 0.2$ given that $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$.

14 a. The first four moments of a distribution about X=4 are 1,4,10 and 45 respectively. Show that the Mean is 5, Variance is 3 , $\mu_3 = 0$ *and* $\mu_4 = 26$.

OR

b. Let 'X' be a random variable with p.d.f $f(x) = \begin{cases} \frac{1}{3}e^{\frac{-x}{3}}, & x > 0 \\ 0, & otherwise \end{cases}$

Calculate (i) P(X>3) (ii) m.g.f of 'X' (iii) E(X) and Var(X).

15 a. Calculate the M.G.F of the distribution given by $f(x) = \begin{cases} \lambda e^{-\lambda x}, & x > 0 \\ 0, & otherwise \end{cases}$ and hence find M_4 (Fourth Moment).

OR

b. Show that the random process X(t) = A sint + B cost where A and B are independent random variables with zero means and equal standard deviations is stationary of the second order.

P.T.O

SL.NO:1356

16 a. A man either uses a car or catches a train to go office each day. He never goes 2 days in a row by train but he drives one day, then the next day he is just as likely to drive again as he is to travel by train .Now suppose that on the first day of the week ,the man tossed a fair dice and drove to work if and only if a 6 appeared . Find the probability that he went by a train on the third day and also the probability he went by a car to work in a long run?

OR

b. For the Random process $X(t) = A\sin(\omega t + \varphi)$, where A and ω are constants, φ is a random variable uniformly distributed in $(0, 2\pi)$. Calculate the autocorrelation function of the process.

17 a. Consider the process $X(t) = A\cos\omega t + B\sin\omega t$ where A and B are random variables with E(A)=0=E(B) and E(AB)=0. Examine $\{X(t)\}$ is mean ergodic or not.

OR

b. Find the mean and variance of the stationary process X(t) whose auto correlation function is $R(\tau) = \dfrac{25\tau^2 + 36}{6.25\tau^2 + 4}$.

18 a. Determine the mean square value of the process whose power density spectrum is $S_{xx}(\omega) = \dfrac{\omega^2 + 9}{\omega^4 + 5\omega^2 + 4}$

OR

b. Determine the power spectral density of a WSS process with auto correlation function is given by $R(\tau) = e^{-\alpha\tau^2}$

Answer ALL questions

PART-C (2 x 15 = 30)

19 a. From the following table values of x and f(x), determine f(0.23) and f(0.29) applying suitable Newton's formula.

x	0.20	0.22	0.24	0.26	0.28	0.30
f(x)	1.6596	1.6698	1.6804	1.691	1.7024	1.7139

OR

P.T.O

b.

Apply Rung- Kutta Method of fourth order solve $\frac{dy}{dx}=\frac{y^2-x^2}{y^2+x^2}$ with

$y(0)=1, h=0.2,$ *to* find $y(0.2)$

20 a.

If the density function of a continuous random variable 'X' is given

by $f(x)=\begin{cases} ax, & 0\le x\le 1 \\ a, & 1\le x\le 2 \\ 3a-ax, & 2\le x\le 3 \\ 0, & otherwise \end{cases}$

(i).Determine the value of 'a' (ii) Find the CDF of 'X'.

OR

b.

The cross power spectrum of real random processes $\{X(t)\} and \{Y(t)\}$ is given by; $S_{XY}(\omega)=\begin{cases} a+jb\omega, & |\omega|<1 \\ 0, & elsewhere \end{cases}$ .Calculate the Cross-correlation function.

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SL.NO:1356

SL.NO:1354 **SUBJECT CODE:17MABS10**

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
COMMON TO EEE,ECE AND MECT

PARTIAL DIFFERENTIAL EQUATIONS & LINEAR ALGEBRA

Time : Three Hours Maximum Marks:100 Marks

Answer **ALL** questions

Part-A (10 x 2 =20 Marks)

1 Find the partial differential equation by eliminating arbitrary constants a and b from $(x-a)^2+(y-b)^2+z^2=1$

2 Solve $\left(D^2-6DD'+9D'^2\right)z=0$

3 List the laws assumed to derive the one dimensional heat flow equation

4 Classify the partial differential equation $u_{xx}+xu_{xy}=0$

5 Define Linear independence

6 Prove that (1,1,1),(0,1,1) and (0,1,-1) generate $R^3(F)$

7 State Cauchy-Schwarz inequality

8 Let V be an inner product space. Let $u,v\in V$ be arbitrary and 'a' any scalar. Prove that $||u||>0, if\ u\neq 0$

9 State the dimension of $L(U,V)$

10 Find the Eigen values of the matrix $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$

p.t.o

Answer **Any FIVE** questions

Part-B (5 x10 =50 Marks)

11 a. Find the partial differential equation by eliminating the arbitrary function 'f' from $z = f\left(\frac{xy}{z}\right)$

OR

b. Find the partial differential equation by eliminating the arbitrary function 'f' from $z = f\left(x^2 + y^2 + z^2\right)$

12 a. (i) Solve $z = p^2 + q^2$

(ii) Solve $p^2 + q^2 = x^2 + y^2$

OR

b. A string is stretched and fastened to two points l apart. Motion is started by displacing the string into the form $y = k\sin\left(\frac{\pi x}{l}\right)$ from which it is released at time t=0. Determine the displacement of the point of the string at a distance x from one end at time t.

13 a. A taut string of length 20 cms fastened at both ends is displaced from its position of equilibrium , by imparting to each of its points an initial velocity given by $v = \begin{cases} x & in \ \ 0 < x < 10 \\ 20 - x & in \ \ 10 < x < 20 \end{cases}$

.Determine the displacement function $y(x\,,\,t)$

OR

b. A square plate is bounded by the lines x=0, y=0, x=l and y=l. Its faces are insulated and $u(l,\ y) = ly - y^2$, $0 < y < 1$ while the other three edges are kept at $0^\circ C$. Determine the steady state temperature distribution in the plate.

14 a. Show that the vector $(1,2,1),(2,1,0)$ and $(1,-1,2)$ form a basis for R^3

OR

b. Prove that the intersection of any number to subspace of a vector space $V(F)$ is a subspace $V(F)$.

15 a. For each of the following lists of vectors in R^3 ,determine whether the first vector can be expressed as a linear combination of the other two

(i) $(-2,0,3),(1,3,0),(2,4,-1)$

(ii) $(3,4,1),(1,-2,1),(-2,-1,1)$

OR

b. Suppose T is a linear operators on an inner product space V(F).Then show that adjoint T^* of T exists such that $TT^* = T^*T = I$ iff T is unitary

16 a. Let V be an inner product space. Let $u, v \in V$ be am arbitrary and 'a' any scalar. Prove that

$(i)\ \|u\| > 0\ if\ u \neq 0$

$(ii)\ \|au\| = |a|\,\|u\|$

$(iii)\ |\langle u, v\rangle| \leq \|u\|\,\|v\|$

$(iv)\ \|u + v\| \leq \|u\| + \|v\|$

OR

b. A linear operator on R^2 is defined by $T(x, y) = (x + 2y, x - y)$ Find the adjoint T^* if the inner product is standard one.

17 a. Show that the mapping $T: V_2(R) \to V_3(R)$ defined as

T(a,b)=(a+b,a-b,b) is a linear transformation from $V_2(R)$ into $V_3(R)$ .Determine the range, rank, null space and nullity of T.

OR

b. If A is a linear transformation on a vector space V such that $A^2 - A + I = 0$ then prove that A is invertible

18 a. Let V be an n-dimensional vector space over the F and let T be a linear transformation from V into V such the range and null space of T are identical prove that n is even. Give an example of such a linear transformation

OR

b. Prove that the intersection of two subspace W_1 and W_2 of a vector space $V(F)$ is also a subspace of $V(F)$.

Answer ALL questions
PART-C (2 x 15 = 30)

19 a. Determine whether the following vectors is in the span of S

$(i)\ (2,-1,1) \qquad S=\{(1,0,2),(-1,1,1)\}$

$(ii)\ 2x^3-x^2+x+3 \qquad S=\{x^3+x^2+x+1, x^2+x+1, x+1\}$

$(iii)\begin{pmatrix}1 & 2\\ -3 & 4\end{pmatrix} \qquad S=\left\{\begin{pmatrix}1 & 0\\ -1 & 0\end{pmatrix},\begin{pmatrix}0 & 1\\ 0 & 1\end{pmatrix},\begin{pmatrix}1 & 1\\ 0 & 0\end{pmatrix}\right\}$

OR

b. A rod of length l has its ends A and B kept at $0°C$ and $100°C$ until steady state conditions prevail. If the temperature at B is reduced suddenly to $0°C$ and kept so while that of A is maintained, Determine the temperature $u\ (x\ ,\ t)$ at a distance x from A and at time t.

20 a. Solve the system of equations $x+3y=80$, $2x+5y=100$, $5x-2y=60$, $-x+8y=130$, $10x-y=150$ by using least square method

OR

b. Identify the Eigen values of the matrix $\begin{bmatrix}1 & 1 & 1\\ 0 & 1 & 1\\ 0 & 0 & 1\end{bmatrix}$ and also find eigen vectors

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SL.NO:1337 **SUBJECT CODE:17MABS13**

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022

PDE APPLICATION AND COMPLEX ANALYSIS

Time : Three Hours Maximum Marks:100 Marks

Answer **ALL** questions

Part-A (10 x 2 =20 Marks)

1 Form the PDE by eliminating arbitrary constants a and b from $z = (x^2 + a^2)(y^2 + b^2)$

2 Solve $(D^4 - 2D^3D' + 2DD'^3 - D'^4)z = 0$.

3 Find the Fourier constant b_n for $x \sin x$ in $-\pi < x < \pi$, when expressed as a Fourier series.

4 Find the Fourier coefficient a_n in the expansion of $f(x) = \sinh x$ in $(-\pi, \pi)$ as a Fourier series.

5 Find the value of b_n if $f(x)$ is a function defined in $-2 \le x \le 2$.

6 Write a^2 stand for the wave equation $\frac{\partial^2 y}{\partial t^2} = a^2 \frac{\partial^2 y}{\partial x^2}$

7 Find the invariant points of $w = \frac{3z-5}{1+z}$.

8 Find the invariant points of $w = \frac{1+z}{1-z}$

(P.T.O)

9

Evaluate $\int_c \frac{dz}{(z-3)^2}$ where C is the unit circle $|z|=1$

10

Use Cauchy's integral formula, Evaluate $\int_c \frac{z}{(z-1)^3} dz$ where C is $|Z|=2$.

Answer **Any FIVE** questions

Part-B (5 x10 =50 Marks)

11 a.

Solve $\frac{y^2 z}{x} p + xzq = y^2$

OR

b.

(a)Solve $z = p^2 + q^2$.

(b)Solve $p^2 + q^2 = x^2 + y^2$

12 a.

Find the Fourier series to represent the function $f(x) = |x|$, $-\pi < x < \pi$.

OR

b.

Find the sine series for the function $f(x) = \begin{cases} x \text{ in } o \le x \le \frac{l}{2} \\ l - x \text{ in } \frac{l}{2} \le x \le l \end{cases}$

(P.T.O)

SL.NO:1337

13 a. Find the displacement of any point 'x' of the string at any time t>0 if a tightly stretched flexible string has its ends fixed at x=0 and x=l.At time t=0 the string is given a shape defined by $f(x) = kx(lx - x^2)$,where 'k' is a constant and then released from rest.

OR

b. Find the bilinear transformation which maps the points $z_1 = -1, z_2 = 0, \& z_3 = 1,$ into the points $w_1 = 0, w_2 = i, \& w_3 = 3i,$ respectively

14 a. Find an analytic function whose imaginary part is $3x^2y - y^3$

OR

b. Evaluate $\int_C \frac{2z-1}{z(z+1)(z-3)}dz$ where C is the circle $|z| = 2$.

15 a. Determine Taylor's series to represent the function $\frac{z^2-1}{(z+2)(z+3)}$ in the region $|z| < 2$.

OR

b. Evaluate $\int_C \frac{4-3z}{z(z-1)(z-2)}dz$ where C is the circle $|z| = \frac{3}{2}$ using residue theorem

16 a. Solve $pyz + qzx = xy$

(P.T.O)

OR

b.

Find the Fourier series for the function $f(x) = x$ in the interval $0 \le x \le 2\pi$.

17 a.

Solve the Fourier Series of $f(x) = x + x^2$ in $(-\pi, \pi)$ of periodicity 2π

OR

b.

Show that the displacement at any time t is

$$y(x,t) = \frac{8kl^3}{a\pi^4} \sum_{n=1,3,5}^{\infty} \frac{1}{n^4} \sin\frac{n\pi x}{l} \sin\frac{n\pi at}{l}$$

If a tightly stretched string with fixed end points x = 0 and x = l is initially at rest in its equilibrium position. It is set vibrating string giving each point a velocity $kx(l-x)$

18 a.

Show that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$ if $f(z)$ is a regular function of z

OR

b.

Find an analytic function whose imaginary part is $3x^2y - y^3$

(P.T.O)

SL.NO:1337

Answer ALL questions
PART-C (2 x 15 = 30)

19 a.

Solve $r+s-6t=y\cos x$

OR

b.

Find the fourier series as far as the second harmonic to represent the function y=f(x) in $(0,2l)$ given in the following data

x	0	1	2	3	4	5
$f(x)$	9	18	24	28	26	20

20 a.

Find $f(z)$ in terms of z ,if $f(z)=u+iv$ is an analytic function and $u-v=e^x(\cos y-\sin y)$,.

OR

b.

Evaluate $\int_C \frac{z^2-2z}{(z+1)^2(z^2+4)}dz$ where C is the circle $|z|=3$ using residue theorem

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SL.NO:1338

SL.NO:1303A **SUBJECT CODE:17MABS17**

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
ELECTRONICS AND COMMUNICATION ENGINEERING

NUMERICAL METHODS, RANDOM PROCESSES & OPTIMIZATION

Time : Three Hours Maximum Marks:100 Marks

Answer **ALL** questions

Part-A (10 x 2 =20 Marks)

1 What is the difference between Interpolation and Extrapolation?

2 Form the Newton's difference table for the following data.

x	4	6	8	10
y	1	3	8	16

3 State the disadvantage of Taylor series method.

4 What is the error term in Milne's corrector formula?

5 Differentiate Single step and Multistep methods.

6 Using Euler's method find $y(0.2)$ from $\frac{dy}{dx} = x + y$, $y(0) = 1$ with $h = 0.2$

7 Given X and Y are independent random variables with variance 2 and 3, find the variance of $(3X + 4Y)$.

8 Define first order stationary process.

9 Write the Standard form of L.P.P.

10 Define surplus variable.

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Answer **Any FIVE** questions

Part-B (5 x10 =50 Marks)

11 a. Find $f(1), f(5)$ and $f(9)$ using Newton's divided difference formula from the following data.

x	0	2	3	4	7	8
$y=f(x)$	4	26	58	112	466	668

OR

b. From the following data ,find 'θ' at $x=43$

x	40	50	60	70	80	90
θ	184	204	226	250	276	304

12 a. Using Modified Euler method, find $y(0.1), y(0.2)$, given $\frac{dy}{dx}=x^2+y^2$, $y(0)=1$.

OR

b. Find y for $x = 0.2$ correct to 4 decimal places, given $\frac{d^2y}{dx^2} - x\left(\frac{dy}{dx}\right)^2 + y^2 = 0$ using Runge – Kutta method, initial conditions are $x = 0, y = 1, y' = 0$.

13 a. A random variable X has the following probability distribution

Values of X	-2	-1	0	1	2	3
$P(X)$	0.1	k	0.2	$2k$	0.3	$3k$

(i) Determine 'k'

(ii) Calculate $P(X<2)$ and $P(-2<X<2)$.

(iii) Determine the CDF of X.

(iv) Calculate the mean of X.

OR

b. A continuous random variable X has the P.D.F $f(x)=kx^2e^{-x}, x\geq 0$ Calculate the rth moment of X about the origin. Hence determine the mean and variance of X.

14 a. The density function of a random variable 'X' is given by $f(x)=Kx(2-x),\ 0\leq x\leq 2$. Calculate '$K$', Mean and variance.

OR

b. Suppose that customers arrive at a bank according to a Poisson process with mean rate of 3 per minute. Find the probability that during a time interval of two minutes

(i) Exactly 4 customers arrive
(ii) More than 4 customers arrive
(iii) Fewer than 4 customers arrive.

15 a. Consider the process $X(t) = A\cos\omega t + B\sin\,\omega t$ where A and B are random variables with $E(A) = 0 = \mathrm{E}(B)$ and $E(AB) = 0$. Prove that $\{X(t)\}$ is mean ergodic.

OR

b. Solve the following LPP by the graphical method:

$MaxZ = 45x_1 + 80x_2$

Subject to

$5x_1 + 20x_2 \leq 400$

$10x_1 + 15x_2 \leq 450$

$x_1, x_2 \geq 0$

16 a. Use simplex method to solve the following LPP

Maximize $z = 4x_1 + 10x_2$

Subject to

$2x_1 + x_2 \leq 50$

$2x_1 + 5x_2 \leq 100$

$2x_1 + 3x_2 \leq 90$

$x_1, x_2 \geq 0$

OR

b. Calculate the initial basic feasible solution for the following transportation problem by using Vogel's Approximation method.

		Distribution centers				Availability
	S_1	11	13	17	14	250
Origin	S_2	16	18	14	10	300
	S_3	21	24	13	10	400
Requirements		200	225	275	250	

17 a. The processing time, in hours for the jobs when allocated to the different machines are indicated below. Assign the machines for the jobs so that the total processing time is minimum.

		Machines				
		M_1	M_2	M_3	M_4	M_5
Jobs	J_1	9	22	58	11	19
	J_2	43	78	72	50	63
	J_3	41	28	91	37	45
	J_4	74	42	27	49	39
	J_5	36	11	57	22	25

OR

b. The assignment cost of assigning any one operator to any one machine is given in the following table

		Operators			
		I	II	III	IV
Machine	A	10	5	13	15
	B	3	9	18	3
	C	10	7	3	2
	D	5	11	9	7

Determine the optimal assignment by Hungarian Method.

18 a. Define a random process. Explain the classification of random processes with suitable examples.

OR

b. Find $y(1.1)$ *and* $y(1.2)$ by Taylors series method, for $\frac{dy}{dx} = x + y$ given $y(1)=0$.

Answer ALL questions
PART-C (2 x 15 = 30)

19 a. Use Lagrange's formula to fit a polynomial to the data

x	-1	0	1	2
y	-8	3	1	12

and hence find $y\ (x=0.5)$.

OR

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b.

A random variable X has the following probability function.

Values of X	0	1	2	3	4	5	6	7
$P(x)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2+k$

(i) Determine the value of 'k'

(ii) Calculate $P(X<6), P(X\geq 6)$ *and* $P(0<X<5)$.

(iii) Determine the distribution function of X.

(iv) *If* $P(X\leq K)>\frac{1}{2}$, Find the minimum value of k.

20 a.

The transition probability matrix of a Markov chain $\{X_n\}$, having states 1, 2, and 3 is $P=\begin{bmatrix}0.1 & 0.5 & 0.4\\0.6 & 0.2 & 0.2\\0.3 & 0.4 & 0.3\end{bmatrix}$ and the initial distribution is

P $^{(0)}$ = (0.7, 0.2, 0.1). Calculate (i) $P\{X_2=3/X_0=1\}$ (ii) $P\{X_2=3\}$ and (iii) $P\{X_3=2, X_2=3, X_1=3, X_0=1\}$

OR

b.

Analyse the starting solution of the following transportation model

1	2	6	7
0	4	2	12
3	1	5	11
10	10	10	

Using (a) North-west corner rule (b) Least cost method (iii) Vogel's approximation method.

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1303 A

SL.NO:1268 **SUBJECT CODE:17MABS07**

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
COMMON TO BIOTECH AND PHARMA

BIOSTATISTICS

Time : Three Hours Maximum Marks:100 Marks

Answer **ALL** questions
Part-A (10 x 2 =20 Marks)

1 State the limitations of statistics
2 Define primary data
3 Define Tabulation
4 Write the general rules for constructing diagrams
5 Write the elements involved in the process of sampling.
6 Define Non-Probability sampling.
7 What are the test of significance in small samples
8 State any two assumptions of t – test.
9 What are the assumptions made in Randomized Block Design?
10 Write down the ANOVA table for RBD

Answer **Any FIVE** questions
Part-B (5 x10 =50 Marks)

11 a.

(a) Prepare a bar diagram for the following data

India's foreign debt as on 01.04.2000	
Source of borrowing	Amount of loan (In cores of Rs.)
USA	1800
Russia	1200
United Kingdom	800
Japan	600
Germany	500

(b) The regional rainfall indices during the year 2001 to 2003 are given below

Year	Zone				
	West	North	East	South	Centre
2001	78.4	88.9	83.7	89.9	86.5
2002	75.6	62.5	103.6	75.5	77.4
2003	121.2	116.5	107.6	123.9	90.3

Represent the data by a multiple bar diagram

(P.T.O)

OR

b.

(a) Write the difference between primary data and secondary data.
(b) Construct a subdivided bar-diagram and multiple bar diagram for the following data

Species	1 year-old	2 year-old	3 year-old
C-catla	3.5	5.0	7.5
C-carpia	1.5	2.0	3.5
L-rohiter	3.0	4.5	5.0
Totor	2.5	3.0	6.0

12 a. There are two bags. The first bag contains 4 white and 2 black balls; the second contains 5 white and 4 black balls. Two balls are transferred from first bag to the second bag and then one ball is taken from the second bag. What is the probability that it is a white ball?

OR

b. Two dices are tossed. Find the probability of getting an "even number on the first die or a total of 8".

13 a.

Two random samples gave the following results.

Sample	Size	Sample Mean	Sum squares of deviations from the mean
1	10	15	90
2	12	14	108

Test whether the samples come from the same normal population

OR

b. The following table show that the distribution of digit in number chosen at random from a telephone directory

Digits	0	1	2	3	4	5	6	7	8	9
Frequency	1026	1107	997	966	1075	933	1107	972	964	853

Test at 5% level whether the digits may be taken to occur equally frequently in the directory.

(P.T.O)

14 a.

The three samples below have been obtained from normal population with equal variances. Test the hypothesis that the sample means are equal

Samples		
8	7	12
10	5	19
7	10	13
14	9	12
11	9	14

OR

b.

Five doctors, each test 5 treatments for a certain disease and observe the number of days each patients requires to recover. The results are as follows

Doctors	Treatments				
	1	2	3	4	5
A	10	14	23	19	20
B	11	15	24	17	21
C	9	12	20	16	19
D	8	13	17	17	20
E	12	15	19	15	22

Discuss the difference between a) Doctors b) Treatments

15 a.

Construct $\overline{X}$ – Chart and R – Chart for the following data.

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean	14	15	14	13	12	10	16	17	18	20
Range	3	1	2	1	1	1	2	2	3	4

(Given sample size 5).

OR

b.

The following data refers to the visual defects found during the inspection of the first 10 samples of size 50 each from a lot of two-wheelers manufactured by an automobile company

Sample No.	1	2	3	4	5	6	7	8	9	10
No. of defectives	4	3	2	3	4	4	4	1	3	2

Draw a 'P' chart to show that the fraction defective are under control

16 a. Construct a control chart for the proportion of defectives obtained in repeated random samples of size 100 from a process which is considered to be under control when the proportion of defective p is equal to 0.20. Draw the control line and upper and lower control limits

OR

b. 10 samples each of size 50 were inspected and the number of defectives in the inspection were: 2,1,1,2,3,5,5,1,2,3.Draw the appropriate control chart for defectives

17 a. Explain in detail restricted Random Sampling with example

OR

b. Discuss about various methods of sampling.

18 a. Random samples of 400 men and 600 women were asked whether they would like to have a fly-over near their residence 200 men 325 women were in favour of it. Test the equality of proportion of men and women in the proposal?

OR

b. The mean produce of wheat from a sample of 100 fields comes to 200kg per acre and another sample of 150 fields gives a mean 220 kg per acre. Assuming the standard deviation of the yield at 11 kg for the universe, test if there is a significant difference between the means of the samples?

Answer ALL questions
PART-C (2 x 15 = 30)

19 a.

(a) Write the difference between primary data and secondary data.
(b) Construct a subdivided bar-diagram and multiple bar diagram for the following data

Species	1 year-old	2 year-old	3 year-old
C-catla	3.5	5.0	7.5
C-carpia	1.5	2.0	3.5
L-rohiter	3.0	4.5	5.0
Totor	2.5	3.0	6.0

OR

b. a) A box contains 4 bad and 6 good tubes. Two are drawn out from the box at a time. One of them is tested and found to be good. What is the probability that the other one is also good?
b) State and prove Baye's Theorem

20 a.

(i) A sample of 26 bulbs gives a mean life of 990 hours with a standard deviation of 20 hours .The manufacturer claims that the mean life of bulbs is 1000 hours is the sample not up to the standard.

(ii) Two random samples of sizes 400 and 500 showed mean 10.9 and 11.5 respectively. Can the samples be regarded as drawn from a population with variance 25?

OR

b. A completely randomized design experiment with 10 plots and 3 treatments gave the following results

Plot No.	1	2	3	4	5	6	7	8	9	10
Treatment	A	B	C	A	C	C	A	B	A	B
Yield	5	4	3	7	5	1	3	4	1	7

Analyze the result for treatment effects.

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SL.NO:1268

SL.NO: 1289 SUBJECT CODE:17MABS14

VINAYAKA MISSIONS RESEARCH FOUNDATION

(Deemed to be University)

B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022

COMMON TO CSE , ARTIFICIAL INTELLIGENCE & CYBER SECURITY

NUMERICAL METHODS AND NUMBER THEORY

Time : Three Hours Maximum Marks:100 Marks

Answer **ALL** questions

Part-A (10 x 2 =20 Marks)

1 Use Trapezoidal rule to find the area of the curve between x axis and the lines $x=2$ and $x=5$ when a curve passes through $(2, 8)$, $(3, 27)$, $(4, 64)$ and $(5, 125)$.

2 Use Romberg's method to find I if $I_1 = 0.775, I_2 = 0.7828$

3 Define transcendental equation

4 Name two iterative methods to solve a system of algebraic equations

5 Write Newton's Backward Interpolation Formula

6 State fundamental theorem of arithmetic

7 State Fermat's little theorem

8 Explain the iteration method

9 Find the quotient and the remainder when

a. 207 is divided by 15

b. -23 is divided by 5.

10 Verify that $(p-1)! \equiv -1 (\mathrm{mod}\ p)$ where $p=5$, without using Wilson's theorem.

Answer **Any FIVE** questions

Part-B (5 x10 =50 Marks)

11 a. Use Newton - Raphson method, find the real root of $x\log_{10} x = 1.2$ correct to 4 decimal places

OR

(p.t.o)

b. Solve the following system of equations by Gauss Elimination method

$x+y+z=9$
$2x-3y+4z=13$
$3x+4y+5z=40$

12 a. Apply Gauss Jordan method to find inverse of a matrix $\begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$

OR

b. Use Newton's Divided difference formula ,find u(3), given u(1)= -26,u(2)=12,u(4)=256 and u(6)=844

13 a. Use Newton's forward interpolation formula, find the value of $\text{Sin } 47°$ given that $\text{Sin } 45° = 0.7071$, $\text{Sin } 50° = 0.7660$, $\text{Sin } 55° = 0.8192$, and $\text{Sin } 60° = 0.8660$.

OR

b. Use Newton's Forward Interpolation Formula, find y at x=5.

x	4	6	8	10
y	1	3	8	10

14 a. Apply Lagrange's formula inversely, to obtain the root of the equation $f(x)=0$ given that $f(0)=-4$, $f(1)=1$, $f(3)=29$ and $f(4)=52$.

OR

b. Use (i) Trapezoidal rule (ii) Simpson's one third rule, evaluate $\int_0^1 xe^x dx$ from the following data.

x	0	0.25	0.5	0.75	1
$y=xe^x$	0	0.321	0.824	1.588	2.718

Compare your result with actual value.

15 a. Apply Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ rule by dividing interval into 6 equal parts, evaluate $\int_0^6 \frac{dx}{1+x^2}$

OR

b. Use Romberg's method, compute $I = \int_0^1 \frac{dx}{1+x^2}$ correct to 3 decimal places. Hence find the value of π.

16 a. Use inclusion-exclusion principle, find the number of positive integers ≤ 3000 and divisible by 3, 5 or 7

OR

b. Apply Base-b representation theorem, express 3014 in base eight and $3ABC_{sixteen}$ in base ten

17 a. Use Euclidean algorithm, find $gcd\,(2076,1776)$

OR

b. Use Chinese remainder theorem, solve $x \equiv 1(\bmod 3)$, $x \equiv 2(\bmod 5)$ and $x \equiv 3(\bmod 7)$

18 a. Apply Fermat's Little theorem, show that $2^{341} \equiv 2(\bmod 341)$.

OR

b. Use Euler's theorem, find the remainder when 199^{2020} is divided by 28

(p.t.o)
Sl.No.1289

Answer ALL questions
PART-C (2 x 15 = 30)

19 a. Analyze the Fermat's Little theorem is true even for a composite integer. Use Fermat's Little theorem, prove that $4^{13,332} \equiv 16(\text{mod}13,331)$.

OR

b. Analyze the problem and find the last nonzero digit (from the left) in the decimal value of $234!$.

20 a. Use Gauss - Jordan method, find the inverse of a matrix $\begin{pmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{pmatrix}$

OR

b. Use Gaussian two point and three point formulae to evaluate $I = \int_0^1 \frac{dt}{1+t}$.

Find a boundary for the error in three point formula and compare it with true error

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SL.NO: 1289

SL.NO:1242 **SUB CODE: 17MABS11**

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
COMMON TO MECHANICAL AND AUTO

NUMERICAL METHODS FOR MECHANICAL SCIENCES

(Candidates admitted under 2017 Regulations-SCBCS)

Time : Three Hours Maximum Marks:100 Marks

Answer **ALL** questions

Part-A (10 x 2 =20 Marks)

1 What is meant by diagonally dominant?

2 Write *Gauss elimination method* to solve $AX = B$.

3 When *Bessel's* formula is to be used?

4 Write the second order divided difference formula.

5 Write the basic principle for deriving *Simpson's* $\frac{1}{3}$ *Rule*.

6 What is the Truncation error in *Trapezoidal rule*?

7 Mention modified Euler algorithm to solve $\frac{dy}{dx} = f(x, y)$, $y(x_o) = y_o$ at $x = x_0 + h$

8 Write down Euler algorithm to the differential equation $\frac{dy}{dx} = f(x, y)$

9 Write *Bender-Schmidt scheme* to solve $\frac{\partial^2 u}{\partial x^2} = \frac{1}{\alpha^2}\frac{\partial u}{\partial t}$

10 What is point wise solution of a differential equation?

P.T.O

Answer **Any FIVE** questions

Part-B (5 x10 =50 Marks)

11 a.

Solve $e^x - 4x = 0$ by Newton's Method.

OR

b.

Find a real root of $x^3 - 9x + 1 = 0$ that lies between 2 and 3 by the Method of False position, correct to 3 decimal places.

12 a.

Solve the following system of equations by Gauss Jacobi method

$10x - 2y + z = 12$

$x + 9y - z = 10$

$2x - y + 11z = 20$

OR

b.

Using *Newton's Divided Difference Formula to f*ind the value of $\log_{10} 656$. Given

$\log_{10} 654 = 2.8156,\ \log_{10} 658 = 2.8182,\ \log_{10} 659 = 2.8189,$ and $\log_{10} 661 = 2.8202$.

13 a.

From the following table values of x and $f(x)$, determine y(42)

x	20	25	30	35	40	45
$f(x)$	354	332	291	260	231	204

OR

b.

Apply *Lagrange's* formula inversely, to obtain the root of the equation $f(x) = 0$ given that

$f(0) = -4,\ f(1) = 1,\ f(3) = 29$ and $f(4) = 52$.

P.T.O

SL.NO:1242

14 a. Identify first and second derivatives of the function y at the point $x = 1.2$ using the following data.

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

OR

b. Identify the first two derivatives of y at $x = 54$ from the following data.

x	50	51	52	53	54
y	3.6840	3.7084	3.7325	3.7563	3.7798

15 a. Use of *Romberg's method*, to compute $I = \int_0^1 \frac{dx}{1+x}$ correct to 4 decimal places. Hence find $\log_e 2$.

OR

b. Solve $\frac{dy}{dx} + y - x^2 = 0,\ y(0.2) = 0.8213$, Find $y(0.3)$ correct to four decimal places by using *Modified Euler's method.*

16 a. Use the Taylor series method, to find approximate values of y and z corresponding to $x = 0.1$, given that $y(0) = 2, z(0) = 1$ by solving $\frac{dy}{dx} = x + z$ and $\frac{dz}{dx} = x - y^2$.

OR

b. Apply the *Runge-Kutta method*, tabulate the solution of the system $\frac{dy}{dx} = x + z,\ \frac{dz}{dx} = x - y,$ $y(0) = 0,\ z(0) = 1,\ h = 0.1$. Find $y(0.1)$, $z(0.1)$

17 a. Solve the equation $y'' - xy = 0$ given $y(0) = -1,\ y(1) = 2$ by finite difference method taking n=2.

P.T.O

SL.NO:1242

4

OR

b.

Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, $0 \le x \le 1,\ t \ge 0$ with $u(x,0) = x(1-x),\ 0 < x < 1$ and $u(0,t) = 0 = u(1,t),\ \forall\, t > 0$ using explicit method with $\Delta x = 0.2$ for three steps.

18 a.

Solve numerically $u_{tt} = 4u_{xx}$ with boundary conditions $u(0,t) = 0 = u(4,t),\ u_t(x,0) = 0$ and $u(x,0) = x(4-x)$

OR

b.

Using the Simpson's rule, evaluate $\int_1^2 \int_1^2 \frac{1}{x+y}\,dx\,dy$ by dividing into two equal sub intervals.

Answer ALL questions
PART-C (2 x 15 = 30)

19 a.

Using *Gauss – Jordan* method to solve the following system.

$$x + 2y + z = 3$$
$$2x + 3y + 3z = 10$$
$$3x - y + 2z = 13$$

OR

b.

Given the data

x	0	1	2	3	4
y	2	3	12	35	78

Construct the cubic polynomial of x, using *Newton's Backward Interpolation formula*.

P.T.O

SL.NO:1242

5

20 a. Identify the first, second and third derivatives of $f(x)$ at $x = 1.5$ if

x	1.5	2.0	2.5	3.0	3.5	4.0
$f(x)$	3.375	7.000	13.625	24.000	38.875	59.000

OR

b. Using *Modified Euler method*, Find $y(0.1)$, $y(0.2)$, given $\frac{dy}{dx} = x^2 + y^2, y(0) = 1.$

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SL.NO:1242

SL.NO:1231 **SUBJECT CODE:17MABS04**

VINAYAKA MISSIONS RESEARCH FOUNDATION

(Deemed to be University)

B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022

MECHANICAL ENGINEERING

MATHEMATICS FOR MECHANICAL SCIENCES

Time : Three Hours Maximum Marks:100 Marks

Answer **ALL** questions

Part-A (10 x 2 =20 Marks)

1 Obtain the partial differential equation by eliminating arbitrary constants a and b from $(x-a)^2+(y-b)^2+z^2=1$.

2 Form the partial differential equation by eliminating arbitrary function f from $z=f\left(x^2+y^2\right)$.

3 What are Dirichlet's Conditions?

4 Find the value of a_n in the cosine series expansion of $f(x)=k$ in $(0,10)$.

5 What are the possible solutions of the one dimensional heat equation $u_t=\alpha^2 u_{xx}$.

6 In steady state conditions derive the solution of one dimensional heat flow equation.

7 If the probability that a target is destroyed on any one shot is 0.5, what is the probability that it would be destroyed on 6^{th} attempt?

8 For a certain type of computers, the length of time between charges of the battery is normally distributed with a mean of 50 hours and a standard deviation of 15 hours. John owns one of these computers and wants to know the probability that the length of time will be between 50 and 70 hours.

p.t.o

9 State the equation of the two regression lines.

10 Give the limitations of method of least squares.

Answer **Any FIVE** questions

Part-B (5 x10 =50 Marks)

11 a. Find the complete and singular solution of $z = px + qy + p^2 + q^2$

OR

b. Solve $z^2(p^2 + q^2 + 1) = 1$

12 a. Express $f(x) = (\pi - x)^2$ as a Fourier series of period 2π in the Interval $0 < x < 2\pi$

OR

b. Determine the Sine series for the function $f(x) = x$ in $(0, l)$

13 a. A string is stretched and fastened to two points at a distance 'l' apart. Motion is started by displacing the string into the form $y = k\sin\left(\frac{\pi x}{l}\right)$ from which it is released at time $t = 0$. Calculate the displacement of the point of the string at a distance 'x' from one end at time t.

OR

b. Determine the solution to the equation $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$ that satisfies the conditions $u(0,t) = 0,\ u(l,t) = 0$ and $u(x,0) = u_0$ for all x.

14 a. If 10% of the screws produced by an automatic machine are defective, Calculate the probability that out of 20 screws selected at random, there are

(i) exactly 2 defective

(ii) atmost 3 defective

(iii) atleast 2 defective

OR

b. Determine the mean and variance of geometric distribution.

15 a. The ranking of ten students in Statistics and Mathematics are as follows. Determine the coefficient of rank correlation?

Statistics	3	5	8	4	7	10	2	1	6	9
Mathematics	6	4	9	8	1	2	3	10	5	7

OR

b. Calculate Karl Pearson's coefficient of correlation

Price	10	11	13	15	18
Demand	60	52	48	40	30

16 a. (i) Solve $p+q=\sin x+\sin y$

(ii) Solve $p+q=x+y$

OR

b. Determine the Fourier series of period 2π, for the function $f(x)=x^2$ in $(-\pi,\pi)$.

17 a. A square plate is bounded by the lines $x=0$, $y=0, x=20$ and $y=20$. Its faces are insulated. The temperature along the upper horizontal edge is given by $u(x, 20) = x(20-x)$, $0 < x < 20$ while the other three edges are kept at 0° c. Determine the steady state temperature distribution in the plate.

OR

b. In a normal distribution, 31% of the items are under 45 and 8% are over 64. Calculate the mean and variance of the distribution.

18 a. Calculate the Mode for the following frequency distribution.

C.I	130-134	135-139	140-144	145-149	150-154	155-159	160-164
f	5	15	28	24	17	10	1

OR

b. Determine the regression line of Y on X if

X	1	4	2	3	5
Y	3	1	2	5	4

Answer ALL questions

PART-C (2 x 15 = 30)

19 a. (i) Solve $z = px + qy + \sqrt{pq}$

(ii) Solve $pyz + qzx = xy$

OR

b. Calculate the Fourier series expansion of period 2π for the function $y = f(x)$ which is defined in $(0, 2\pi)$ by means of the table of value given below. Find the series up to the third harmonic.

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

20 a. A rod 30 cm long has its ends A and B kept at 20^0 C and 80^0 C respectively until steady state conditions prevail. The temperature at each end is then suddenly reduced to $0^\circ C$ and kept so. Calculate the resulting temperature $u(x,t)$ in the rod.

OR

b. In a partially destroyed laboratory record of an analysis of correlation data, the following results only are legible. Variance of $X = 9$,Regression equations are $8X - 10Y + 66 = 0$, $40X - 18Y - 214 = 0$
Determine,

(a) the mean values of X and Y
(b) the correlation coefficient between X and Y
(c) the standard deviation of Y

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SL.NO:1231

SL.NO:1165 **SUBJECT CODE:17MABS01**

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
HUMANITIES & SCIENCES

ENGINEERING MATHEMATICS

Time : Three Hours Maximum Marks:100 Marks

Answer **ALL** questions

Part-A (10 x 2 =20 Marks)

1 Obtain the characteristic equation of $\begin{pmatrix} 2 & -3 & 1 \\ 3 & 1 & 3 \\ -5 & 2 & -4 \end{pmatrix}$

2 Define orthogonal matrices.

3 Define evolute.

4 Find the centre of curvature of the curve $y = x^2$ at the origin.

5 If $u = x^2 y^3$ where $x = \log t$ and $y = e^t$ Find $\frac{du}{dt}$

6 Examine the maximum and minimum values of $3x^2 - y^2 + x^3$

7 Integrate $\int_0^1 \int_1^2 x(x+y)dydx.$

8 Integrate $\int_0^{\pi/2} \int_0^{\pi/2} \sin(\theta+\phi)d\theta d\phi$

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

10 State Stoke's theorem

(p.t.o)

Answer **Any FIVE** questions

Part-B (5 x10 =50 Marks)

11 a. Find the Eigen values and Eigenvectors of the matrix $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{pmatrix}$.

OR

b. Obtain the Eigen values and Eigenvector of the matrix $\begin{pmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{pmatrix}$

12 a. Obtain the equation to the circle of curvature of the curve $xy = c^2$ at (c, c).

OR

b. Prove that the radius of curvature at any point of the cycloid $x = a(\theta + \sin\theta); y = a(1 - \cos\theta)$ is $4a\cos\frac{\theta}{2}$

13 a. Find the maximum and minimum values of the function $x^3y^2(1-x-y)$

OR

b. (i) If $u = \sin^{-1}\frac{x}{y} + \tan^{-1}\frac{x}{y}$, then find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$

(ii) Find $\frac{du}{dt}$ as a total derivative and verify the result by the direct substitution of $u = x^2 + y^2 + z^2$ when $x = e^{2t}, y = e^{2t}\cos 3t$, and $z = e^{2t}\sin 3t$

14 a. Integrate $\int_0^a \int_0^{\sqrt{a^2-x^2}} \int_0^{\sqrt{a^2-x^2-y^2}} \frac{dz\,dy\,dx}{\sqrt{a^2-x^2-y^2-z^2}}$

OR

(p.t.o)

b. Obtain the area enclosed by the parabola $y^2 = 4ax$, $x-$axis and the latus rectum of the parabola.

15 a. If $\overline{F} = x^2\vec{i} + xy\vec{j}$ evaluate $\int \vec{F}.d\vec{r}$ from (0, 0) to (1, 1) along the line y=x

OR

b. Obtain the values of a and b so that the surfaces $ax^3 - by^2z = (a+3)x^2$ and $4x^2y - z^3 = 11$ may cut orthogonally at $(2,-1,-3)$

16 a. Find the volume bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$.

OR

b. For the given curve $x = a\cos\theta, y = b\sin\theta$ Find ρ at $\left(\frac{a}{\sqrt{2}}, \frac{b}{\sqrt{2}}\right)$

17 a. Obtain the equation to the circle of curvature of the curve $xy = c^2$ at (c, c).

OR

b. Prove that the radius of curvature at any point of the cycloid $x = a(\theta + \sin\theta); y = a(1-\cos\theta)$ is $4a\cos\frac{\theta}{2}$

18 a. Prove that $\nabla^2(r^n) = n(n+1)r^{n-2}$ $where$ $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ and $r = |\vec{r}|$

OR

b. For the curve $x^3 + y^3 = 2$ find the co-ordinates of the centre of curvature at the point (1, 1)

Answer ALL questions

PART-C (2 x 15 = 30)

19 a. Diagonalise the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ and hence find A^5

OR

b. Obtain the equation of the evolute of the curve $x^{2/3} + y^{2/3} = a^{2/3}$

20 a. Determine the value of $\int_0^1 \int_0^{x^2} (x^2 + y^2)\, dydx$

OR

b. Change the order of integration in $\int_0^a \int_y^a \frac{x^2}{\sqrt{x^2 + y^2}} dxdy$ and then evaluate it.

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SL.NO:1165

SL.NO:1108 **SUBJECT CODE:17MABS16**

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
MECHANICAL ENGINEERING

NUMERICAL METHODS

Time : Three Hours Maximum Marks:100 Marks

Answer **ALL** questions

Part-A (10 x 2 =20 Marks)

1 Define transcendental equation

2 When *Gauss-Elimination method* may fail?

3 When *Bessel's* formula is to be used?

4 State *Inverse Lagrange's* Interpolation Formula.

5 Explain Numerical Differentiation.

6 How will you improve the accuracy in the *Trapezoidal Rule*?

7 How many prior values are required to predict the next value in Adam's method?

8 Write the third order *Runge-Kutta method* algorithm to find the numerical solution of the first order differential equation.

9 What is different methods for solving Boundary Value Problem.

10 Solve $xy'' + y = 0,\ y(1) = 1,\ y(2) = 2$ with $h = 0.5$

Answer **Any FIVE** questions

Part-B (5 x10 =50 Marks)

11 a. Evaluate $\sqrt{12}$ to four decimal places by *Newton - Raphson* method

OR

b. Solve the following system of equations by Gauss Seidel method

$$\begin{aligned} 8x + y + z &= 8 \\ 2x + 4y + z &= 4 \\ x + 3y + 5z &= 5 \end{aligned}$$

(p.t.o)

12 a. Using *Newton's Divided Difference Formula to f*ind the value of $\log_{10} 656$. Given $\log_{10} 654 = 2.8156,\ \log_{10} 658 = 2.8182,\ \log_{10} 659 = 2.8189,$ and $\log_{10} 661 = 2.8202$.

OR

b. Using Newton's Forward Interpolation Formula, evaluate y at x=5.

x	4	6	8	10
y	1	3	8	10

13 a. Solve $\int_0^6 \frac{dx}{1+x^2}$ by using *Simpson's* $\frac{1}{3}$ and $\frac{3}{8}$ rule by dividing interval into 6 equal parts.

OR

b. Using Gaussian three-point formula , evaluate $\int_1^5 \frac{dx}{x}$

14 a. Apply the *Runge-Kutta method* of fourth order, to find $y(0.2)$, given $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$, $h = 0.2$.

OR

b. Apply the *Runge-Kutta method* of fourth order, to find $y(0.1)$, $y(0.2)$, given $\frac{dy}{dx} = \frac{1}{2}(1+x)y^2,\ y(0) = 1.$

15 a. Solve the equation $y'' - xy = 0$ given $y(0) = -1,\ y(1) = 2$ by finite difference method taking n=2.

OR

b. Solve by finite difference method, the boundary value problem $\frac{d^2y}{dx^2} - y = 0$ with $y(0) = 0$ and $y(2) = 4$ choosing $\Delta x = 0.5$

16 a. Using the Simpson's rule, evaluate $\int_1^2 \int_1^2 \frac{1}{x+y} dxdy$ by dividing into two equal sub intervals.

OR

b. Use of *Romberg's method*, to compute $I = \int_0^1 \frac{dx}{1+x}$ correct to 4 decimal places. Hence find $\log_e 2$.

(p.t.o)

Sl.No.1108

17 a. Find the inverse of a matrix $\begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$ by *Gauss Jordan* method

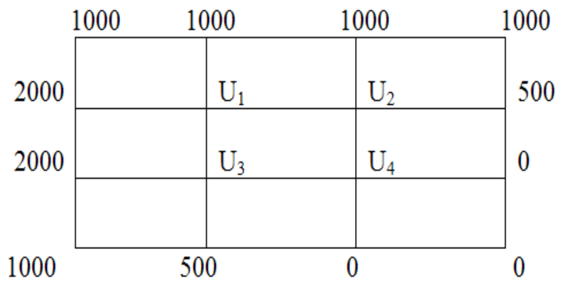
OR

b. Solve $\frac{dy}{dx} = x + y$, given $y(1) = 0$, Find $y(1.1)$ and $y(1.2)$ by *Taylors series method*

18 a. Solve $\frac{dy}{dx} = \frac{1}{2}(x + y)$, given $y(0) = 2$, $y(0.5) = 2.636$, $y(1) = 3.595$ and $y(1.5) = 4.968$ by using Milne's method find to $y(2)$

OR

b. Solve the Laplace equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown.



Answer ALL questions

PART-C (2 x 15 = 30)

19 a. Using *Gauss – Jordan* method to solve the following system.

$$x + 2y + z = 3$$
$$2x + 3y + 3z = 10$$
$$3x - y + 2z = 13$$

OR

b. Using the *Bessel's formula*, to obtain the value of $y(5)$, given

x	0	4	8	12
$f(x)$	143	158	177	199

20 a. Using *Modified Euler method*, Find $y(0.1)$, $y(0.2)$, given $\frac{dy}{dx} = x^2 + y^2, y(0) = 1$.

OR

b. Solve $y'' - y = x$, $x \in (0,1)$ given y (0) =y (1) =0, using finite differences dividing the interval into 4 equal parts.

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SL.NO:1108

SL.NO:1099 **SUBJECT CODE:17MABS08**

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
CIVIL ENGINEERING

MATHEMATICS FOR CIVIL ENGINEERS

Time : Three Hours Maximum Marks:100 Marks

Answer **ALL** questions

Part-A (10 x 2 =20 Marks)

1 Find the complementary function of $(D^2-3D+5)y = 5\sin 5x$

2 Solve $\left(x^2D^2-2\right)y=0$

3 Prove that $L[\cosh at]=\frac{s}{s^2-a^2}$

4 Find $L\left[e^{2t}+7e^{-7t}\right]$

5 Find $L^{-1}\left[\frac{s}{(s+2)^2+1}\right]$

6 Define convolution theorem

7 Find the Fourier Sine transform of $e^{-ax}, a>0$

8 Prove that $F_c[f(ax)]=\frac{1}{a}F_c\left(\frac{s}{a}\right)$

9 Find $Z\left[\frac{a^n}{n!}\right]$

p.t.o

10 State Initial and Final value theorems of Z transform

Answer **Any FIVE** questions

Part-B (5 x10 =50 Marks)

11 a. Solve $(D^3+3D^2+3D+1)y=5+\cos 2x$

OR

b. Solve $(D^2+4)y=x^4+\cos^2 x^2 x$

12 a. Solve the simultaneous equations $\frac{dx}{dt}+y=e^t$, $x-\frac{dy}{dt}=t$

OR

b. (i) Prove that $L[\sinh at]=\frac{a}{s^2-a^2}$

(ii) Find $L[\sin 3t\cos t]$

13 a. (i)Find $L(t\cos^3 t)$

(ii) Find the Laplace transform of $\frac{\sin at}{t}$

OR

b. (i) Find $L[t^2e^{3t}\sinh t]$

(ii) Find $L\left[\frac{1-\cos t}{t}\right]$

14 a. Find $L^{-1}\left[\frac{1-s}{(s+1)(s^2+4s+13)}\right]$ by using method of partial fractions

OR

b. Solve $(D^2+D)y=t^2+2t$ Where $y(0)=4$, $y'(0)=-2$ using Laplace transform

p.t.o

15 a. Solve $y'' + y = 2e^t$ Where $y(0) = 1,\ y'(0) = 2$ using Laplace transform.

OR

b. Find the Fourier Transform of f(x) given by

$f(x)=\begin{cases}1, & |x|<a \\ 0, & |x|>a>0\end{cases}$ and hence evaluate the integral $\int_0^\infty \frac{\sin x}{x}dx$

16 a. Find the Fourier cosine transform of e^{-x^2}

OR

b. Find the Fourier Sine transform of $e^{-2x}, x>0$. Hence evaluate $\int_0^\infty \frac{x^2}{(x^2+4)^2}dx$

17 a. (i) Find (i) $Z[n^2]$ & $Z[e^{-t}\sin 2t]$

(ii) Find $Z^{-1}\left[\frac{z^3}{(z-1)^2(z-2)}\right]$

OR

b. Find $Z^{-1}\left[\frac{z^2}{z^2+4}\right]$ using Residue theorem

18 a. Find $Z^{-1}\left[\frac{3z^2-18z+26}{(z-2)(z-3)(z-4)}\right]$ by the method of partial fraction.

OR

b. Use Power series technique, find the inverse Z-transform of

$F(z) = \frac{z}{2z^2-3z+1}, |z|>1.$

Answer ALL questions

PART-C (2 x 15 = 30)

19 a.

(i) Solve $\frac{d^2y}{dx^2}+4\frac{dy}{dx}+4y=e^{-x}\sin 2x$

(ii) Solve $(D^3-3D^2+3D-1)y=x^2e^x$

OR

b.

(i) Find $L\left[\frac{1-e^t}{t}\right]$

(ii)) Find $L\left[\frac{\sin 3t\cos t}{t}\right]$

20 a.

Solve the following initial value problem using Laplace transform

$$\frac{d^2y}{dt^2}+6\frac{dy}{dt}+9y=2e^{-3t},\ y(0)=1,\ y'(0)=-2$$

OR

b.

Find $Z^{-1}\left[\frac{8z^2}{(2z-1)(4z+1)}\right]$ using convolution theorem

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SL.NO:1099

SL.NO:1098 **SUBJECT CODE:17MABS03**

VINAYAKA MISSIONS RESEARCH FOUNDATION
(Deemed to be University)
B.E./ B.TECH DEGREE EXAMINATIONS- FEB -2022
COMMON TO PHARMA & BIOTECH

MATHEMATICS FOR BIO-ENGINEERING

Time : Three Hours Maximum Marks:100 Marks

Answer **ALL** questions

Part-A (10 x 2 =20 Marks)

1 Differentiate $\left(x^2-4\right)\left(2x^2-7\right)$ with respect to x.

2 If $z=x^3+y^3-3axy$,Find the second order partial derivatives of z

3 Integrate $\int \cos 4x \cos x \, dx$

4 Integrate $\int\left(\frac{\cos 2x}{\cos^2 x \sin^2 x}\right)dx$

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

6 Solve $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+13y=0$

7 Determine mode for the following 0 , 2 , 5 , 6 , 9 , 5 , 6 , 14 , 7 , 15 , 5 , 6 , 5

8 Define Skewness.

p.t.o

9 Write the differences between correlation and regression

10 If $r_{12} = 0.5,\ r_{13} = 0.3,\ r_{23} = 0.45$ find $R_{3.12}$

Answer **Any FIVE** questions

Part-B (5 x10 =50 Marks)

11 a.

(i)If $y = e^{ax} \sin bx$ prove that $\frac{d^2y}{dx^2} - 2a\frac{dy}{dx} + (a^2 + b^2)y = 0$

(ii)If $y = x^{\tan x} + \sin x^{\cos x}, Find\ \frac{dy}{dx}$

OR

b. One end of a ladder 17 feet along is leaning against a wall. If the foot of the ladder be pulled away from the wall at the rate of 3ft/min. Show how fast is the top of the ladder descending when the foot is 8 ft from the wall?

12 a.

(i) Integrate $\int x^2 e^{2x} dx$

(ii) Integrate $x \log(1+x)$ with respect to 'x'

OR

b. Integrate $\int (4x+11)\sqrt{x^2+4x+5}dx$

13 a.

Integrate $\int (\log x)^2 dx$

OR

b. Solve $\cos(x+y)\,dy = dx$ by variable separable method

14 a. Solve $(D^2 + 2D + 1)y = \sin 2x \cos x$

OR

b. (i) Form the differential equation from $y = a\cos(\log x) + b\sin(\log x)$

(ii)Form the differential equation of all circles touching the axis of y at the origin and having centres on the x-axis.

15 a. Solve $xdy - ydx = \sqrt{x^2 + y^2}\,dx$

OR

b. For the following data, Find the missing frequencies if N=100 and Median = 90

Interval	0-20	20-40	40-60	60-80	80-100	100-120	120-140	140-160	160-180
Frequency	6	9	?	14	20	15	?	8	7

16 a. Calculate coefficient of skewness by Karl Pearson's method

Profit	10-20	20-30	30-40	40-50	50-60
No. of components	18	20	30	22	10

OR

b. The first four moments of a distribution about the value 4 of the variables are -1.5, 17, -30 and 108. Find the moments about mean, β_1 and β_2 . Also find the mean.

17 a. Calculate the mean and standard deviation for the following frequency distribution.

x	6	7	8	9	10	11	12
f	3	6	9	13	8	5	4

OR

p.t.o

b.

Obtain the multiple linear regression equation of X_1 and X_2 and X_3 from the following data relating to three variables given below.

X_1	4	6	7	9	13	15
X_2	15	12	8	6	4	3
X_3	30	24	20	14	10	4

18 a.

The ranking of 10 students in two subjects A and B are as follows.

A	3	5	8	4	7	10	2	1	6	9
B	6	4	9	8	1	2	3	10	5	7

Find the rank correlation.

OR

b.

(i) If $r_{12} = 0.60,\ r_{13} = 0.70,\ r_{23} = 0.65$ *and* $S_1 = 1.0$, *find* $S_{1.23}, R_{1.23}$ *and* $r_{12.3}$

(ii) If $r_{12} = 0.80,\ r_{13} = -0.56,\ r_{23} = 0.40$ *then obtain* $R_{1.23}$ *and* $r_{12.3}$

Answer ALL questions

PART-C (2 x 15 = 30)

19 a. Examine for maxima and minima of the function $f(x,y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2$

OR

b. Integrate $\int \frac{x^2+1}{(x^2-1)(2x-1)} dx$

20 a. Solve : $(D^2 - 7D + 12)y = e^{5x} + \cos 2x$

OR

5

b.

Ten competitors in a beauty contest are ranked by three judges in the following order.

Judge I	1	6	5	10	3	2	4	9	7	8
Judge II	3	5	8	4	7	10	2	1	6	9
Judge III	6	4	9	8	1	2	3	10	5	7

Use rank correlation coefficient to discuss which pair of judges has the nearest approach to common tastes in beauty.

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SL.NO:1098