"Education for Knowledge, Science, and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur

(Empowered Autonomous)

DEPARTMENT OF MATHEMATICS

Date : 17/ 09/2024

B. Sc. I Sem. I
Internal Examination 2024-25

All the students of B.Sc. I are hereby informed that their Internal Examination of Mathematics will be conducted from **27th September, 2024 to 28th September, 2024 in Room No. 41.** The examination will be conducted only one time, students are directed to attend the examination without fail. Syllabus and schedule for examination will be as mentioned in following table.

Sr. No.	Date	Name of Paper	Units
1	27th September, 2024 Time: 2.30 pm to 3.30 pm	Basic Algebra (DSC03MAT11)	Unit I:- Algebra Of Complex Numbers Unit II:- Matrices (Except system of equations)
2	28th September, 2024 Time: 2.30 pm to 3.30 pm	Calculus (DSC03MAT12)	Unit I:- Differentiation (Upto Leibnitz's theorem and it's examples) Unit II:- Mean Value Theorems and Indeterminate forms (Indeterminate forms)

Nature of question paper

Time:-1 Hours **Total Marks:20**

Q.1) Select the correct alternative. **[04]**

i)

ii)

iii)

iv)

Q.2) Attempt any One. **[08]**

i)

ii)

Q.3) Attempt any Two. **[08]**

i)

ii)

iii)

(Prof. S. P. Thorat)
HEAD
DEPARTMENT OF MATHEMATICS
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

B.Sc. Part- I (Mathematics) (Sem-I) Internal Examination: September 2024

Subject : Basic Algebra (DSC03MAT11) **Day and Date : Friday, 27th September 2024**

Marks : 20 **Time : 02:30 PM -03:30 PM**

Q.1. Select the correct alternative of the following. [04]

1. A square matrix A = $[a_{ij}]$ in which _____, is called upper triangular matrix.

   A) $a_{ij} = 0$ for $i > j$ B) $a_{ij} = 0$ for j> i C) $a_{ij} = 0$ for $i = j$ D) $a_{ij} = 0$ for $i \neq j$

2. If $a_1, a_2, a_3 \ldots a_n$ are eigen values of A then the eigenvalues of kA^{-1} are ____.

   A) $a_1, a_2, a_3 \ldots a_n$ B) 0,0,…0 C) $ka_1, ka_2, ka_3 \ldots ka_n$ D) $\frac{1}{ka_1}, \frac{1}{ka_2}, \frac{1}{ka_3} \ldots \frac{1}{ka_n}$

3. For any two complex numbers z_1 *and* z_2, the value of $\text{Arg}(\frac{z_1}{z_2})$ = ____.

   A) $Arg\ z_1 + Arg\ z_2$ B) $Arg\ z_1 - Arg\ z_2$ C) $Arg\ z_1 * Arg\ z_2$ D) $\frac{Arg\ z_1}{Arg\ z_2}$

4. $\frac{(\cos\theta + i\sin\theta)^9}{(\cos\theta + i\sin\theta)^{15}}$ = ____.

   A) $(\cos 6\theta + i\sin 6\theta)$ B) $(\cos 5\theta + i\sin 5\theta)$ C) $(\cos 5\theta - i\sin 5\theta)$ D) $(\cos 6\theta - i\sin 6\theta)$

Q.2. Attempt any one of the following. [08]

1. State and prove De Moivre's Theorem.

2. Find all the eigenvalues and eigenvectors of the following matrix.

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

Q.3. Attempt any two of the following. [08]

1. Find all values of $(\sqrt{3} + i)^{\frac{1}{5}}$.

2. If A is any square matrix then prove that

   i) A + A' is a symmetric matrix.

   ii) A – A' is a skew- symmetric matrix.

   iii) A can be uniquely expressed as sum of symmetric and skew-symmetric matrix.

3. If w is primitive 5th root of unity, then show that $(1 - w)(1 - w^2)(1 - w^3)(1 - w^4) = 5$.

Vivekanand college (Empowered Autonomous) Kolhapur

Department of Mathematics

B.Sc. I (Sem I) Internal Examination :2024-2025

Subject code: Calculus (DSC03MAT12) **Day and Date: Saturday,28th September2024**

Total marks: 20 **Time: 2.30pm -3.30pm**

Q1. Select the correct alternative. (04)

(1) Evaluate. $\lim_{x\to 0}\frac{a^x-1}{x}$

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

(2) Evaluate $\lim_{x\to 0}\frac{\sin x}{x}$

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

(3) If y $=(ax+b)^m$ *then* $y_n = 0$ if

(a) $m = n$ (b) $m < n$ (c) $m > n$ (d) $m \neq n$

(4) If y $=e^{2x}$ *then* y_n if

(a) $2^n e^{2x}$ (b) $2^n e^x$ (c) $2\,e^{2x}$ (d) $n^2 e^x$

Q2. Attempt any one. (08)

(1) State and prove Leibnitz's Theorem.

(2) Find a, b such that $\lim_{x\to 0}\frac{a\sin 2x - b\tan x}{x^3} = 1$.

Q3. Attempt any two. (08)

(1) State and prove L-Hospital Rule.

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

(3) If y $=\frac{x}{1+3x+2x^2}$ then find y_n.

****

Vivekanand college (Empowered Autonomous) Kolhapur

Department of Mathematics

B.Sc. I (Sem I) Internal Examination :2024-2025

Subject code: Calculus (DSC03MAT12) **Day and Date: Saturday,28th September2024**

Total marks: 20 **Time: 2.30pm -3.30pm**

Q1. Select the correct alternative. (04)

(1) Evaluate. $\lim_{x\to 0}\frac{a^x-1}{x}$

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

(2) Evaluate $\lim_{x\to 0}\frac{\sin x}{x}$

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

(3) If y $=(ax+b)^m$ *then* $y_n = 0$ if

(a) $m = n$ (b) $m < n$ (c) $m > n$ (d) $m \neq n$

(4) If y $=e^{2x}$ *then* y_n if

(a) $2^n e^{2x}$ (b) $2^n e^x$ (c) $2\,e^{2x}$ (d) $n^2 e^x$

Q2. Attempt any one. (08)

(1) State and prove Leibnitz's Theorem.

(2) Find a, b such that $\lim_{x\to 0}\frac{a\sin 2x - b\tan x}{x^3} = 1$.

Q3. Attempt any two. (08)

(1) State and prove L-Hospital Rule.

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

(3) If y $=\frac{x}{1+3x+2x^2}$ then find y_n.

"Education for Knowledge, Science, and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur

(Empowered Autonomous)

DEPARTMENT OF MATHEMATICS

Date : 17/09/2024

B. Sc. II Sem. III
Internal Examination 2024-25

All the students of B.Sc. II **(Major)** are hereby informed that their Internal Examination of Mathematics will be conducted from **23rd September, 2024 to 24th September, 2024 in Room No. 513.** The examination will be conducted only one time, students are directed to attend the examination without fail. Syllabus and schedule for examination will be as mentioned in following table.

Sr. No.	Date	Name of Paper	Units
1	23rd September, 2024 Time: 11.30 am to 12.30 pm	Multivariable Calculus (DSC03MAT31)	Unit I :- Jacobian Unit III:- Vector Differential Calculus
2	24th September, 2024 Time: 11.30 am to 12.30 pm	Integral Calculus (DSC03MAT32)	Unit I :- Beta and Gamma Functions Unit II :- Differentiation under Integral Sign and error function

Nature of question paper

Time:-1 Hours **Total Marks:20**

Q.1) Select the correct alternative. **[04]**

i)

ii)

iii)

iv)

Q.2) Attempt any One. **[08]**

i)

ii)

Q.3) Attempt any Two. **[08]**

i)

ii)

iii)

(Prof. S. P. Thorat)

HEAD
DEPARTMENT OF MATHEMATICS
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

"Education for Knowledge, Science, and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur

(Empowered Autonomous)

DEPARTMENT OF MATHEMATICS

Date : 17/ 09/2024

B. Sc. II Sem. III
Internal Examination 2024-25

All the students of B.Sc. II **(Minor)** are hereby informed that their Internal Examination of Mathematics will be conducted from **23rd September, 2024 to 24th September 2024 in Room No. 513.** The examination will be conducted only one time, students are directed to attend the examination without fail. Syllabus and schedule for examination will be as mentioned in following table.

Sr. No.	Date	Name of Paper	Units
1	23rd September, 2024 Time: 2.30 pm to 3.30 pm	Calculus of Multiple Variables (MIN03MAT31)	Unit I :- Jacobian Unit III:- Vector Differential Calculus
2	24th September, 2024 Time: 2.30 pm to 3.30 pm	Calculus of Integrable functions (MIN03MAT32)	Unit I :- Beta and Gamma Functions Unit III:- Multiple Integral

Nature of question paper

Time:-1 Hours **Total Marks:20**

Q.1) Select the correct alternative. **[04]**

i)

ii)

iii)

iv)

Q.2) Attempt any One. **[08]**

i)

ii)

Q.3) Attempt any Two. **[08]**

i)

ii)

iii)

(Prof. S. P. Thorat)
HEAD
DEPARTMENT OF MATHEMATICS
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

Vivekanand College, Kolhapur (Empowered Autonomous)
B.Sc. II (Sem-III) (Major) Internal Examination 2024-25
Multivariable Calculus
(Course Code: DSC03MAT31)

Date: 23/09/2024 **Time: 1 Hr.** **Total Marks: 20**

Q. 1 Select the correct alternative. **[04]**

i) If $x = rcos\theta, y = rsin\theta$ then $\frac{\partial(x,y)}{\partial(r,\theta)}\frac{\partial(r,\theta)}{\partial(x,y)} =$ ___ .

A) r^2 B) r C) 1 D) 0

ii) If u = $sin\theta cos\varphi$ and v = $sin\theta sin\varphi$ then $\frac{\partial(x,y)}{\partial(\theta,\varphi)} =$____.

A)$sin\theta$ B)$cos\varphi$ C) $sin\theta cos\theta$ D) $sin\varphi cos\varphi$

iii) If $\bar{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$ then $grad(r) =$...

A) $\frac{\bar{r}}{r}$ B) $\frac{r}{\bar{r}}$ C) r D) $\bar{r}$

iv) If $\bar{f}$ is a constant vector, then....

A) $div\bar{f} = 0$ *and* $curl\bar{f} \neq 0$ B) $div\bar{f} \neq 0$ *and* $curl\bar{f} \neq 0$

C) $div\bar{f} = 0$ *and* $curl\bar{f} = 0$ D) $div\bar{f} \neq 0$ *and* $curl\bar{f} = 0$

Q.2 Attempt any One. **[08]**

i) If p, q are functions of u, v and u, v are functions of x, y then show that $\frac{\partial(p,q)}{\partial(x,y)} = \frac{\partial(p,q)}{\partial(u,v)}\frac{\partial(u,v)}{\partial(x,y)}$.

ii) a) Find the directional derivative of $x^2 + y^2 + z^2$ at $(1, 2, 3)$ in the direction of $3\hat{\jmath} + 4\hat{k}$.

b) Find i) $\nabla^2 \log(x^2 + y^2)$

Q.3 Attempt any Two. **[08]**

i) If $u = 3x + 2y - z, v = x - 2y + z, w = x + 2y - z$ then find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$.

ii) If $\bar{r}$ is position vector of point (x, y, z) and r is $|\bar{r}|$ then, prove that $div(r^n \cdot \bar{r}) = (n + 3)r^n$

iii) If $v = 2x^2\hat{\imath} - 3yz\hat{\jmath} + xz^2\hat{k}$ and $\emptyset = 2z - x^3y$ find $v \cdot \nabla\emptyset$ at $(1, -1, 1)$

****

Vivekanand college (Empowered Autonomous) Kolhapur

Integral Calculus

B.Sc. II (Sem III) Internal Examination :2024-2025

Subject code: DSC03MAT32 Day and Date: Saturday,24th september2024

Total marks: 20 Time: 2.30pm -3.30pm

Q1. Select the correct alternative. (4)

(1) value of erf(∞) = ___.

(a) 0 (b) 1 (c) 2 (d) ∞

(2) If $f(a) = \int_0^1 \sin\frac{ax}{x}\,dx$ then $f'(a) =$ ___.

(a) $\sin a$ (b) $\cos a$ (c) $\frac{\cos a}{a}$ (d) $\frac{\sin a}{a}$

(3) Γ5=___.

(a) 5! (b) 6! (c)1 (d) 24

(4) Γ(n + 1) =___.

(a) $n\Gamma n$ (b) $n!$ (c)(n+1)! (d) both (a) and (b)

Q2. Attempt any one. (8)

(1) Prove that $\int_0^1 x^m(\log x)^n\,dx = \frac{(-1)^n}{(m+1)^{n+1}}\Gamma(n+1)$ .hence solve $\int_0^1 (x\log x)^4\,dx$

(2) Prove that $\int_0^\infty \frac{\tan^{-1}ax}{x(1+x^2)}\,dx = \frac{\pi}{2}\log(1+a)$.

Q3. Attempt any two. (8)

(1) Evaluate $\int_0^\infty e^{-x^4}\,dx$

(2) Compute erf(0.3) correct to three decimal places.

(3) Evaluate $\int_0^\infty \frac{x^5}{5^x}\,dx$

Vivekanand College, Kolhapur (Empowered Autonomous)
B.Sc. II (Sem-III) (Minor) Internal Examination 2024-25
Calculus Of Multiple Variables
(Course Code: MIN03MAT31)

Date: 23/09/2024 Time: 1 Hr. Total Marks: 20

Q. 1 Select the correct alternative. [04]

i) If $x = r\sin\theta, y = r\cos\theta$ then $\frac{\partial(x,y)}{\partial(r,\theta)}\frac{\partial(r,\theta)}{\partial(x,y)} = \ldots$

A) r B) r^2 C) 0 D) 1

ii) If $u = x^2 - y^2, v = xy$ then , $\frac{\partial(u,v)}{\partial(x,y)} = \cdots$

A) $x^2 - y^2$ B) $x^2 + y^2$ C)2 $(x^2 + y^2)$ D) 1

iii) If $\emptyset = e^{r^2}$ then, $\nabla\emptyset = \ldots$

A) $2e^r \cdot \bar{r}$ B) $e^r \cdot \frac{\bar{r}}{r}$ C) $2e^r \cdot \frac{\bar{r}}{r}$ D) $2e^{r^2} \cdot \bar{r}$

iv) $curl\ (grad\ \emptyset) = \ldots$

A) 0 B) $\bar{r}$ C) r D) 1

Q.2 Attempt any One. [08]

i) If p, q are functions of u, v and u, v are functions of x, y then show that $\frac{\partial(p,q)}{\partial(x,y)} = \frac{\partial(p,q)}{\partial(u,v)}\frac{\partial(u,v)}{\partial(x,y)}$.

ii) a) Find the directional derivative of $\emptyset(x,y,z) = xy + 4z + 2x$ in the direction of $\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$ at $(1,2,0)$

b) If $\bar{a}$ is constant vector then prove that $curl\ (\bar{r} \times \bar{a}) = -2\bar{a}$

Q.3 Attempt any Two. [08]

i) If $x = u - v + w,\ y = u^2 - v^2 - w^2,\ z = u^3 + v$ then find $\frac{\partial(x,y,z)}{\partial(u,v,w)}$.

ii) If $\bar{f} = (x + y + 1)\hat{\imath} + \hat{\jmath} + (-x - y)\hat{k}$ then prove that $\bar{f} \cdot curl\ \bar{f} = 0$.

iii) If $\bar{f} = x^2y\hat{\imath} + y^2z\hat{\jmath} + z^2x\hat{k}$ then find div $(\bar{f})$ at point (1, -1 ,1)

Vivekanand college (Empowered Autonomous) Kolhapur

Calculus of Integrable Functions

B.Sc. II (Sem III) Internal Examination :2024-2025

Subject code: MIN03MAT32 **Day and Date: Tuesday,24th september2024**

Total marks: 20 **Time: 2.00pm -1.00pm**

Q1. Select the correct alternative. **(4)**

(1) Evaluate $\int_0^1 \int_0^x xy\, dx\, dy$

(a) $\frac{-1}{8}$ (b) $\frac{1}{7}$ (c) $\frac{1}{2}$ (d) $\frac{1}{8}$

(2) Evaluate $\int_0^1 \int_0^{x^2} e^{y/x}\, dy\, dx$

(a) $\frac{1}{2}$ (b) $\frac{-1}{2}$ (c) $\frac{4}{3}$ (d) $\frac{3}{4}$

(3) $\Gamma n =$

(a) n! (b) $(n-1)!$ (c)(n+1)! (d) n(n+1) !

(4) $\int_0^1 x^m (\log x)^n\, dx =$

(a) $\frac{(-1)^n}{(m+1)^{n+1}}\Gamma(n+1)$ (b) $\frac{(-1)^n}{(m+1)^{n+1}}\Gamma n$ (c) $\frac{(-1)^n}{(m+1)^n}\Gamma(n+1)$ (d) $\frac{(-1)^{n+1}}{(m+1)^{n+1}}\Gamma(n+1)$

Q2. Attempt any one **(8)**

(1) *Change of order of integration and Evaluate* $\int_0^1 \int_0^{\sqrt{1-x^2}} \frac{y\,dx\,dy}{(1+y^2)\sqrt{1-x^2-y^2}}$.

(2) Prove that $\int_0^\infty x^m e^{-ax^n}\, dx = \frac{1}{n}\frac{1}{a^{\frac{m+1}{n}}}\Gamma\frac{m+1}{n}$ hence solve $\int_0^\infty x^7 e^{-2x^2} dx$.

Q3. Attempt any two. **(8)**

(1) Evaluate $\int_0^1 x^3 \log\left[\frac{1}{x}\right]^4\, dx$.

(2) Evaluate $\int_0^\pi 2\, d\theta \int_0^{a(1+\cos\theta)} r\, dr \int_0^h \left(1-\frac{r}{\cos\theta}\right) dz$.

(3) show that $\int_0^1 dy \int_0^1 \frac{x-y}{(x+y)^3} dx \neq \int_0^1 dx \int_0^1 \frac{x-y}{(x+y)^3} dy$.

"Education for Knowledge, Science, and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe
Shri Swami Vivekanand Shikshan Sanstha's
Vivekanand College, Kolhapur
(Empowered Autonomous)
KOLHAPUR

DEPARTMENT OF MATHEMATICS

Date : 17/ 09/2024

B. Sc. III Sem. V
Internal Examination 2024-25

All the students of B.Sc. III are hereby informed that their Internal Examination of Mathematics will be conducted from **24th September, 2024 to 27th September, 2024.** The examination will be conducted only one time, students are directed to attend the examination without fail. Syllabus and schedule for examination will be as mentioned in following table.

Sr. No.	Name of Paper	Units
1	**Real Analysis (DSE-1003E1)** Date: 24th September, 2024 Time: 12.30 pm to 1.30 pm	Unit I :- Sequences Of Real Numbers Unit II :- Series Of real Numbers
2	**Modern Algebra (DSE-1003E2)** Date: 25th September, 2024 Time: 1.30 pm to 2.30 pm	Unit I :- Groups
3	**Partial Differential Equation (DSE-1003E3)** Date: 26th September, 2024 Time: 12.30 pm to 1.30 pm	Unit I :- Partial Differential Equations Unit II :- Non-Linear Partial Differential Equations
4	**Numerical Methods (DSE-1003E4)** Date: 27th September, 2024 Time: 11.30 pm to 12.30 pm	Unit I :- Numerical Interpolation (For unequal interval) Unit II :- Numerical Interpolation (For equal interval)

Nature Of Question Paper

Time:1 Hour **Marks: 30**

Q.1) Choose the correct alternative **[06]**

i)
ii)
iii)
iv)
v)
vi)

Q.2) Attempt any Two **[16]**

i)
ii)
iii)

Q.3) Attempt any Two **[08]**

i)
ii)
iii)

Thorat

(Prof. S. P. Thorat)

HEAD
DEPARTMENT OF MATHEMATICS
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

B.Sc. Part- III (Mathematics) (Sem-V) Internal Examination: September 2024

Subject : Real Analysis (DSE1003 E1) **Day and Date : Tuesday, 24th September 2024**

Marks : 30 **Time : 12:30 PM - 01:30 PM**

Q.1. Select the correct alternative of the following. **[06]**

1. The statement "A bounded sequence of real number has a convergent subsequence." is called ___.

   A) Monotone Convergence theorem B) Bolzano Weierstrass theorem

   C) Cauchy's theorem D) Density theorem

2. If $\{s_n\}_{n=1}^{\infty}$ is Cauchy sequence then $\{s_n\}_{n=1}^{\infty}$ is ____ sequence.

   A) Bounded B) Convergent C) Divergent D) Both A and B

3. The series $\sum_{n=1}^{\infty}\frac{1}{n}$ ___.

   A) Diverges B) Oscillates C) Converges D) Bounded

4. The series $\frac{1}{2}+\frac{1}{6}+\frac{1}{12}+\ldots+\frac{1}{n(n+1)}$ converge to____.

   A) 0 B) 1 C) -1 D) 2

5. The supremum and infimum value of set $\{(-1)^n : n \in N\}$ is.....respectively

   A) 0, 3/2 B) 0, 1 C) -1, 1 D) -1, 3/2

6. If $\sum_{n=1}^{\infty} a_n$ convergent series then $\lim_{n\to\infty} a_n =$ ___

   A) 0 B) 1 C) 2 D) 3

Q.2. Attempt any two of the following. **[16]**

1. For each $n \in \mathbb{N}$ let $I_n = [a_n, b_n]$ be a non-empty closed bounded interval of real numbers such that

   $I_1 \supset I_2 \supset I_3 \ldots \supset I_n \supset I_{n+1} \ldots$. And $\lim_{n\to\infty}(b_n - a_n) = 0$ then prove that, $\cap_{n=1}^{\infty} I_n$ contains precisely one point.

2. If $\{a_n\}_{n=1}^{\infty}$ is a sequence of positive numbers such that

   a) $a_1 \geq a_2 \geq a_3 \ldots \geq a_n \geq \cdots$ and

   b) $\lim_{n\to\infty} a_n = 0$

   Then prove that the alternating series $\sum_{n=1}^{\infty}(-1)^n a_n$ converges.

3. Prove that, A non-decreasing sequence which is bounded above is convergent.

Q.3. Attempt any two of the following. **[08]**

1. If $\{s_n\}_{n=1}^{\infty}$ is Cauchy sequence then prove that $\{s_n\}_{n=1}^{\infty}$ is bounded sequence.

2. Find for what values of x does the $\sum_{n=1}^{\infty}\frac{1}{n^x}$ converges.

3. Find $\lim_{n\to\infty}\frac{1}{n+1}+\frac{1}{n+2}+\frac{1}{n+3}\ldots+\frac{1}{n+n}$.

Vivekanand College, Kolhapur (Empowered Autonomous)
B.Sc. (Part-III) Semester-V Internal Examination, September 2024
MATHEMATICS
Modern Algebra

Subject Code: DSC-1003E2 **Time: 01:50-02:30PM**
Date: 25/09/2024 **Total Marks: 30**

Q. 1 Select the correct alternative for each of the following: **[06]**

i] If O(G)=150 and O(H)=25 then [G : H]=.....
a] 5 b] 6 c] 7 d] 8

ii] $< \mathbb{R}, \circ >$ where $\circ$ is usual multiplication is.....
a] Group b] Abelian group c] Not a group d] Quotient group of Z

iii] Identity permutation is ....
a] Always even b] Always odd c] Maybe even d] Maybe odd.

iv] With usual notation, In $\mathbb{Z}_7$, Order of 3 [O(3)] is ...
a] 4 b] 5 c] 7 d] 9

v] Number of Permutation defined on set S having 'n' elements is....
a] n b] n-1 c] $n!$ d] $(n-1)!$

vi] I) Cyclic group is always abelian. II) Abelian group is always cyclic. Then
a] Only II is true. b] Both I and II are true c] Both I and II are false d] I is true and II is false

Q.2. Attempt any Two of the following: **[16]**

i] Define generator of a cyclic group. Prove that order of cyclic group is equal to order of it's generator.
ii] Prove that non-empty subset H of group G is subgroup of G if and only if for $a, b \in H$ then $ab^{-1} \in H$
iii] State and prove Lagrange's theorem.

Q.3. Attempt any Two of the following: **[08]**

i] In a group G show that inverse of an element is unique.
ii] Define normaliser of element a in group G. Show that, Centre of group G is subgroup of G.
iii] Define permutation,Even,Odd permutation. Express f = (1 2 3 4 5)(1 2 3)(4 5) in product of transpositions.
iv] Define cyclic group. Show that, Subgroup of cyclic group is cyclic.

VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

B.Sc. III (Sem v) Internal Examination: 2024-2025

Partial Differential Equation

Subject code: DSE1003E3 **Day and Date: Thursaday,26th September 2024**

Total – 30 marks **Time: 12.30pm -1.30pm**

Q. Select the correct Alternative. [6]

(1) The order and degree of the partial differential equation $(\frac{\partial z}{\partial x})^2 + \frac{\partial^3 z}{\partial y^3} = 2x(\frac{\partial z}{\partial x})$ respectively are__

a) 2,1 b) 3,1

c) 1,2 d) 1,3

(2) The equation $P_p + Q_q = R$ is known as...

a) Charpit's equation b) Bernoulli's equation c) Clairaut's equation d) Lagrange's equation

(3) Eliminating arbitrary constants, a and b from $z = a(x + y) + b$ to form the partial differential equation is...

a) $\frac{\partial z}{\partial x} = \frac{\partial z}{\partial y}$ b) $\frac{\partial z}{\partial x} = 0$ c) $\frac{\partial z}{\partial y} = 0$ d) $\frac{\partial^2}{\partial x^2} + x = 0$

(4) The general solution of the linear partial differential equation Pp+Qq=R is ----

a) ø(u, v)= 1 b) ø(u,v) = -1 c)ø(u,v) = 0 d) ø(u) =1

(5) After Eliminating the arbitrary constants from the Equation $z = ax^3 + by^3$ we get __

a) $3z = px + qy$ b) $z = px + qy$ c) $z = py$ d) $3z = px - qy$

(6) family of partial differential equations representing all spheres with centre at X-Y plane and radius r is given by ____

a)$p^2 + q^2 + r^2 = 1$ b) $p^2 + q^2 + 1 = r^2$ c) $(p^2 + q^2 + 1)z^2 = r^2$ d) $p^2 + q^2 + r^2 = z^2$

Q.2) Attempt any two of the following [16]

(1) Explain the Lagrange's method of solving Pp + Qq = R when P, Q, R are functions of x, y, z. and hence solve $p + q = \sin x$.

(2) Explain the method of forming the partial differential equation of $\phi(u, v) = 0$ by eliminating the arbitrary function ϕ where u and v are the function of x, y, z.

(3)) Derive the partial differential equation by elimination of arbitrary constant.

Eliminate the arbitrary constant from the following equation $z = (x - a)^2 + (y - b)^2$.

Q.2) Attempt any Two of the following [8]

(1) Eliminate the arbitrary constants from the Equation $\log(az - 1) = x + ay + b$.

(2) Eliminate the arbitrary function from the Equation $f\left(\frac{z}{x^3}, \frac{y}{x}\right) = 0$.

(3) Eliminate the arbitrary function from the Equation $x + y + z = f(x^2 + y^2 + z^2)$.

Vivekanand college (Empowered Autonomous) Kolhapur.

Department of Mathematics

B.Sc. III (Sem V) Internal Examination :2024-2025

Subject code: DSE-1003 E4 (Numerical Methods) Day and Date: Friday,27th september2024

Total marks: 30 Time: 11.30am -12.30pm

Q1. Select the correct alternative. **(6)**

(1) f (x_0, x_1, x_2)= _____

(a) $\frac{f(x_1, x_2)-f(x_0, x_1)}{x_0-x_1}$ (b) $\frac{f(x_1, x_2)-f(x_0, x_1)}{x_0-x_2}$

(c) $\frac{f(x_1, x_2)-f(x_0, x_1)}{x_2-x_0}$ (d) $\frac{f(x_1, x_2)-f(x_0, x_1)}{x_1-x_0}$

(2) The 2^{nd} degree polynomial passing through the points (0,2), (1,7), (2,14), (3,23) is__

(a) x^2- 4x + 2 (b) x^2- 4x - 2 (c) x^2+ 4x + 2 (d) x^2 + 2

(3) Newton's forward and Backward interpolation is useful when data is__

(a) Equally spaced (b) Unequally spaced (c) Both A and B (d) None of these

(4) For shift operator E, $E^{-n} f(x)$ = ---------

(a) f (x+nh) (b) f (x-nh) (c) f (x+mh) (d) f (x-mh)

(5) The value of $\Delta^4 e^x$ is

(a) $e^x(e^h-1)^{-4}$ (b) $(e^x-1)^4 e^h$ (c) $e^x(e^h-1)^4$ (d) $e^h(e^x-1)^{-4}$

(6) Lagrange's Interpolating formula for

(a) f(x)= $\sum_{i=0}^{\infty} f(x_i)\, l_i(x)$ (b) f(x)= $\sum_{i=0}^{n} f(x_i)\, l_i(x)$

(c) f(x)= $\sum_{i-n}^{n} f(x_i)\, l_i(x)$ (d) None of these

Q2. Attempt any Two. **(16)**

(1) Find cubic polynomial passing through the points (2,4), (4,56),(9,711),(10,980)and hence estimate dependent variable 3,5,7,11. Also express the interpolating polynomial in powers of (x-1) and hence estimate the value of f(x) at x=1.1 and 1.5

(2) find number of persons getting wages less than Rs25 and Rs85

Wages(Rs)	0 - 20	20 - 40	40 - 60	60 - 80	80 - 100
No.of.Persons	11	30	26	23	10

(3) From following

Temperature °C	140	150	160	170
Pressure (Kg F/cm^2)	3.685	4.854	6.302	8.076

Find pressure for temperature 142°C and 169°C.

Q3. Attempt any two. **(8)**

(1) Find the Lagrangian from of interpolating polynomial of the data

X	1	2	3	4
F(x)	1	4	9	16

Find F'(2.5)

(2) Using Newton Divided difference formula, If u_{20} =24.37, u_{22} =49.28, u_{23} =162.86, u_{32} =240.5 then Find u_{28}

(3) From following data find the number of students who have obtained less than 45 marks using Newton forward interpolation formula

Marks	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80
No .of Students	31	42	51	35	31

Date : 20/02/2025

"Education for Knowledge, Science, and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur

(Empowered Autonomous)

DEPARTMENT OF MATHEMATICS

B. Sc. I Sem. II
Internal Examination 2024-25

All the students of B.Sc. I are hereby informed that their Internal Examination of Mathematics will be conducted on **3rd and 4th March, 2025 from 10.15 am to 11.30 am** in Room No. 513. Syllabus for examination will be as mentioned in following table.

Sr. No.	Name of Paper	Units
1	DSC-III Differential Equations-I (03/03/2025)	Unit I – Ordinary Differential equation of 1st order and 1st degree Unit II–Linear Differential equation with constant Coefficients upto Particular Integral e^{ax} , $\sin ax$, $\cos ax$
2	DSC-IV Discrete Mathematics (04/03/2025)	Unit I – Propositional Calculus Unit II– Graph Theory Upto Complement of graph

Nature of question paper

Time:-1 Hours **Total Marks:20**

Q.1) Choose correct Alternative **[04]**

i)
ii)
iii)
iv)

Q.2) Attempt any One **[08]**

i)
ii)

Q.3) Attempt any two **[08]**

i)
ii)
iii)

(Prof. S. P. Thorat)
HEAD
ARTMENT OF MATHEMATICS
VEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

Vivekanand college (An Empowered Autonomous Institute), Kolhapur
Department of Mathematics
B.Sc.-I (Sem-II) Internal Examination: 2024-2025

Day and Date: Monday, 3rd March 2025 Time: 10.15 AM to 11.30 AM Total Marks: 20

Q.1. Select the Correct Alternative. [4]

(1) The order of the differential equation $\frac{d^2x}{dt^2}+\frac{dx}{dt}+e^t=0$ is..... sin x

a) 1 b) 2 c) 3 d) Not defined

(2) The Integrating factor of $\frac{dy}{dx}+y\sec x=\tan x$ is....

a) $\sec x$ b) $\log(\sec x+\tan x)$ c) $\sec x.\tan x$ d) $\sec x+\tan x$

(3) The solution of Differential equation $\frac{d^2y}{dx^2}-5\frac{dy}{dx}+6y=0$ is....

a) $y=c_1e^{2x}+c_2e^{3x}$ b) $y=c_1e^{-2x}+c_2e^{-3x}$ c) $y=c_1e^{2x}+c_2e^{-3x}$ d) $y=c_1e^{-2x}+c_2e^{3x}$

(4) The value of $\frac{1}{D^2+4}\sin x=...$

a) $\frac{1}{5}\sin x$ b) $\frac{1}{5}\cos x$ c) $\frac{1}{3}\sin x$ d) $\frac{1}{3}\cos x$

Q.2. Attempt any One. [8]

(1) State and prove necessary and sufficient condition for the Differential Equation $Mdx+Ndy=0$ to be Exact Differential Equation.

(2) If $f(D)y=X$ where $X=e^{ax}$ then with usual notation prove that $\frac{1}{f(D)}e^{ax}=\frac{1}{f(a)}e^{ax}$ where $f(a)\neq 0$.

Hence find the particular integral of Differential equation $(D^2-3D+6)y=e^{2x}$.

Q.3.Attempt any Two. [8]

(1) Find the complete solution of Differential equation $\frac{d^2y}{dx^2}-3\frac{dy}{dx}+2y=\cos 3x$.

(2) Solve $\cos x\,(e^y+1)dx+e^y\sin x\,dy=0$.

(3) Solve $x\log x\frac{dy}{dx}+y=2\log x$.

Vivekanand college (An Empowered Autonomous Institute), Kolhapur
Department of Mathematics
B.Sc.-I (Sem-II) Internal Examination: 2024-2025

Day and Date: Monday, 3rd March 2025 Time: 10.15 AM to 11.30 AM Total Marks: 20

Q.1. Select the Correct Alternative. [4]

(1) The order of the differential equation $\frac{d^2x}{dt^2}+\frac{dx}{dt}+e^t=0$ is..... sin x

a) 1 b) 2 c) 3 d) Not defined

(2) The Integrating factor of $\frac{dy}{dx}+y\sec x=\tan x$ is....

a) $\sec x$ b) $\log(\sec x+\tan x)$ c) $\sec x.\tan x$ d) $\sec x+\tan x$

(3) The solution of Differential equation $\frac{d^2y}{dx^2}-5\frac{dy}{dx}+6y=0$ is....

a) $y=c_1e^{2x}+c_2e^{3x}$ b) $y=c_1e^{-2x}+c_2e^{-3x}$ c) $y=c_1e^{2x}+c_2e^{-3x}$ d) $y=c_1e^{-2x}+c_2e^{3x}$

(4) The value of $\frac{1}{D^2+4}\sin x=...$

a) $\frac{1}{5}\sin x$ b) $\frac{1}{5}\cos x$ c) $\frac{1}{3}\sin x$ d) $\frac{1}{3}\cos x$

Q.2. Attempt any One. [8]

(1) State and prove necessary and sufficient condition for the Differential Equation $Mdx+Ndy=0$ to be Exact Differential Equation.

(2) If $f(D)y=X$ where $X=e^{ax}$ then with usual notation prove that $\frac{1}{f(D)}e^{ax}=\frac{1}{f(a)}e^{ax}$ where $f(a)\neq 0$.

Hence find the particular integral of Differential equation $(D^2-3D+6)y=e^{2x}$.

Q.3.Attempt any Two. [8]

(1) Find the complete solution of Differential equation $\frac{d^2y}{dx^2}-3\frac{dy}{dx}+2y=\cos 3x$

(2) Solve $\cos x\,(e^y+1)dx+e^y\sin x\,dy=0$.

(3) Solve $x\log x\frac{dy}{dx}+y=2\log x$.

Vivekanand College, Kolhapur (An Empowered Autonomous Institute)
B.Sc. I (Semester-II) Internal Examination: February 2025

Course Name: Discrete Mathematics **Course Code: DSC03MAT22**
Day & Date: Tuesday, 04/03/2025 **Time: 10.30 am to 11.30 am** **Total Marks: 20**

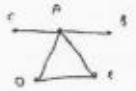
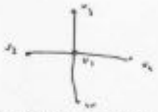
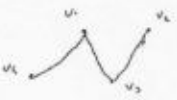
Instructions:
1. **All questions are compulsory.**
2. **Figures in right side indicates full marks.**

Q.1. Select the correct alternative for each of the following. **[04]**

i) If a graph has 8 edges then total degree of graph is ___.

A) 16 B) 4 C) 8 D) 10

ii) Which of the following graphs is(are) regular?

A)  B)  C)  D) 

iii) What is the negation of statement "All apples are red"?

A) Some apples are not red B) all apples are not red

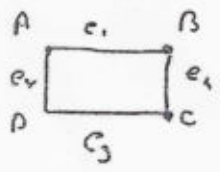
C) there are no red apples D) It is not true that all apples are red

iv) Which of the following statements is logically equivalent to $p \to q$?

A) $\neg p \vee q$ B) $p \wedge q$ C) $\neg p \to \neg q$ D) $p \vee \neg q$

Q.2 Attempt any One of the following. **[08]**

i) Check whether following pair of graphs are isomorphic or not.



G1

G2

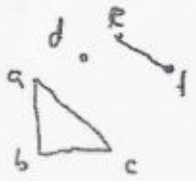
ii) Test the validity of the argument using truth table

1] $H_1: P \to Q$, $H_2: \neg R \to P$, $H_3: Q$ and C:R 2] $H_1: P \vee \neg Q$, $H_2: \neg Q \to R$, $H_3: P \to S$, $H_4: \neg R$ and C:S

Q.3 Attempt any Two of the following. **[08]**

i) Draw graph from following adjacency matrix $\begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$

i) Find Degree of each vertex, Degree of graph, Identify isolated vertex, pendent, odd vertex, even vertex of following graph.



ii) Prove by indirect method $(P \vee Q), P \to R, Q \to S, \vdash S \vee R$

****

Jiya Salim Mu

॥ ज्ञान, विज्ञान आणि सुंसस्कार यासाठी शिक्षण प्रसार ॥
– शिक्षणमहर्षी डॉ. बापूजी साळुंखे

(अधिकारप्रदत्त स्वायत्त)
कोल्हापूर

VIVEKANAND COLLEGE, KOLHAPUR.
(Empowered Autonomous)

SUPPLIMENT

Jr. Supervisor's Sign. :	
Students Sign. :	Jamulla
Seat No. :	7261
Seat No. in words :	Seven two six one
Suppliment No. :	1
	46759
Centre	V.C.K.

4 + 8 + 8 = 20/20

प्र. क्र. Q. No.

Q. 1

1] b] 2

2] d] $\sec x + \tan x$

3] a] $y = c_1 e^{2x} + c_2 e^{3x}$

4] c] $\frac{1}{3} \sin x$

Q. 2

1] Theorem :-

Statement : The necessary and sufficient con
for the Differential equation $M\,dx + N\,dy = 0$
be exact differential equation.
Then $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$
where, M & N are functions of x & y.

Proof :

I] Necessary Part :-

02 Section	Q. No.												
	Marks												

प्र. क्र.
Q. No.

Suppose, $M\,dx + N\,dy = 0$

To Prove, $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$

we know that, definition of exact D.E.

$$M\,dx + N\,dy = du \quad \text{---} (1)$$

where, u is the function of x & y

ie. $u = f(x, y)$

differentiate u w.r.t. x

$$du = \frac{\partial u}{\partial x}\,dx + \frac{\partial u}{\partial y}\,dy \quad \text{---} (2)$$

from eqn (1) & (2)

$$M\,dx + N\,dy = \frac{\partial u}{\partial x}\,dx + \frac{\partial u}{\partial y}\,dy$$

equating above terms, we get

$$M = \frac{\partial u}{\partial x} \quad \& \quad N = \frac{\partial u}{\partial y}$$

differentiate M & N partially w.r.t. y & x resp

$$\frac{\partial M}{\partial y} = \frac{\partial}{\partial y}\left(\frac{\partial u}{\partial x}\right) \quad \& \quad \frac{\partial N}{\partial x} = \frac{\partial}{\partial x}\left(\frac{\partial u}{\partial y}\right)$$

$$\frac{\partial M}{\partial y} = \frac{\partial^2 u}{\partial y \cdot \partial x} \quad \& \quad \frac{\partial N}{\partial x} = \frac{\partial^2 u}{\partial x \cdot \partial y}$$

but, we know that,

$$\frac{\partial^2 u}{\partial y \cdot \partial x} = \frac{\partial^2 u}{\partial x \cdot \partial y}$$

$$\therefore \quad \frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$$

प्र. क्र.
Q. No.

II] Sufficient Part :-

Suppose, $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$ is exact differential eqⁿ.

To prove, $M\,dx + N\,dy = du$

let,

$$\int M\,dx = u$$

differentiate above eqⁿ partially w.r.t. x, we get

$$M = \frac{\partial u}{\partial x} \quad \text{---} \quad (1)$$

differentiate eqⁿ (1) partially w.r.t. y

$$\frac{\partial M}{\partial y} = \frac{\partial}{\partial y}\left(\frac{\partial u}{\partial x}\right)$$

$$\frac{\partial M}{\partial y} = \frac{\partial^2 u}{\partial y \cdot \partial x}$$

but, $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$ ... given

$$\therefore \frac{\partial N}{\partial x} = \frac{\partial^2 u}{\partial y \cdot \partial x}$$

Integrating above eqⁿ w.r.t. y

$$N = \frac{\partial u}{\partial y} + f(y)$$

substitute value of M & N in eqⁿ

$$M\,dx + N\,dy = \frac{\partial u}{\partial x}\,dx + \left(\frac{\partial u}{\partial y} + f(y)\right)dy$$

$$= \frac{\partial u}{\partial x}\,dx + \frac{\partial u}{\partial y}\,dy + f(y)\,dy$$

$$= du + \int d[f(y)]\,dy$$

$$= d\left[u + \int f(y)\,dy\right]$$

04	Section	Q. No.												
		Marks												

प्र. क्र.
Q. No.

$M\,dx + N\,dy = dv$

$\therefore M\,dx + N\,dy = 0$ is exact differential equat

Q 3

1] Consider, given differential eqⁿ is

$$\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = \cos 3x$$

using operator D,

$$(D^2 - 3D + 2)y = \cos 3x$$

now,

Auxillary eqⁿ is,

$$m^2 - 3m + 2 = 0$$

$$m^2 - 2m - m + 2 = 0$$

$$m(m-2) - (m-2) = 0$$

$$(m-2)(m-1) = 0$$

$$(m-2) = 0 \quad \& \quad m-1 = 0$$

$$m = 2 \quad \& \quad m = 1$$

$$\therefore m = 1, 2$$

$$C.F = C_1 e^x + C_2 e^{2x}$$

now,

$$P.I = \frac{1}{D^2 - 3D + 2} \cos 3x$$

$$P.I. = \frac{1}{-9 - 3D + 2} \cos 3x$$

$$P.I = \frac{1}{-3D - 7} \cos 3x$$

Jiya Salim Mulla

॥ ज्ञान, विज्ञान आणि सुंसस्कार यासाठी शिक्षण प्रसार ॥

- शिक्षणमहर्षी डॉ. बापूजी साळुंखे

(अधिकारप्रदत्त स्वायत्त)
कोल्हापूर

VIVEKANAND COLLEGE, KOLHAPUR.
(Empowered Autonomous)

SUPPLIMENT

Jr. Supervisor's Sign. :	
Students Sign. :	Jsmulla
Seat No. :	7261
Seat No. in words :	Seven two six one
Suppliment No. :	2
	46745
Centre	V.C.K.

प्र. क्र.
Q. No.

$$P.I. = -\frac{1}{(7+3D)} \cos 3x$$

$$P.I. = -\frac{(7-3D)}{(7+3D)(7-3D)} \cos 3x$$

$$P.I. = -\frac{(7-3D)}{49-9D^2} \cos 3x$$

$$P.I. = -\frac{(7-3D)}{49-9(-9)} \cos 3x$$

$$P.I. = -\frac{(7-3D)}{49+81} \cos 3x$$

$$P.I. = -\frac{(7-3D)}{130} \cos 3x$$

$$P.I. = -\frac{1}{130}[7-3D]\cos 3x$$

$$P.I. = \frac{-1}{130}[7\cos 3x - 3(-\sin 3x)3]$$

$$P.I. = \frac{-1}{130}[7\cos 3x + 9\sin 3x]$$

Solution is

$$y = C.F. + P.I.$$

$$y = C_1 e^x + C_2 e^{2x} - \frac{1}{130}(7\cos 3x + 9\sin 3x)$$

02	Section	Q. No.												
		Marks												

प्र. क्र.
Q. No.

Q. 3.2] let, $\cos x (e^y+1)\,dx + e^y \sin x\,dy = 0$

comparing above eqn with $M\,dx + N\,dy = 0$

we get,

$M = \cos x (e^y+1)$

$N = e^y \sin x$

now,

$$\frac{\partial M}{\partial y} = \cos x \cdot e^y \quad \& \quad \frac{\partial N}{\partial x} = e^y \cos x$$

$$\therefore \frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$$

which is exact differential equation

solution is

$$\int_{y=\text{const.}} M\,dx + \int \text{term not containing } x \text{ in } N\,dy = 0$$

$$\int_{y=c} \cos x (e^y+1)\,dx + \int 0\,dy = 0$$

$$\sin x \int_{y=c} \cos x \cdot e^y\,dx + \int_{y=c} \cos x\,dx = 0$$

$$\therefore \sin x\, e^y + \sin x = c$$

$$\therefore \boxed{\sin x (e^y+1) = c}$$

प्र. क्र.
Q. No.

3.3] let, given differential eqⁿ.

$$x \log x \frac{dy}{dx} + y = 2 \log x$$

divide by $x \log x$ both sides, we get,

$$\frac{dy}{dx} + \frac{1}{x \log x} \cdot y = \frac{2 \log x}{x \log x}$$

$$\therefore \frac{dy}{dx} + \frac{1}{x \log x} y = \frac{2}{x}$$

here,

$$P = \frac{1}{x \log x} \quad \& \quad Q = \frac{2}{x}$$

now, $\int P\,dx = \int \frac{1}{x \log x}\,dx$

$$\int P\,dx = \log(\log x) + c$$

$$\left[\because \int \frac{f'(x)}{f(x)}\,dx = \log f(x) + c\right]$$

now, $I.F. = e^{\int P\,dx}$

$$I.F. = e^{\log(\log x)}$$

$$I.F. = \log x$$

soln is

$$y(I.F.) = \int Q\,(I.F.)\,dx + c$$

$$y \cdot \log x = \int \frac{2}{x} \cdot \log x\,dx + c$$

$$y \cdot \log x = 2\,\frac{[\log x]^2}{2} + c$$

04	Section	Q. No.												
		Marks												

प्र. क्र.
Q. No.

$$\left[\because \int f'(x).f(x)\,dx = \frac{[f(x)]^{n+1}}{n+1} + c\right.$$

$$y \log x = [\log x]^2 + C$$

$$\therefore \boxed{y = \log x + c.\log x}$$

"Education for Knowledge, Science, and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur

(Empowered Autonomous)

DEPARTMENT OF MATHEMATICS

Date:11/02/2025

B. Sc. II Sem. IV

Notice

Internal Examination 2024-25

All the students of B.Sc. II Sem. IV (Major Mathematics) are hereby informed that their Internal Examination of Mathematics will be conducted from **24th February, 2025 to 25th February, 2025 in Room No.513.** The examination will be conducted only one time. Syllabus and schedule for examination will be as mentioned in following table.

Sr. No.	Name of Paper, Time and Date	Units
1	**Discrete Mathematics** Monday, 24/02/2025 Time: 11.30 am to 12.30 pm	Unit I- Recurrence relation Unit III – Basics of Graph Theory Unit IV – Paths and Circuits
2	**Integral Transform** Tuesday, 25/02/2025 Time: 11.30 am to 12.30 pm	Unit I –Laplace Transform Unit III – Fourier Transform

Nature Of Question Paper

Time:1 Hour **Marks: 20**

Q.1) Choose the correct alternative. **[04]**

i)

ii)

iii)

iv)

Q.2) Attempt any One of the following. **[08]**

i)

ii)

Q.3) Attempt any Two of the following. **[08]**

i)

ii)

iii)

(Prof. S. P. Thorat)
HEAD
DEPARTMENT OF MATHEMATICS
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

"Education for Knowledge, Science, and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe
Shri Swami Vivekanand Shikshan Sanstha's
Vivekanand College, Kolhapur
(Empowered Autonomous)
KOLHAPUR

DEPARTMENT OF MATHEMATICS

Date:08/02/2025

B. Sc. III Sem. VI
Notice
Internal Examination 2024-25

All the students of B.Sc. III(Mathematics) are hereby informed that their Internal Examination of Mathematics will be conducted from **24th February, 2025 to 28th February, 2025.** The examination will be conducted only one time. Syllabus and schedule for examination will be as mentioned in following table.

Sr. No.	Name of Paper, Time and Date	Units
1	**Metric Space** Monday, 24/02/2025 Time: 11.50 am to 12.50 pm	Unit I – Limit and metric space Unit II – Continuous function on metric space
2	**Linear Algebra** Tuesday, 25/02/2025 Time: 11.50 am to 12.50 pm	Unit I – Vector Spaces Unit II – Inner product Spaces
3	**Complex Analysis** Thursday, 27/02/2025 Time: 11.50 am to 12.50 pm	Unit I – Analytic Functions Unit II- Elementary Functions
4	**Optimization Techniques** Friday, 28/02/2025 Time: 11.50 am to 12.50 pm	Unit I – Linear programming Problem Unit I – Transportation problem

Nature Of Question Paper

Time:1 Hour **Marks: 30**

Q.1) Choose the correct alternative. **[06]**

i)
ii)
iii)
iv)
v)
vi)

Q.2) Attempt any Two of the following. **[16]**

i)
ii)
iii)

Q.3) Attempt any Two of the following. **[08]**

i)
ii)
iii)

(Prof. S. P. Thorat)
HEAD
DEPARTMENT OF MATHEMATICS
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

Vivekanand College, Kolhapur (Empowered Autonomous Institute)
B.Sc. II (Semester-IV), Internal Examination: February 2025

Course Name: Discrete Mathematics **Course Code: DSC03MAT41**
Day & Date: Monday, 24/02/2025 **Time: 11.30 am to 12.30 pm** **Total Marks: 20**
Instructions:
1. All questions are compulsory **2. Figures in right side indicates full marks.**

Q.1. Select the correct alternative for each of the following. **[04]**

i) The number of edges in a complete-bipartite graph $K_{m,n}$ is .....

A) $m+n$ B) $m-n$ C) mn D) m^2+n^2

ii) A vertex of degree ..... is called as pendant vertex.

A) 1 B) 2 C) 3 D) 0

iii) Order of recurrence relation $a_{n+2} - 5a_{n-3} + a_{n-4} = n2^n$ is.....

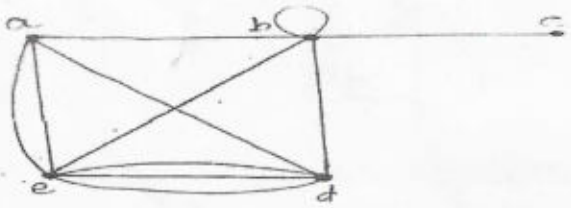
A) 3 B) 2 C)4 D) 6

iv)Particular solution of $a_n = 7a_{n-1} + 8$ is .....

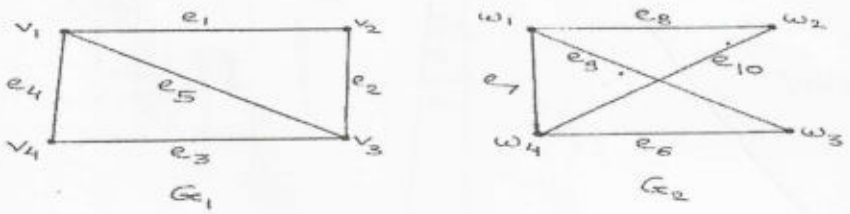
A) $a_n = A_1(-1)^n$ B) $\frac{-4}{3}$ C)$a_n = A_1(-1)^n \frac{-4}{3}$ D) None of these

Q.2 Attempt any One of the following. **[08]**

i) a) Verify Handshaking lemma of the following graphs.



b) Determine whether given pair of graphs are isomorphic or not.



ii) Find total solution of recurrence relation $a_n - 5a_{n-1} + 6a_{n-2} = 7^n$.

Q.3 Attempt any Two of the following. **[08]**

i) If G be a graph with n-vertices out of which 't' number of vertices have degree k and other have degree $k+1$ then prove that $t = (k+1)n - 2e$. Where, e is the number of edges in G.

ii) Draw a graph with the following ~~adjacency~~ incidency matrix

$$\begin{bmatrix} 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 2 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \end{bmatrix}$$

iii) Solve the homogeneous solution of recurrence relation $a_n + 5a_{n-1} + 6a_{n-2} = 0$.

****

Vivekanand College, Kolhapur (Empowered Autonomous Institute)

B.Sc. II (Semester-IV) Internal Examination: 2025

Course Name: Integral Transform **Course Code: DSC03MAT42**

Day & Date: **Time:** **Total Marks: 20**

Instructions:

1. All questions are compulsory.

2. Figures in right side indicates full marks.

Q.1. Select the correct alternative for each of the following. **[04]**

i) $L\{(t^2+1)^2\} =$ _____

A) $\frac{24}{s^5}+\frac{4}{s^3}+\frac{1}{s}$ B) $\frac{24}{s^5}+\frac{4}{s^3}+\frac{12}{s}$ C) $\frac{24}{s^5}+\frac{14}{s^3}+\frac{1}{s}$ D) $\frac{24}{s^5}+\frac{4}{s^3}+\frac{21}{s}$

ii) $L\{(\sin t+\cos t)^2\} =$ _____

A) $\frac{s^2+4s+4}{s(s^2+4)}$ B) $\frac{s^2+2s+4}{s(s^2+4)}$ C) $\frac{s^2+2s+4}{s(s^2+16)}$ D) $\frac{s^2+4s+4}{s(s^2+16)}$

iii) Infinite Fourier transform of $F(x)$ is_____, where $F(x)=\begin{cases}\frac{1}{2\epsilon}, & |x|\geq\epsilon\\ 0, & |x|<\epsilon\end{cases}$

A) $\frac{1}{\sqrt{2\pi}}\frac{\cos s\epsilon}{s}$ B) $\frac{1}{\sqrt{2\pi}}\frac{\tan s\epsilon}{s}$ C) $\frac{1}{\sqrt{2\pi}}\frac{\sin s\epsilon}{s\epsilon}$ D) $\frac{1}{\sqrt{2\pi}}\sin s\epsilon$

iv) Infinite Inverse Fourier transform is F(x) = ___.

A) $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} f(s)e^{sx}\,ds$ B) $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} f(s)e^{-isx}\,ds$

C) $\frac{1}{\sqrt{4\pi}}\int_{-\infty}^{\infty} f(s)e^{isx}\,ds$ D) $\frac{1}{\sqrt{2}}\int_{-\infty}^{\infty} f(s)e^{isx}\,ds$

Q.2 Attempt any One of the following. **[08]**

i) If $f_1(s)$ and $f_2(s)$ are Laplace transform of $F_1(t)$ and $F_2(t)$ respectively, then prove that

$L\{C_1F_1(t)+C_2F_2(t)\} = C_1f_1(s)+C_2f_2(s)$. Find $L\{e^{4t}+4t^2-5sin3t+6cos4t\}$.

ii) If $L\{F(t)\} = f(s)$ then prove that $L\left\{\int_0^t F(u)\,du\right\} = \frac{1}{s}f(s)$.

Q.3 Attempt any Two of the following. **[08]**

i) Obtain infinite Fourier transform of $F(x) = e^{-|x|}$.

ii) Obtain infinite Fourier transform of $F(x)=\begin{cases}1, |x|<k\\ 0, |x|>k\end{cases}$

iii) Find Laplace transform of $F(t) = e^{-3t}(2\cos 5t-3\sin 5t)$.

****

Vivekanand College, Kolhapur (Empowered Autonomous Institute)

B.Sc. II (Semester-IV), Internal Examination: February 2025

Course Name: Graph theory and recurrence relation **Course Code : MIN03MAT41**

Day & Date: Friday, 28/02/2025 **Time: 3.30 pm to 4.30 pm** **Total Marks: 20**

Instructions:

1. All questions are compulsory

2. Figures in right side indicates full marks.

Q.1. Select the correct alternative for each of the following. **[04]**

i) The number of edges in a complete-bipartite graph $K_{m,n}$ is .....

A) $m+n$ B) $m-n$ C) mn D) m^2+n^2

ii) If G is a simple graph with 5 vertices and 6 edges, then the number of edges in the complement of G is .....

A) 14 B) 24 C) 4 D) 30

iii) Order of recurrence relation $a_{n+4} - 5a_{n-5} + a_{n-4} = n2^n$ is.....

A) 3 B) 9 C)4 D) 8

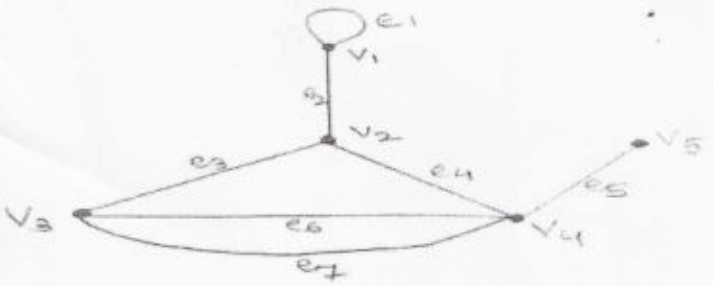
iv)General form particular solution of $a_n - 6a_{n-1} + 9a_{n-1} = n3^n$ is .....

A) $a_n = (P_1n^3 + P_2n^2)\,3^n$ B) $a_n = (P_1n + P_2)\,3^n$ C)$a_n = (P_1n + P_2)$ D) $a_n = (P_1n^3 + P_2n^2)$

Q.2 Attempt any One of the following. **[08]**

i) a) Define Path and trail.

b) Write the adjacency matrix and Incidency matrix of the following graph



ii) Find total solution of recurrence relation $a_n + 5a_{n-1} + 6a_{n-2} = 42(4^n)$.

Q.3 Attempt any Two of the following. **[08]**

i) State and prove Handshaking lemma.

ii) Draw the graph $K_{3,4}$, K_6

iii) Solve the homogeneous solution of recurrence relation $a_{n+2} - 3a_{n+1} + 2a_n = 0$.

****

Vivekanand College, Kolhapur (Empowered Autonomous Institute)

B.Sc. II (Semester-IV) Internal Examination: 2025

Course Name: Laplace and Fourier transformations **Course Code: MIN03MAT42**

Day & Date: Friday, 28/03/2025 **Time:** **Total Marks: 20**

Instructions:

1. All questions are compulsory.

2. Figures in right side indicates full marks.

Q.1. Select the correct alternative for each of the following. **[04]**

i) $L\{\frac{(e^{-at}-1)}{a}\} =$ _____

A) $\frac{1}{s+a}$ B) $\frac{1}{s}$ C) $-\frac{1}{s(s+a)}$ D) $\frac{1}{s(s+a)}$

ii) $L\{(\sin t - \cos t)^2\} =$ _____

A) $\frac{s^2-4s+4}{s(s^2+4)}$ B) $\frac{s^2-2s+4}{s(s^2+4)}$ C) $\frac{s^2-2s+4}{s(s^2+16)}$ D) $\frac{s^2-4s+4}{s(s^2+16)}$

iii) Infinite Fourier transform of $F(x)$ is_____, where $F(x) = \begin{cases} 1, & |x| < k \\ 0, & |x| > k \end{cases}$

A) $\sqrt{\frac{2}{\pi}}\frac{\cos sk}{s}$ B) $\sqrt{\frac{2}{\pi}}\frac{\tan sk}{s}$ C) $\sqrt{\frac{2}{\pi}}\frac{\sin sk}{s}$ D) $\sqrt{\frac{2}{\pi}}\sin sk$

iv) Infinite Fourier cosine transform is $f_c(s) =$ ___.

A) $\sqrt{\frac{\pi}{2}}\int_{-\infty}^{\infty} f(x)\cos sx\ ds$ B) $\sqrt{\frac{2}{\pi}}\int_{0}^{\infty} f(x)\cos sx\ ds$

C $\sqrt{\frac{\pi}{2}}\int_{0}^{\infty} f(x)\cos sx\ ds$ D) $\sqrt{\frac{2}{\pi}}\int_{-\infty}^{\infty} f(x)\cos sx\ ds$

Q.2 Attempt any One of the following. **[08]**

i) State and prove first shifting theorem for Laplace transform. Also find $L\{e^{-t}(3\sinh 2t - 5\cosh 2t)\}$.

ii) If $f(s)$ is fourier transform of $F(x)$ then prove that $\frac{1}{a}f\left(\frac{s}{a}\right)$ is fourier transform of $F(ax)$.

Q.3 Attempt any Two of the following. **[08]**

i) Obtain the Laplace transform of $F(t) = \frac{e^{-at}-e^{-bt}}{t}$.

ii) Obtain Fourier sine transform of $F(x) = \frac{1}{x}$, $0 < x < \infty$.

iii) Find Laplace transform of $F(t) = t^2\cos 3t$.

02	Section	Q. No.												
		Marks												

प्र. क्र.
Q. No.

Q. 2.

a] To verify the Handshaking lemma.

$$\sum_{i=1}^{n} d(v) = 2e.$$

Now, $d(a) = 4$
$d(b) = 6$
$d(c) = 1$
$d(d) = 5$
$d(e) = 6$

$\therefore \quad \Sigma d(v) = 22$

08 Then,

$\Sigma e = 11$

$\therefore \quad \Sigma d(v) = 2e$
$= 2 \times 11$
$= 22$

$\therefore$ Handshaking lemma is verify.

b] Isomorphic or not

In this two graph G_1 & G_2 the vertices and edges are equal.

$d(v_1) = 3 \quad d(v_2) = 2 \quad d(v_3) = 3 \quad d(v_4) =$
$d(w_1) = 3 \quad d(w_2) = 2 \quad d(w_3) = 2 \quad d(w_4) =$

Name : Atihant Kiran Patil
Internal Exam.
Roll No: 7748
Date : 24-02-25

25094

(अधिकारप्रदत्त स्वायत्त)
कोल्हापूर

Signature of Jr. Super.

विवेकानंद कॉलेज, कोल्हापूर. (अधिकरप्रदत्त स्वायत्त)

परीक्षेच्या _____ या विषयाच्या प्रयोग परीक्षा

Practical Examination in, _____

at the _____ Examination

उमेदवाराचा आसन क्रमांक _____ विभाग _____
(Candidate's Seat No.) (Section)

उमेदवारांना सूचना

१. प्रश्न काळजीपूर्वक वाचा आणि त्याप्रमाणे विचारलेला प्रयोग करा.
२. उपकरणांच्या वापराबाबत तुम्हांला काही माहीत नसेल तर परीक्षक किंवा प्रयोगशाळा सहाय्यक यांना तुम्हाला मदत करण्याविषयी विनंती करा.
३. कोणताही विद्युतप्रयोग करण्यापूर्वी, प्रत्यक्ष पुरविलेली सर्व उपकरणे आणि सर्व 'कनेक्शन' नीट पाहून घेऊन संबंधित कामाची नीटनेटकी कार्ययोजना करण्याची नितांत आवश्यकता आहे आणि ह्यानंतर पुढे काम चालू करण्याविषयी परीक्षकांची परवानगी मिळविणे आवश्यक आहे.
४. सर्व निरीक्षणे कोटकवजा तक्त्यात भरावी. मधल्या सर्व गणना आणि निर्णय हे क्य तितक्या सुवाच्चपणे आणि स्पष्टपणे नोंदविलेले असणे हे हितावह आहे.
५. प्रारंभिक किंवा अंतिम निरीक्षणात संख्यावाचक आकडे एकावर एक लिहू नयेत. जर लिहिलेला कोणताही आकडा नको असेल तर त्यावर एक रेघ ओढून पाहिजे असलेला आकडा त्याच्याजवळ लिहा. प्रयोगशाळेतून बाहेर पडण्यापूर्वी आपले टेबल चांगल्या स्थितीत आहे याची खात्री करा.

INSTRUCTIONS TO CANDIDATES

1. Read the question carefully and perform the experiment as required.
2. If there by anything the apparatus that you do not know, ask the examiner or the laboratory assistant to help you.
3. Before doing any electrical experiment, it is absolutely essential that you make a neat working sketch of all apparatus actually provided and of the necessary connection and obtain the examiner's permission to proceed.
4. Express all observations in a tabular form. It is also desirable that all intermediate calculations and results should be entered as neatly and clearly as possible.
5. No numerical figures should be written over either in the preliminary or final observations. If any figure is shought to be discarded it should be run through and the desired figure written near to it.
6. Please see that your table is in good order before you leave the laboratory.

(येथून लेखनास सुरवात करा.) (Begin writing here.)

3P 8+8 = (14)

प्र. क्र. Q. No.	
Q.1. 1.	C] mn
2.	A] 1
03 3.	D] 6
4.	C] $a_n = A_1(-1)^n - \frac{4}{3}$

प्र. क्र.
Q. No.

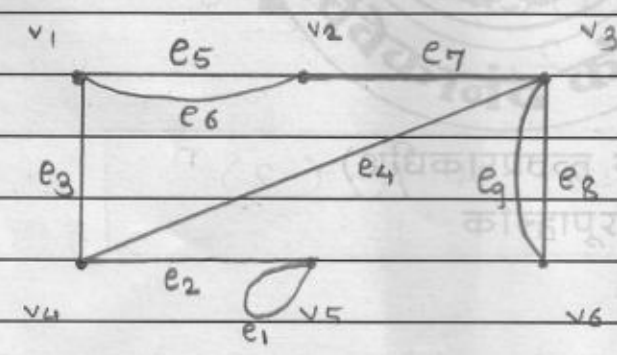
$v_1 \longleftrightarrow \omega_1$
$v_2 \longleftrightarrow \omega_2$
$v_3 \longleftrightarrow \omega_4$
$v_4 \longleftrightarrow \omega_3$

$e_1 \longleftrightarrow e_8$
$e_2 \longleftrightarrow e_{10}$
$e_3 \longleftrightarrow e_6$
$e_4 \longleftrightarrow e_9$
$e_5 \longleftrightarrow e_7$

$\therefore$ The graph G_1 and G_2 are isomorphic

Q. 8.

ii] Graph :



G

04 Section	Q. No.													
	Marks													

प्र. क्र.
Q. No.

iii] $a_n + 5a_{n-1} + 6a_{n-2} = 0.$

Soln: $a_n + 5a_{n-1} + 6a_{n-2} = 0$

put $a_n = \alpha^n$

$$\alpha^n + 5\alpha^{n-1} + 6\alpha^{n-2} = 0.$$
$$\alpha^{n-2}\left[\alpha^2 + 5\alpha + 6\right] = 0$$
$$\alpha^2 + 5\alpha + 6 = 0.$$
$$\alpha^2 + 3\alpha + 2\alpha + 6 = 0$$
$$\alpha(\alpha+3) + 2(\alpha+3) = 0$$
$$(\alpha+3)(\alpha+2) = 0$$
$$\therefore \alpha = -3, -2.$$

$$\therefore a_n^{(h)} = A_1(-3)^n + A_2(-2)^n$$

$\therefore A_1$ & A_2 const

25100

(अधिकारप्रदत्त स्वायत्त)
कोल्हापूर

Signature of Jr. Super.

विवेकानंद कॉलेज, कोल्हापूर. (अधिकरप्रदत्त स्वायत्त)

_____ परीक्षेच्या _____ या विषयाच्या प्रयोग परीक्षा

Practical Examination in, _____

at the _____ Examination

उमेदवाराचा आसन क्रमांक _____ विभाग _____
(Candidate's Seat No.) (Section)

उमेदवारांना सूचना

१. प्रश्न काळजीपूर्वक वाचा आणि त्याप्रमाणे विचारलेला प्रयोग करा.
२. उपकरणांच्या वापराबाबत तुम्हांला काही माहीत नसेल तर परीक्षक किंवा प्रयोगशाळा सहाय्यक यांना तुम्हाला मदत करण्याविषयी विनंती करा.
३. कोणताही विद्युतप्रयोग करण्यापूर्वी, प्रत्यक्ष पुरविलेली सर्व उपकरणे आणि सर्व 'कनेक्शन' नीट पाहून घेऊन संबंधित कामाची नीटनेटकी कार्ययोजना करण्याची नितांत आवश्यकता आहे आणि ह्यानंतर पुढे काम चालू करण्याविषयी परीक्षकांची परवानगी मिळविणे आवश्यक आहे.
४. सर्व निरीक्षणे कोटकवजा तक्त्यात भरावी. मधल्या सर्व गणना आणि निर्णय हे क्य तितक्या सुवाच्चपणे आणि स्पष्टपणे नोंदविलेले असणे हे हितावह आहे.
५. प्रारंभिक किंवा अंतिम निरीक्षणात संख्यावाचक आकडे एकावर एक लिहू नयेत. जर लिहिलेला कोणताही आकडा नको असेल तर त्यावर एक रेघ ओढून पाहिजे असलेला आकडा त्याच्याजवळ लिहा. प्रयोगशाळेतून बाहेर पडण्यापूर्वी आपले टेबल चांगल्या स्थितीत आहे याची खात्री करा.

INSTRUCTIONS TO CANDIDATES

1. Read the question carefully and perform the experiment as required.
2. If there by anything the apparatus that you do not know, ask the examiner or the laboratory assistant to help you.
3. Before doing any electrical experiment, it is absolutely essential that you make a neat working sketch of all apparatus actually provided and of the necessary connection and obtain the examiner's permission to proceed.
4. Express all observations in a tabular form. It is also desirable that all intermediate calculations and results should be entered as neatly and clearly as possible.
5. No numerical figures should be written over either in the preliminary or final observations. If any figure is shought to be discarded it should be run through and the desired figure written near to it.
6. Please see that your table is in good order before you leave the laboratory.

(येथून लेखनास सुरवात करा.) (Begin writing here.)

प्र. क्र.
Q. No.

Q. 2.

ii] $a_n - 5a_{n-1} + 6a_{n-2} = 7^n$

put $a_n = \alpha^n$

$\alpha^n - 5\alpha^{n-1} + 6\alpha^{n-2} = 0$

$\alpha^{n-2}[\alpha^2 - 5\alpha + 6] = 0$

$\alpha^2 - 5\alpha + 6 = 0$

02 Section | Q. No. | Marks

प्र. क्र. Q. No.

$\therefore \alpha^2 - 3\alpha - 2\alpha + 6 = 0$

$\alpha(\alpha-3) - 2(\alpha-3) = 0$

$(\alpha-3)(\alpha-2) = 0$

$\therefore \alpha = 3, 2$

$\therefore a_n^{(h)} = A_1(3)^n + A_2(2)^n$

To Find P.S.

$P_n = 7^n$

$a_n^p = P(7)^n$

$P(7)^n - 5P(7)^{n-1} + 6P(7)^{n-2} = 7^n$

~~$P(7)^{n-2}$~~ ~~$= P$~~

$7^n \left[P - \frac{5P}{7} + \frac{6P}{7^2} \right] = 7^n$

(8)

$\frac{49P - 35P + 6P}{49} =$ [illegible]

$49P - 35P + 6P = 49$

$20P = 49$

$P = \frac{49}{20}$

$\therefore a_n^h = A_1(3)^n + A_2(2)^n + \frac{49}{20}(7)^n.$

Miss. Pasimal Chandrashekhar Kadam

॥ ज्ञान, विज्ञान आणि सुंसस्कार यासाठी शिक्षण प्रसार ॥
– शिक्षणमहर्षी डॉ. बापूजी साळुंखे

(अधिकारप्रदत्त स्वायत्त)
कोल्हापूर

VIVEKANAND COLLEGE, KOLHAPUR.

(Empowered Autonomous)

BSc-III (Minor)

SUPPLIMENT

Sub: Basi Discrete Mathematics.

Jr. Supervisor's Sign. :	
Students Sign. :	@PKadam
Seat No. :	7754
Seat No. in words :	Seven seven five four
Suppliment No. :	1
	46939
Centre	VCK

03 + 8 + 8 = 19/20

प्र. क्र.
Q. No.

Q.1.

i. C] mn

ii. C] 4

iii. D] 8

Q 03

iv. A] $a_n = (P_1 n^3 + P_2 n^2) 3^n$

04 Sc | 02 Section | Q. No. | Marks

प्र. Q. I | प्र. क्र. Q. No.

Q.2. i) a) Path: A finite walk $u_0e_1u_1e_2 \ldots u_{k-1}e_ku_k$ in which the vertices are distinct repeated edges is called path.

b) Trail : A finite sequence of walk in which can be repeated but distinct edges is called as trail.

b) Adjacency matrix.

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

08

Incidency matrix.

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

Section | Q. No. | Marks

प्र. क्र.
Q. No.

Given that,

$$a_n + 5a_{n-1} + 6a_{n-2} = 42(4^n)$$

2. ii) To find homogeneous solution,

Consider, $f(n) = 0$

$$a_n + 5a_{n-1} + 6a_{n-2} = 0$$

Put $a_n = \alpha^n$

$$\therefore \alpha^n + 5\alpha^{n-1} + 6\alpha^{n-2} = 0$$

$$\therefore \alpha^{n-2}(\alpha^2 + 5\alpha + 6) = 0$$

$$\therefore \alpha^2 + 5\alpha + 6 = 0$$

$$\therefore (\alpha+2)(\alpha+3) = 0$$

$$\therefore \alpha = -2, -3.$$

$$\therefore a_n^{(h)} = A_1(-2)^n + A_2(-3)^n$$

To find particular solution,

$$f(n) = 42(4^n) \qquad \therefore a_n = P(4^n)$$

$$\therefore P(4^n) + 5P(4^{n-1}) + 6P(4^{n-2}) = 42(4^n)$$

$$\therefore (4^n)\left(P + \frac{5P}{4} + \frac{6P}{4^2}\right) = 42(4^n)$$

$$\therefore P + \frac{5P}{4} + \frac{6P}{16} = 42$$

$$\therefore \frac{16P + 20P + 6P}{16} = 42$$

$$\therefore \frac{42P}{16} = 42$$

04	Section	Q. No.											
		Marks											

प्र. क्र.
Q. No.

$\therefore 42P = 42 \times 16$

$P = \frac{42 \times 16}{42}$

$\therefore \boxed{P = 16}$

$\therefore a_n^{(P)} = 16(4^n)$

∴ Total solution is,

$a_n = a_n^{(h)} + a_n^{(P)}$

(8)

$\boxed{a_n = A_1(-2)^n + A_2(-3)^n + 16(4^n)}$

Miss. Parimal Chandrashekhar Kadam.

॥ ज्ञान, विज्ञान आणि सुंसस्कार यासाठी शिक्षण प्रसार ॥

– शिक्षणमहर्षी डॉ. बापूजी साळुंखे

(अधिकारप्रदत्त स्वायत्त)
कोल्हापूर

VIVEKANAND COLLEGE, KOLHAPUR.

(Empowered Autonomous)

BSc-II(Minor)

SUPPLIMENT

Jr. Supervisor's Sign. :	
Students Sign. :	PKadam
Seat No. :	7754
Seat No. in words :	Seven seven Five four
Suppliment No. :	2
	46910
Centre	VCK.

Sub: Discrete Mathematics

प्र. क्र.
Q. No.

Q.3.

i) Statement:

If a graph G has n vertices & e no. of edges, then,

$$\sum_{i=1}^{n} d(v_i) = 2e.$$

OR

Total sum of degree of vertices is twice the no. of ed

Proof:

Let, there be n no of vertices in graph G.
e ~~be~~. be the no. of edges.

04

We know that,

Every edge in graph contributes precisely two to the sum of degree & each loop also contributes tw to the sum of degree.

Q. No

02	Section	Q. No.											
		Marks											

प्र. क्र.
Q. No.

$\therefore \sum_{i=1}^{n} d(v_i) = 2e.$

i.e. Total sum of degree of vertices is twice the no. of edges.

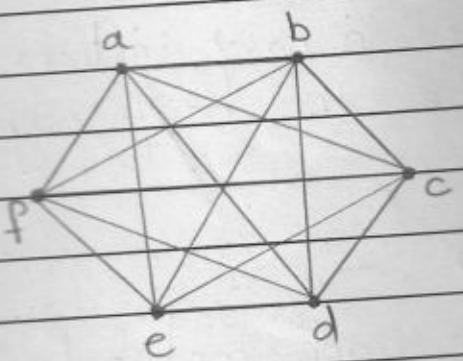
$\therefore$ Handshaking lemma is proved.

ii) $K_{3,4}$

$K_{3,4}$

04

K_6



Section	Q. No.												
	Marks												

प्र. क्र.
Q. No.

Q.3.

iii) Given that,

$$a_{n+2} - 3a_{n+1} + 2a_n = 0$$

Put $a_n = \alpha^n$

$$\therefore \alpha^{n+2} - 3\alpha^{n+1} + 2\alpha^n = 0$$
$$\therefore \alpha^n (\alpha^2 - 3\alpha + 2) = 0$$
$$\therefore \alpha^2 - 3\alpha + 2 = 0$$
$$\therefore (\alpha - 1)(\alpha - 2) = 0$$
$$\therefore \alpha = 1, 2.$$

$$\therefore a_n^{(n)} = A_1 (1)^n + A_2 (2)^n$$

"Education for Knowledge, Science, and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur

(Empowered Autonomous)

DEPARTMENT OF MATHEMATICS

Date: 28/02/2025

B. Sc. II Sem. IV

Notice

Internal Examination 2024-25

All the students of B.Sc. II Sem. IV (Minor Mathematics) are hereby informed that their Internal Examination of Mathematics will be conducted from **28th February, 2025 to 1st March, 2025 in Room No.513.** The examination will be conducted only one time. Syllabus and schedule for examination will be as mentioned in following table.

Sr. No.	Name of Paper, Time and Date	Units
1	**Discrete Mathematics** Monday, 03/03/2025 Time: 2.30 P.M to 3.30	Unit I- Recurrence relation Unit III – Basics of Graph Theory Unit IV – Oaths and Circuits
2	**Integral Transform** TUESDAY 04/03/2025 Time: 2.30 P.M to 3.30.	Unit I –Laplace Transform Unit III – Fourier Transform

Nature Of Question Paper

Time:1 Hour **Marks: 20**

Q.1) Choose the correct alternative. **[04]**

i)

ii)

iii)

iv)

Q.2) Attempt any One of the following. **[08]**

i)

ii)

Q.3) Attempt any Two of the following. **[08]**

i)

ii)

iii)

(Prof. S. P. Thorat)
HEAD
DEPARTMENT OF MATHEMATICS
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

B.Sc. Part- III (Mathematics) (Sem-VI) Internal Examination: February 2024

Subject : Metric Space(DSE1003 F1) **Day and Date : Monday, 24th February 2024**

Marks : 30 **Time : 11:50 PM - 12:50 PM**

Q.1. Select the correct alternative of the following. **[06]**

1. Consider statements:

I) Arbitrary intersection of closed sets is again closed set.

II) Arbitrary union of open sets in open .

A) both statements are true B) both statements are false.

C) only I is true D) only II is true

2. Set A= {1,2,3} is ___ in discrete metric space.

A) infinite B) oscillatory C) closed D) open

3. With usual notation B[2;5] in usual metric space is____.

A) (3,7) B) (-3,7) C) (2,5) D) (5,2)

4. In any metric space limit of a convergent sequence ___.

A) is constant sequence B) are not unique C) unique D) same

5. Every Cauchy sequence in ____ metric space is convergent.

A) usual B) discrete C) any D) both A and B

6. Consider statements:

I) If d1 and d2 are metric on M then show that d1+d2 is again a metric on M.

II) $<\mathbb{R}, \rho>$ forms a metric space where $\rho(x, y) = |x - y|$.

A) both statements are true B) both statements are false.

C) only I is true D) only II is true

Q.2. Attempt any two of the following. **[16]**

1. If a Cauchy sequence has convergent subsequence then show that the sequence itself is convergent.
2. Show that, If $<M_1, \rho_1>$ and $<M_2, \rho_2>$ are two metric spaces $f: M_1 \to M_2$ is continuous function on M_1 if and only if $f^{-1}(G)$ is closed set in M_1 whenever G is closed set in M_2.
3. Show that finite intersection of open sets is open and finite union of closed sets is closed.

Q.3. Attempt any two of the following. **[08]**

1. Show that $<\mathbb{R}^2, \rho>$ forms a metric space where $\rho(x, y) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2}$ for $x = (x_1, x_2), y = (y_1, y_2)$ in $\mathbb{R}^2$.
2. If $<M, \rho>$ is an metric space then show that $<M, \rho'>$ is also metric space where $\rho'(x, y) = \frac{\rho(x,y)}{1+\rho(x,y)}$ for all x, y in M.
3. If $<M_1, \rho_1>$, $<M_2, \rho_2>$ and $<M_3, \rho_3>$ are metric spaces . $f: M_1 \to M_2$, $g: M_2 \to M_3$ be two functions and If f is continuous at $a \in M_1$ and g is continuous at $f(a) \in M_2$ then show that $g \circ f$ is continuous at $a \in M_1$.

Vivekanand College (Empowered Autonomous) Kolhapur.

Department of Mathematics

B.Sc. III (Sem VI) Internal Examination: 2024-25

Subject code DSE1003F3 (Complex Analysis) Day and Date : Thursday,27th February 2025

Total Marks: 30 Time: 11.30am- 12.30pm

Q1. Select the correct alternative.

(1) If $z = -1-i\sqrt{3}$ then arg(z)=----------

a) $\frac{-2\pi}{3}$ b) $\frac{2\pi}{3}$ c) $\frac{\pi}{6}$ d) $\frac{-\pi}{6}$

(2) The function $f(z)=|z|^2$ is ----------

a) continuous everywhere but no where differentiable except at origin.

b) continuous everywhere and differentiable for every z.

c) discontinuous everywhere and differentiable for every z.

d) neither continuous nor differentiable.

(3) Which of the following function f(z) satisfies Cauchy- Riemann equations?

a) $f(z) = \bar{z}$=x- iy b) $f(z)= z^2=x^2 - y^2 + 2ixy$

c) f(z)= xy + iy d) $f(z)=|z|^2$

(4) Which part of the analytic function satisfies Laplace's differential equation?

a) only real part b) only imaginary part

c) both real imaginary part d) none of these.

(5) The function $f(z)=\frac{z^3+4}{(z^2-3)(z^2+1)}$ has singular points are ------

a) $z = \pm\sqrt{3}, z = i$ b) $z = \pm 3, z = \pm i$

c) $z = \pm\sqrt{3}, z = \pm i$ d) $z = \pm\sqrt{3}, z = -1$

(6) The regular function is-------

a) Conformal b) Isomorphic

c) Holomorphic d) Homomorphic

Q2 Attempt any two. [16]

(1) Cauchy Riemann Polar form If f(z) = u+iv be analytic function and $z = re^{i\theta}$ where, u, v, r, θ are all real numbers then show that $\frac{\partial u}{\partial x} = \frac{1}{r}\frac{\partial v}{\partial \theta}$, $\frac{\partial v}{\partial r} = -\frac{1}{r}\frac{\partial u}{\partial \theta}$

(2) If a function f(z)= u+iv is analytic in a domain D then its component function u & v are harmonic in D

(3) Show that an analytic function with constant modulus in a domain is constant. Hence verify that $f(z) = e^{-y}sinx - i\,e^{-y}cosx$

Q3 Attempt any two [8]

(1) Find the harmonic conjugate v(x,y) where u(x,y) = $2x(1-y)$

(2) Show that $e(2\pm 3\pi i)$= $-e^2$

(3) Show that $\log(1-i) = \frac{1}{2}ln2 - \frac{\pi}{4}i$

****

Vivekanand College (Empowered Autonomous Institute) Kolhapur.

Department of Mathematics

B.Sc. III (Sem VI) Internal Examination: February, 2025

Subject Code: DSE1003F4 (Optimization Techniques) Day and Date : Friday,28th February 2025

Total Marks: 30 Time: 11.50am- 12.50pm

Q1. Select the correct alternative. **[06]**

i) The set of all possible solutions of general L.P.P. is called -----

A) objective function B) constraints C) decision variables D) feasible region

ii) If the constraint in the L.P.P. is = type, then we use ----- in Big-M method.

A) only artificial variables B) only surplus variables

C) only slack variables D) both slack and surplus variables

iii) A basic feasible solution for $m \times n$ transportation problem is non-degenerate, if number of occupied cells is -----

A) $> m+n-1$ B) $< m+n-1$ C) $= m+n-1$ D) $= m-n-1$

iv) If total supply from all sources is equal to total demand from all destinations, then transportation problem is -----

A) balanced B) unbalanced C) degenerate D) non-degenerate

v) If the constraint in the L.P.P. is $\leq$ type, then we use ----- in simplex method.

A) only artificial variables B) only surplus variables

C) only slack variables D) both slack and surplus variables

vi) For the L.P.P. in canonical form, all constraints are of ----- type.

A) $\geq$ B) $\leq$ C) $=$ D) $\neq$

Q2 Attempt any two. **[16]**

1) Solve the following L.P.P. by Simplex Method.

Max $Z=3x_1+3x_2+4x_3$, subject to $2x_1+3x_2 \leq 8, 2x_1+2x_2+4x_3 \leq 15, 2x_2+5x_3 \leq 10$, $x_1,x_2,x_3 \geq 0$

2) Solve the following L.P.P. by Big Method.

Min $Z = 7x_1+15x_2+20x_3$,subject to $2x_1+4x_2+6x_3 \geq 24, 3x_1+9x_2+6x_3 \geq 30$, $x_1,x_2,x_3 \geq 0$

3) Find the optimal solution of Transportation problem by using Modified Distribution method.

	D1	D2	D3	D4	Supply
S1	11	13	17	14	250
S2	16	18	14	10	300
S3	21	24	13	10	400
Demand	200	225	275	250	

Q3 Attempt any two **[08]**

(1) Find the initial basic feasible solution of the Transportation problem by using North West Corner method.

	D1	D2	D3	D4	D5	Supply
S1	5	8	6	6	3	8
S2	4	7	7	6	5	5
S3	8	4	6	6	4	9
Demand	4	4	5	4	8	

(2) Find the initial basic feasible solution of the Transportation problem by using Least Cost OR Matrix Minimum method.

	D1	D2	D3	D4	Supply
S1	30	25	40	20	100
S2	29	26	35	40	250
S3	31	33	37	30	150
Demand	90	160	200	50	

3) Find the initial basic feasible solution of the Transformation problem by using Vogel approximation method.

	A	B	C	Supply
F1	5	1	8	15
F2	3	9	6	25
F3	4	2	7	30
F4	7	11	10	20
Demand	18	25	22	

VIVEKANAND COLLEGE, KOLHAPUR (AN EMPOWERED AUTONOMOUS INSTITUTE)

B.Sc. Part- III (Mathematics) (Sem-VI) Internal Examination

Subject:- Linear Algebra Course code:- DSE-1003 F3

Total Marks:-30 Date:-25/03/2025

Q.1) Select correct alternatives [06]

i) $\mathbb{R}(\mathbb{Q})$ is subspace of ____.

a) $\mathbb{C}(\mathbb{R})$ b) $\mathbb{C}(\mathbb{Q})$ c) $\mathbb{R}(\mathbb{R})$ d) $\mathbb{C}(\mathbb{C})$

ii) If u,v are elements of inner product space $V(F)$ and $\alpha \in F$ then, $\overline{(u, \alpha v)}$= _____.

a) $\bar{\alpha}\,\overline{(u, v)}$ b)$(\alpha u, \alpha v)$ c) $\bar{\alpha}(u, v)$ d) $\alpha\,\overline{(u, v)}$

iii) For inner product space $V(F)$, if $(u, v) = 0$ for all $v \in V$ then

a) u = 0 b) v= 0 c) u≠ v ≠ 0 d) u= v = 0

iv) Inner product space over complex field is called ____.

a) Euclidean Space b) Complex space c) unitary space d) quotient space

v) $dim(\{0\})$ =

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

vi) If $T: V \rightarrow W$ *is* homomorphism then $Range(T)$ is_____.

a) subspace of V b) subspace of W c) not subspace d) subspace of T

Q.2) Attempt any two of the following [16]

i) Define inner product space. State and prove Cauchy-Schwartz inequality.

ii) Prove that, Necessary and sufficient condition for a non-empty set W of vector space $V(F)$ to be a subspace is that W is closed under vector addition and scalar multiplication.

iii) Prove that If S is finite subset of vector space $V(F)$ such that $L(S) = V$ then there exist subset of S which forms basis of V.

Q.3) Attempt any two of the following [08]

i) $T: V \rightarrow U$ is homomorphism then kerT ={0} if and only if T is one-one.

ii) Define sum of two subspace. Show that, sum of two subspace is again a subspace.

iii) Obtain orthogonal basis from {(1,0,1), (1,0,-1), (0,3,4)} of $\mathbb{R}^3(\mathbb{R})$.

iv) If V is an inner product space then for any $x, y \in V$ prove that,

i) $||x + y|| \leq ||x|| + ||y||$ ii) $||x+y||^2 + ||x-y||^2 = 2(||x||^2 + ||y||^2)$

Name :- Avishkar Sudesh Kamble
Paper :- Metric Space
Class :- B.Sc-III
Roll no :- 8258

25049

Signature of Jr. Super.

(अधिकारप्रदत्त स्वायत्त)
कोल्हापूर

विवेकानंद कॉलेज, कोल्हापूर. (अधिकरप्रदत्त स्वायत्त)

परीक्षेच्या _____ या विषयाच्या प्रयोग परीक्षा

Practical Examination in, _____

at the _____ Examination

उमेदवराचा आसन क्रमांक _____ विभाग _____
(Candidate's Seat No.) (Section)

उमेदवारांना सूचना

१. प्रश्न काळजीपूर्वक वाचा आणि त्याप्रमाणे विचारलेला प्रयोग करा.
२. उपकरणांच्या वापराबाबत तुम्हांला काही माहीत नसेल तर परीक्षक किंवा प्रयोगशाळा सहाय्यक यांना तुम्हाला मदत करण्याविषयी विनंती करा.
३. कोणताही विद्युतप्रयोग करण्यापूर्वी, प्रत्यक्ष पुरविलेली सर्व उपकरणे आणि सर्व 'कनेक्शन' नीट पाहून घेऊन संबंधित कामाची नीटनेटकी कार्ययोजना करण्याची नितांत आवश्यकता आहे आणि ह्यानंतर पुढे काम चालू करण्याविषयी परीक्षकांची परवानगी मिळविणे आवश्यक आहे.
४. सर्व निरीक्षणे कोटकवजा तक्त्यात भरावी. मधल्या सर्व गणना आणि निर्णय हे क्य तितक्या सुवाच्चपणे आणि स्पष्टपणे नोंदविलेले असणे हे हितावह आहे.
५. प्रारंभिक किंवा अंतिम निरीक्षणात संख्यावाचक आकडे एकावर एक लिहू नयेत. जर लिहिलेला कोणताही आकडा नको असेल तर त्यावर एक रेघ ओढून पाहिजे असलेला आकडा त्याच्याजवळ लिहा. प्रयोगशाळेतून बाहेर पडण्यापूर्वी आपले टेबल चांगल्या स्थितीत आहे याची खात्री करा.

INSTRUCTIONS TO CANDIDATES

1. Read the question carefully and perform the experiment as required.
2. If there by anything the apparatus that you do not know, ask the examiner or the laboratory assistant to help you.
3. Before doing any electrical experiment, it is absolutely essential that you make a neat working sketch of all apparatus actually provided and of the necessary connection and obtain the examiner's permission to proceed.
4. Express all observations in a tabular form. It is also desirable that all intermediate calculations and results should be entered as neatly and clearly as possible.
5. No numerical figures should be written over either in the preliminary or final observations. If any figure is shought to be discarded it should be run through and the desired figure written near to it.
6. Please see that your table is in good order before you leave the laboratory.

(येथून लेखनास सुरवात करा.) (Begin writing here.)

प्र. क्र. Q. No.	54 18+8 = 29/30
Q.1.	5 Both statements are true
1.	A) ~~Arbitary intersection of closed sets is again closed set~~
2.	c) closed
3.	B) (-3,7)
4.	c) Unique
5.	B) Discrete
6.	A) both statements are true

02 Section | Q. No. | Marks

प्र. क्र. Q. No.

Q.2. 1)

Let $\{S_n\}_{n=1}^{\infty}$ be Cauchy sequence. in $\langle \mathbb{R}, S \rangle$ metric spa
Let $\{S_{nk}\}_{n=1}^{\infty}$ be convergent subsequence of ~~metri~~ Cauchy sequence.

i.e $\{S_{n_k}\} \longrightarrow l$ as $n \to \infty$.

for any $\epsilon_1 > 0$ $\exists$ $N_1 \in \mathbb{N}$ s.t

$S(S_{nk}, l) < \epsilon_1 \quad \forall \quad n \geq N_1$ ——— (1)

Now,

Since $\{S_n\}$ is Cauchy seqn.

for any $\epsilon_2 > 0$ $\exists$ $N_2 \in \mathbb{N}$

$S(S_n, S_m) < \epsilon_2 \quad \forall \quad m, n \geq N_2$ ——— (2)

$S(S_n, l) \leq S(S_n, S_{nk}) + S(S_{nk}, l)$

$N = \max\{N_1, N_2\}$

$S(S_n, l) \leq \epsilon_2 + \epsilon_1 = \epsilon$

$S(S_n, l) < \epsilon$

$\Rightarrow$ Cauchy sequence has convergent subsequence then the sequence itself is convergent

i.e $\lim_{n \to \infty} S_n = l$

where $\{S_n\}_{n=1}^{\infty}$ is Cauchy sequence.

क्र. No. 2.

Given, $\langle M_1, S_1 \rangle$, $\langle M_2, S_2 \rangle$ are two metric spaces.

$f: M_1 \to M_2$ is continuous function.

Let G is closed set in M_2

2) (1) Let G' be open set in M_2 ——— (1)

as f is continuous function then we know that, "f" is continuous iff inverse image of open set is open.

$\Longrightarrow$ $f^{-1}(G')$ be open set in M_1

then $[f^{-1}(G')]'$ be closed set in M_1

Consider,

$$G \cup G' = M_2$$

$$f^{-1}(G) \cup f^{-1}(G') = M_1,$$

$$\Longrightarrow f^{-1}(G) = [f^{-1}(G')]$$

by e. (1)

inverse image of closed set is closed.

(2) Conversly,

$f^{-1}(G)$ is closed in M_1

& G is closed set in M_2

now, we have to show that "f" is continuous.

Let G' be open set in M_2.

Consider,

$$G \cup G' = M_2$$

$$f^{-1}(G) = f^{-1}(G) = M_1$$

$$f^{-1}(G') = [f^{-1}(G)]^{-1}$$

$\Longrightarrow$ $f^{-1}(G)$ is closed in M_1

$\Longrightarrow$ $[f^{-1}(G')]^{-1}$ is open in M_1

$\Longrightarrow$ $f^{-1}(G')$ is open in M_1

then we know, "f" is continuous iff inverse image of open

प्र. क्र. Q. No.

set is open.

$\Rightarrow$ "f" is continuous function

Q.3.

3. $\langle M_1, S_1 \rangle$, $\langle M_2, S_2 \rangle$ & $\langle M_3, S_3 \rangle$ are metric spaces.

$f: M_1 \to M_2$, $g: M_2 \to M_3$ be two functions and.

f is continuous at $a \in M_1$

for any $\epsilon_1 > 0$ $\exists$ $\delta_1 > 0$ s.t

$S_2(f(x), f(a)) < \epsilon_1$ whenever $0 < S_1(x, a) < \delta_1$ ——— (1)

g is continuous at $f(a) \in M_2$

for any $\epsilon_2 > 0$ $\exists$ $\delta_2 > 0$ s.t

$S_3[g(f(x)), g(f(a))] < \epsilon_2$ whenever ~~$S_2(f(x), f(a)) < \epsilon$~~

$0 < S_2(f(x), f(a)) < \delta_2$ ——— (2)

if $\delta_2 = \epsilon_1$

then $0 < S_2(f(x), f(a)) < \epsilon_1$

then by eqn (1)

for any $\epsilon_2 > 0$ $\exists$ $\delta_1 > 0$ s.t

$S_3[g(f(x)), g(f(a))] < \epsilon_2$ whenever

$S_1(x, a) < \delta_1$

$\Rightarrow$ gof is continuous at $a \in M_1$

Roll no :- 8258

(अधिकारप्रदत्त स्वायत्त)
कोल्हापूर

Signature of Jr. Super.

विवेकानंद कॉलेज, कोल्हापूर. (अधिकरप्रदत्त स्वायत्त)

_____ परीक्षेच्या _____ या विषयाच्या प्रयोग परीक्षा

Practical Examination in, _____

at the _____ Examination

उमेदवराचा आसन क्रमांक _____ विभाग _____
(Candidate's Seat No.) (Section)

उमेदवारांना सूचना

१. प्रश्न काळजीपूर्वक वाचा आणि त्याप्रमाणे विचारलेला प्रयोग करा.
२. उपकरणांच्या वापराबाबत तुम्हांला काही माहीत नसेल तर परीक्षक किंवा प्रयोगशाळा सहाय्यक यांना तुम्हाला मदत करण्याविषयी विनंती करा.
३. कोणताही विद्युतप्रयोग करण्यापूर्वी, प्रत्यक्ष पुरविलेली सर्व उपकरणे आणि सर्व 'कनेक्शन' नीट पाहून घेऊन संबंधित कामाची नीटनेटकी कार्ययोजना करण्याची नितांत आवश्यकता आहे आणि ह्यानंतर पुढे काम चालू करण्याविषयी परीक्षकांची परवानगी मिळविणे आवश्यक आहे.
४. सर्व निरीक्षणे कोटकवजा तक्त्यात भरावी. मधल्या सर्व गणना आणि निर्णय हे क्य तितक्या सुवाच्चपणे आणि स्पष्टपणे नोंदविलेले असणे हे हितावह आहे.
५. प्रारंभिक किंवा अंतिम निरीक्षणात संख्यावाचक आकडे एकावर एक लिहू नयेत. जर लिहिलेला कोणताही आकडा नको असेल तर त्यावर एक रेघ ओढून पाहिजे असलेला आकडा त्याच्याजवळ लिहा. प्रयोगशाळेतून बाहेर पडण्यापूर्वी आपले टेबल चांगल्या स्थितीत आहे याची खात्री करा.

INSTRUCTIONS TO CANDIDATES

1. Read the question carefully and perform the experiment as required.
2. If there by anything the apparatus that you do not know, ask the examiner or the laboratory assistant to help you.
3. Before doing any electrical experiment, it is absolutely essential that you make a neat working sketch of all apparatus actually provided and of the necessary connection and obtain the examiner's permission to proceed.
4. Express all observations in a tabular form. It is also desirable that all intermediate calculations and results should be entered as neatly and clearly as possible.
5. No numerical figures should be written over either in the preliminary or final observations. If any figure is shought to be discarded it should be run through and the desired figure written near to it.
6. Please see that your table is in good order before you leave the laboratory.

(येथून लेखनास सुरवात करा.) (Begin writing here.)

प्र. क्र.
Q. No.

$\langle M, S' \rangle$ is a metric space

define $S : S' \times S' \longrightarrow \mathbb{R}^+ \cup \{0\}$

3. defined by $S'(x,y) = \dfrac{S(x,y)}{1+S(x,y)} \quad \forall \quad x, y \in M.$

2)

(1) $S'(x,x) = \dfrac{S(x,x)}{1+S(x,y,x)}$

but $S(x,x) = 0$

$\Longrightarrow \quad = 0 \quad \forall \quad x \in M$

02 Section | Q. No. | Marks

प्र. क्र. Q. No.

(2) $s'(x,y) = \dfrac{s(x,y)}{1+s(x,y)} \quad \forall \quad x,y \in M$

$= \dfrac{s(y,x)}{1+s(y,x)}$

$\longrightarrow \quad s'(x,y) = s(y,x) \quad \forall \quad x,y \in M$

(3) $s'(x,y) = \dfrac{s(x,y)}{1+s(x,y)}$

since $s(x,y) > 0$

$\Longrightarrow s(x,y) = \dfrac{s(x,y)}{1+s(x,y)} > 0$

$\forall \quad x,y \in M$

$\Longrightarrow \quad s(x,y) > 0 \quad \forall \quad x,y \in M$

(4) $s'(x,y) = \dfrac{s(x,y)}{1+s(x,y)}$

$s'(x,y) \leq s(x,z) + s(z,y)$ [$\because$ triangle inequality] $\forall \quad x,y,z \in M$

$1 + s'(x,y) \leq s(x,z) + s(z,y) + 1$

$s'(x,y) \leq \dfrac{s(x,z) + s(z,y)}{1 + s(x,z) + s(z,y)}$

क्र. No.

$$s'(x,y) \leq \frac{s(x,z)}{1+s(x,z)} + \frac{s(z,y)}{1+s(z,y)}$$

$$s'(x,y) \leq s(x,z) + s(z,y) \quad \forall\ x,y,z \in M$$

from (1), (2), (3) & (4)
$s'(x,y)$ is forms metric space.

2.

3) let A & B two open sets in $\langle M, s \rangle$ metric space.

let ~~$x \in A \cup$~~
$x \in A \cap B$

$\Longrightarrow$ $x \in A$ and B

since A & B are open sets

$\exists\ r > 0$ s.t

$B[x,r] \subseteq A$ and $B[x,r] \subseteq B$

$B[x,r] \subseteq A$ and B

$\Longrightarrow$ $B[x,r] \subseteq A \cap B$

$\Longrightarrow$ finite intersection of open sets is open.

4) let A & B two closed sets in $\langle M, s \rangle$ metric spa

let $x \in \overline{A \cup B}$

$\Longrightarrow$ x is limit point in $A \cup B$

$\exists\ \{x_n\}_{n=1}^{\infty}$ which converges to x.

i.e $\{x_n\}_{n=1}^{\infty}$, $x_n \longrightarrow x$ as $n \longrightarrow \infty$

$\{x_n\}_{n=1}^{\infty}$ must have subsequence $\{x_{n_k}\}$ in A or B

clearly, $\{s_{n_k}\}$ converges to x as $n \to \infty$ in A or B

then say $\{x_{n_k}\} \longrightarrow x$ as $n \to \infty$ in A or B

04	Section	Q. No.												
		Marks												

प्र. क्र.
Q. No.

$x \in \overline{A}$ or $\overline{B}$

$x \in A$ or B.

$x \in A \cup B$

$\overline{A \cup B} \subseteq A \cup B$

$\Rightarrow$ finite union of closed set is closed.

VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

DEPARTMENT OF COMMERCE

NOTICE Date:- 17th March , 2025

All the students of B. Com-I are hereby informed that as a part of Continuous internal evaluation online tests of various subjects are going to be conducted as per the following schedule. link of test will be shared on official telegram channel before 5 minutes. Attempt the online test without fail otherwise absent student will be responsible for their education loss

(B. Com-I)

Group- A (Major Accountancy Minor Business Administration)

Sr. No.	Course Title	Date	Time
1	Accountancy- II (Financial Accounting-I I)	20/03/2025	9:30am to 10:00am
2	Business Administration-I I (Principles of Business Management- II)	20/03/2025	10:30am to 11:00 am
3	Business Economics- II	21/03/2025	9:30am to 10:00am
4	Business Mathematics-I I	21/03/2025	10:30am to 11:00 am
5	Business Statistics- II	22/03/2025	9:30am to 10:00am
6	English for Business Communication- II	22/03/2025	10:30am to 11:00 am

Group- B (Major Business Administration Minor Economics)

Sr. No.	Course Title	Date	Time
1	Accountancy- II (Financial Accounting- II)	20/03/2025	9:30am to 10:00am
2	Business Administration- II (Principles of BusinessManagement- II)	20/03/2025	10:30am to 11:00 am
3	Business Economics- II	21/03/2025	9:30am to 10:00am
4	Marathi- II Hindi- II STD- II	21/03/2025	10:30am to 11:00 am
5	Business Statistics- II	22/03/2025	9:30am to 10:00am
6	English for Business Communication- II	22/03/2025	10:30am to 11:00 am

Mr. Sunny S. Kale
HEAD
DEPARTMENT OF COMMERCE
VIVEKANAND COLLEGE, KOLHAPUR

VIVEKANAND COLLEGE, KOLHAPUR (AN EMPOWERED AUTONOMOUS INSTITUTE) B. Com. I Sem II

Business Mathematics- II

Day: Friday
Date: 21/03/2025

* Indicates required question

1. Email *

2. NAME: *

3. ROLL NO.: *

4. Email *

5. MOBILE NO.: *

6. Q.1 *

A feasible solution is said to be ..... if it minimizes the total transportation cost.

A) basic feasible solution B) optimal solution

C) dummy row D) none of these

Mark only one oval.

- A
- B
- C
- D

7. Q.2 *

The transportation problem is said to be balanced if total supply from all the sources is ..... total demand from all the destination.

A) less than equal to B) grater than equal to c) not equal to D) equal to

Mark only one oval.

- A
- B
- C
- D

8. Q.3 *

A basic feasible solution in which number of occupied cells or allocations is less than..... is called as degenerate basic feasible solution.

A) $m-n+1$ B) $m+n+1$ C) $m-n-1$ D) $m+n-1$

Mark only one oval.

- A
- B
- C
- D

9. Q.4 *

$C(n,0)+C(n,1)+C(n,2)+\cdots+C(n,n)=$.....

A) 2^n-1 B) n^2 C) 2^n-2 D) 2^n

Mark only one oval.

- A
- B
- C
- D

10. Q.5 *

In how many ways can 8 friends sit around a circular table?

A) 4050 B) 5041 C) 5040 D) 4051

Mark only one oval.

- A
- B
- C
- D

11. Q.6 *

Total number of proper positive divisors of 20 =.....

A) 4 B) 6 C) 3 D) 2

Mark only one oval.

- A
- B
- C
- D

12. Q.7 *

$\int_0^1 2x + k = 0$ then value of k =.....

A) 1 B) -1 C) 2 D) -2

Mark only one oval.

- A
- B
- C
- D

13. Q.8 *

$\int_4^9 \frac{dx}{x^{\frac{3}{2}}}$ =.....

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

Mark only one oval.

- A
- B
- C
- D

14. Q.9 *

$\int \log x =$.....

A) $x(1-\log x)+c$ B) $(1-\log x)+c$ C) $x(\log x-1)+c$ D) $(\log x-1)+c$

Mark only one oval.

- A
- B
- C
- D

15. Q.10 *

If $\frac{dy}{dx} < 0$ then $y = f(x)$ is.....

A) a increasing function B) a decreasing function

C) neither increasing nor decreasing D) none of these

Mark only one oval.

- A
- B
- C
- D

16. Q.11 *

$\int e^{2x}\, dx =$.....

A) $\frac{e^x}{2}+c$ B) $\frac{e^{2x}}{2}+c$ C) $2e^{2x}+c$ D) e^x+c

Mark only one oval.

- A
- B
- C
- D

17. Q.12 *

The cost function is given by $C = 2 + 3x + x^2$ when x is the number of articles produced then average cost is .....

A) $\frac{20}{3}$ B) $\frac{3}{20}$ C) $\frac{1}{20}$ D) $\frac{1}{3}$

Mark only one oval.

- A
- B
- C
- D

18. Q.13 *

If $f(x) = x^3 - 2x^2 + x + 10$ then minimum value of the function is .....

A) 2 B) 9 C) 8 D) 10

Mark only one oval.

- A
- B
- C
- D

19. Q.14 *

The gradient of the curve $y = 3x^2 + 5x + 2$ at the point $x = 2$ is .....

A) 17 B) 15 C) 13 D) 19

Mark only one oval.

- A
- B
- C
- D

20. Q.15 *

If $x = \frac{1}{3}t^3 - 3t^2 + 5t$ then $\frac{d^2y}{dx^2}$ =..... at $t = 2$.

A) -1 B) 2 C) -1 D) -2

Mark only one oval.

- A
- B
- C
- D

21. Q.16 *

If $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ then $\frac{dy}{dx}$ =.....

A) $\left(\frac{y}{x}\right)^{\frac{1}{3}}$ B) $\left(\frac{y}{x}\right)^{3}$ C) $\left(\frac{x}{y}\right)^{3}$ D) $-\left(\frac{y}{x}\right)^{\frac{1}{3}}$

Mark only one oval.

- A
- B
- C
- D

22. Q.17 *

If $y = \frac{1}{v}$ then, $\frac{dy}{dx}$ =.....

A) $-\frac{1}{v^2} \cdot \frac{dv}{dx}$ B) $-\frac{1}{v} \cdot \frac{dv}{dx}$ C) $\frac{1}{v^2} \cdot \frac{dv}{dx}$ D) $\frac{1}{v} \cdot \frac{dv}{dx}$

Mark only one oval.

- A
- B
- C
- D

23. Q.18 *

If $y = \log(x + x^2)$ then $\frac{dy}{dx}$ =.....

A) $\frac{1+2x^2}{x+x^2}$ B) $\frac{1+x^2}{x+x^2}$ C) $\frac{1+2x}{x+x^2}$ D) $\frac{x+2x^2}{x+x^2}$

Mark only one oval.

- A
- B
- C
- D

24. Q.19 *

If $x = at^2$, $y = \frac{a}{t}$ then $\frac{dy}{dx}$ =.....

A) $\frac{y}{2x}$ B) $\frac{x}{2y}$ C) $-\frac{y}{2x}$ D) $-\frac{x}{2y}$

Mark only one oval.

- A
- B
- C
- D

25. Q.20 *

If $y = (\log x)^x$ then $\frac{dy}{dx}$ =.....

A) $\left[\frac{1}{\log x} + \log(\log x)\right](\log x)^x$

B) $\left[\frac{1}{\log x} + \log(\log x)\right]$

C) $\left[\frac{1}{\log(\log x)} + \log x\right](\log x)^x$

D) $\left[\frac{1}{\log(\log x)} + \log x\right]$

Mark only one oval.

- A
- B
- C
- D