I & 1st

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586 103

DEPARTMENT OF MATHEMATICS

First Internal Assessment

Sem: I **Sub:** Algebra-I and Calculus-I **(DSC1)** **Code:** 21BSC1C1MAT1L

Date: 05 – 01 -2024 **Time:** 1:30 PM – 2:30 PM **Max. Marks:** 30

Q.No.1. Answer Any Three Questions 2×3=6

a) Find the rank of a matrix $A = \begin{bmatrix} 2 & 1 & -1 \\ 0 & 3 & -2 \\ 2 & 4 & -3 \end{bmatrix}$.

b) If φ for the curve $r = ae^{b\theta}$.

c) If $f(x) = \begin{cases} \frac{x}{|x|} & \text{when } x \neq 0 \\ 0 & \text{when } x = 0 \end{cases}$, then show that $f(x)$ is discontinuous at x=0.

d) Find the nth derivative of e^{ax+b}.

Q.No.2. Answer Any Three Questions 4×3=12

a) Verify the Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$ and hence find A^{-1}.

b) Write a matrix $\begin{bmatrix} 1 & 2 & 4 \\ -1 & 5 & 3 \\ -1 & 6 & 3 \end{bmatrix}$ as the sum of symmetric and skew symmetric matrix.

c) Derive the expression for angle between the radius vector and tangent at any point on the curve.

d) Find the pedal equation of the curve $r = a(1 - cos\theta)$.

Q.No.3. Answer Any Three Questions 4×3=12

a) If $\lim_{x\to a} f(x) = l$ and $\lim_{x\to a} g(x) = m$, then prove that $\lim_{x\to a}[f(x) * g(x)] = l * m$.

b) If a function $f(x)$ is continuous in $[a, b]$, then show that it is bounded in $[a, b]$.

c) State and prove Leibnitz's theorem.

d) Find the nth derivative of $\frac{x}{(x-a)(x-b)}$.

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586 103

DEPARTMENT OF MATHEMATICS

First Internal Assessment

Sem: III | **Sub:** Ordinary Differential Equations and Real Analysis – I **(DSC)** | **Code:** 21BSC3C3MAT1L

Date-03- 01-2024 | **Time:** 1:30 PM – 2:30 PM | **Max. Marks:** 30

Q.No.1. Answer Any Three Questions **2×3=6**

a) Solve $(4x+3y+1)dx+(3x+2y+1)dy=0$.

b) Solve $(D^2-9)y=0$.

c) Define oscillatory sequence. With an example.

d) Show that the series $1^2+2^2+3^2+\cdots+n^2+\cdots$ diverges to $+\infty$.

Q.No.2. Answer Any Three Questions **4×3=12**

a) State and prove necessary and sufficient condition for the equation to be exact.

b) Solve$(3x^2+6xy^2)dx+(6x^2y+4y^3)dy=0$.

c) With usual notation prove that $\frac{1}{f(D)}e^{ax}=\frac{1}{f(a)}e^{ax}$, if $f(a)\neq 0$.

d) Solve $(D^3+D^2+4D+4)y=0$.

Q.No.3. Answer Any Three Questions **4×3=12**

a) If $\lim_{n\to\infty} a_n=a, \lim_{n\to\infty} b_n=b$ then prove that $\lim_{n\to\infty} a_n+b_n=a+b$.

b) If $\lim_{n\to\infty} a_n=l, \lim_{n\to\infty} b_n=m$ then prove that $\lim_{n\to\infty}(a_n\, b_n)=lm$.

c) State and prove p-series test.

d) Test the convergence $\frac{1}{3.7}+\frac{1}{4.9}+\frac{1}{5.11}+\frac{1}{6.13}$

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586 103

DEPARTMENT OF MATHEMATICS

First Internal Assessment

Sem: III **Sub:** Ordinary Differential Equations **(OEC)** **Code:** 21BSC303MAT3-A

Date: 06 – 01 – 2024 **Time:** 1:30 PM – 2:30 PM **Max. Marks: 30**

Q.No.1. Answer Any Three Questions $2\times3=6$

a) Define Ordinary Differential Equation.

b) Solve $p^2 - 5p - 6 = 0$.

c) Solve $p^2 + p = 6$.

d) Solve $(D^2 - 4)y = 0$

Q.No.2. Answer Any Two Questions $4\times2=8$

a) State and prove Necessary condition for exact differential equation.

b) Solve $(3x^2 + 6xy^2)dx + (6x^2y + 4y^3)dy$.

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

Q.No.3. Answer Any Two Questions $4\times2=8$

a) Solve $p^2 + p(x + y) + xy = 0$.

b) Solve $x^2p^2 = 6y^2$.

c) Solve $yp^2 - (1 + xy)p + x = 0$.

Q.No.3. Answer Any Two Questions $4\times2=8$

a) Solve $(D^3 + D^2 + 4D + 4)y = 0$

b) Solve $(D^3 - 6D^2 + 11D - 6)y = 0$

c) With usual notation prove that $\frac{1}{f(D)}e^{ax} = \frac{1}{f(a)}e^{ax}$, if $f(a) \neq 0$

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586 103

DEPARTMENT OF MATHEMATICS

First Internal Assessment Jan-2024

Sem: V **Sub:** Real Analysis – II and Complex Analysis **Code:** 21BSC5C5MATMJ1L

Date: 04 - 01 - 2024 **Time:** 3:00 PM – 4:00 PM **Max. Marks:** 30

Q.No.1. Answer any three of the following. 2×3=6

a) Define upper and lower Riemann sum.

b) Find the convergence of $\int_1^\infty \frac{dx}{x^{3/2}}$.

c) Check whether the given function $f(z) = x^2 + y^2 + ixy$ is analytic or not.

d) State Cauchy's integral theorem and evaluate $\oint_C \frac{dz}{z-a}$ where C is the circle $|z-a| = r$.

Q.No.2. Answer any three of the following. 4×3=12

a) Find $L(P,f)$ and $U(P,f)$ for the function defined by $f(x) = x^2$ on $[0,1]$ and $P = \{0, \frac{1}{4}, \frac{2}{4}, \frac{3}{4}, 1\}$.

b) State and prove necessary and sufficient condition for R-integrability.

c) The improper integral $\int_a^b \frac{dx}{(x-a)^n}$ is convergent if $n < 1$, divergent if $n \geq 1$.

d) Test the convergence of $\int_0^1 \frac{dx}{\sqrt{x^2+x}}$.

Q.No.3. Answer any three of the following. 4×3=12

a) Find the harmonic conjugate of $u = cosx\, coshy$ and also show that u is harmonic.

b) State and prove necessary condition for a function to be analytic.

c) State and prove Cauchy's integral formula.

d) Evaluate $\oint_C \frac{z-1}{(z+1)(z-2)} dz$ where $C: |z-i| = 2$.

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586 103

DEPARTMENT OF MATHEMATICS

First Internal Assessment Jan-2024

Sem: V **Sub:** Vector Integration and Analytical Geometry **Code:** 21BSC5C5MATMJ2L

Date: 05 – 01 – 2024 **Time:** 12:00 Noon – 1:00 PM **Max. Marks: 30**

Q.No.1. Answer any three of the following. 2×3=6

a) Define derivative of a vector function.

b) Define vector line integral.

c) Define sphere and write the different forms of sphere.

d) Define Cone.

Q.No.2. Answer any three of the following. 4×3=12

a) If $\overrightarrow{A(t)}$ and $\overrightarrow{B(t)}$ are two differential vector functions of a scalar variable t, then prove that $\frac{d}{dt}\{\overrightarrow{A(t)}\,\overrightarrow{B(t)}\}=\overrightarrow{A(t)}\frac{d}{dt}\overrightarrow{B(t)}+\overrightarrow{B(t)}\frac{d}{dt}\overrightarrow{A(t)}$.

b) Prove that the necessary and sufficient condition for $\overrightarrow{f(t)}$ to be constant $\frac{d\vec{f}}{dt}=0$.

c) State and prove Green's theorem in the plane.

d) Verify Green's theorem in the plane for $\oint_C (xy+y^2)dx+x^2dy$ where C is the closed curve made up of $y=x$ and $y=x^2$.

Q.No.3. Answer any three of the following. 4×3=12

a) Prove that the equation $ax^2+ay^2+az^2+2ux+2vy+2wz+d=0$ represents a sphere and find its center and radius.

b) Show that the spheres $x^2+y^2+z^2=25$ and $x^2+y^2+z^2-18x-24y-4z+225=0$ touch externally and find the co-ordinates of their common point.

c) Find the equation of cone with vertex at the origin is homogenous in x,y,z of the type

$$ax^2+by^2+cz^2+2fyz+2gzx+2hxy+ux_1+vy_1+\ wz_1+d=0$$

d) Find the equation of the cone given vertex $v(1,1,3)$ which passes through ellipse $4x^2+z^2=1$ and $y=4$.

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586103

DEPARTMENT OF MATHEMATICS

Second Internal Assessment

Sem: I | Sub: Algebra-I and Calculus-I (DSC1) | Code: 21BSC1C1MAT1L

Date: 13 - 02-2024 | Time: 1:30 PM – 2:30 PM | Max. Marks: 30

Q.No.1. Answer Any Three Questions $2\times3=6$

a) Write any four properties of eigen values of square matrix.

b) If φ for the curve $r^2 cos2\theta = a^2$.

c) State Rolle's Theorem.

d) Find the n[th] derivative of $\log x^2 - 4x + 4$.

Q.No.2. Answer Any Three Questions $4\times3=12$

a) Find the inverse of the matrix by elementary transformation

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

b) Solve the system of equation by elementary transformation

$3x + y + 2z = 3, 2x - 3y - z = -3$, $x + 2y + z = 4$.

c) Derivatives of Arc in Cartesian form .

d) Show that the pedal equation of the circle $x^2 + y^2 = 2ax$.

Q.No.3. Answer Any Three Questions $4\times3=12$

a) State and Prove Cauchy's Mean Value Theorem.

b) Verify Rolle'stheorem for$f(x) = x^2 - 6x + 8$. in [2,4].

c) Find the n[th] derivative of $sinx * sin2x * sin3x$.

d) If $y = \sin(m \sin^{-1} x)$, then S.T

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

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586103

DEPARTMENT OF MATHEMATICS

Second Internal Assessment

Sem: III | Sub: Ordinary Differential Equations and Real Analysis - I(DSC) | Code: 21BSC3C3MAT1L

Date-10- 02-2024 | Time: 1:30 PM - 2:30 PM | Max. Marks: 30

Q.No.1. Answer Any Three Questions $2\times3=6$

a) Solve $p^2 - 5p - 6 = 0$.

b) Find the complimentary function of $(D^2 - 2D + 1)y = \cos 3x$.

c) Prove that the sequence $\left\{\frac{n}{n+1}\right\}$ is monotonic increasing sequence.

d) State Raabe's test .

Q.No.2. Answer Any Three Questions $4\times3=12$

a) Solve $(x^2y - 2xy^2)dx - (x^3 - 3x^2y)dy = 0$.

b) Solve $p^2 + p(x + y) + xy = 0$.

c)Derive the condition for integrability of total differential equation $Pdx + Qdy + Rdz = 0$.

d)Solve $(D^2 + 1)y = x \sin 2x$.

Q.No.3. Answer Any Three Questions $4\times3=12$

a) State and prove cauchys second theorem on limits.

b) Prove that the sequence $\{a_n\}$ where $a_n = \frac{1}{n+1} + \frac{1}{n+2} + \frac{1}{n+3} + \cdots + \frac{1}{2n}$ is convergent and its limit lies between $\frac{1}{2}$ and 1

c) State and prove D'Alembert's test.

d) Test the convergence $\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \frac{x^6}{5\sqrt{4}} \cdots$

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586103

DEPARTMENT OF MATHEMATICS

Second Internal Assessment

Sem: III **Sub:** Ordinary Differential Equations **(OEC)** **Code:** 21BSC303MAT3-A

Date: 13-02-2023 **Time:** 12:00 PM – 1:00 PM **Max. Marks: 30**

Q.No.1. Answer Any Three Questions $2\times3=6$

a) Solve $(D^2+1)y=1$.

b) Define differential equation. What are the types of differential equation.

c) Define Exact differential equation.

d) Define Singular solution.

Q.No.2. Answer Any Two Questions $4\times2=8$

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

b) Solve $(D^2+2D+1)y=x\cos x$.

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

Q.No.3. Answer Any Two Questions $4\times2=8$

a) Solve $(xy^2+2x^2y^3)dx+(x^2y+x^3y^2)dy=0$.

b) Solve $(3xy-2ay^2)dx+(x^2-2ayx)dy=0$.

c) Solve $(x^2+y^2+2x)dx+2ydy=0$.

Q.No.4. Answer Any Two Questions $4\times2=8$

a) Solve $y=2px+p^4x^2$.

b) Reduce the equation $(px-y)(x-yp)=2p$ to clairuts form by using substitutions $x^2=u$ and $y^2=v$ and then solve.

c) Show that the family of parabolas $y^2=4a(x+a)$ is self orthogonal.

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586103

DEPARTMENT OF MATHEMATICS

Second Internal Assessment Feb-2024

Sem: V   **Sub:** Real Analysis – II and Complex Analysis   **Code:** 21BSC5C5MATMJ1L

Date: 12 – 02 – 2024   **Time:** 3:00 PM – 4:00 PM   **Max. Marks:** 30

Q.No.1. Answer any three of the following. $2\times3=6$

a) State Fundamental theorem of integral calculus.

b) Evaluate $\int_0^1 x^8(1-x)^7$.

c) Define harmonic function with an example.

d) Define bilinear transformation.

Q.No.2. Answer any three of the following. $4\times3=12$

a) If $f(x)$ and $g(x)$ are bounded and R-integrable in $[a,b]$, then prove that $f(x)g(x)$ is R-integrable in $[a,b]$.

b) Using first mean value theorem prove that $\int_0^\pi \frac{x^2}{5+3cosx}dx$ lies between $\frac{\pi^3}{24}$and $\frac{\pi^3}{6}$.

c) State and prove Abel's test for the convergence of an improper integral.

d) Prove that $\int_0^1 x^{m-1}(1-x)^{n-1}\,dx = 2\int_0^{\frac{\pi}{2}} sin^{2m-1}x\, cos^{2n-1}x\, dx$.

Q.No.3. Answer any three of the following. $4\times3=12$

a) Prove that an analytic function with constant modulus is constant.

b) Find the analytic function where $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$

c) Find the bilinear transformation which maps $z = 1,\ i, -1$ into $w = i, 0, -i$.

d) Discuss the transformation $w = e^z$.

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586103

DEPARTMENT OF MATHEMATICS

Second Internal Assessment Feb-2024

Sem: V **Sub:** Vector Integration and Analytical Geometry **Code:** 21BSC5C5MATMJ2L

Date: 13 – 02 – 2024 **Time:** 12:00 Noon – 1:00 PM **Max. Marks:** 30

Q.No.1. Answer any three of the following. 2×3=6

a) Define Curl of a vector function.

b) State Stokes theorem.

c) Prove that $\nabla * \nabla \emptyset = \nabla^2 \emptyset$.

d) Show that the planes $2x - 4y + 3z + 5 = 0 \; and \; 10x + 11y + 8z - 17 = 0$ are perpendicular.

Q.No.2. Answer any three of the following. 4×3=12

a) If a vector function $\vec{F}$ has a continuous second order partial derivate, then prove that $\nabla \left(\nabla \times \vec{F}\right) = 0$.

b) If $\emptyset = x^3 + y^3 + z^3 - 3xyz$, then find i) div(grad $\emptyset$) ii) curl(grad $\emptyset$).

c) State and prove Gauss divergence theorem.

d) Evaluate $\iint_S F \cdot \hat{n} ds$ where $F = zi + xj - 3y^2zk$ and S is the surface of the cylinder $x^2 + y^2 = 16$ included in the first octant between $z = 0$and $z = 5$.

Q.No.3. Answer any three of the following. 4×3=12

a) Find the equation of the plane that bisects the acute angle between the plane $3x - 6y - 2z + 5 = 0 \; and \; 4x - 12y = 3z - 3 = 0$.

b) Prove the general equation of first degree in x, y, z represents a plane.

c) Define enveloping cone and find its equation.

d) Obtain general form of right circular cylinder.

Ist & IInd

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586 103

DEPARTMENT OF MATHEMATICS

First Internal Assessment

Sem: II | Sub: Algebra-II and Calculus-II | Code: 21BSC1C1MAT1L

Date: 11- 07 -2024 | Time: 9:30 AM – 10:30 AM | Max. Marks: 30

Q.No.1. Answer Any Three Questions $2\times3=6$

a) Define i) Finite set ii) countable set.

b) If a is any element of group $(G,*)$ then prove that $(a^{-1})^{-1} = a$.

c) Find $\frac{\partial u}{\partial x}$ and $\frac{\partial u}{\partial y}$ for $u = x^3 + y^3 - 3axy$.

d) Evaluate $\int_0^1 \int_1^2 (x^2 + y^2)\, dydx$.

Q.No.2. Answer Any Three Questions $4\times3=12$

a) Prove that every subset of finite set is finite.

b) Prove that union of countable collection of countable set is countable.

c) If $G = \{1,5,7,11\}$, than prove that G is abelian group with respective multiplication modulo 12.

d) i) Define semigroup and give an example.

ii) Prove that the identity element of group $(G,*)$ is unique.

Q.No.3. Answer Any Three Questions $4\times3=12$

a) State and prove Euler's theorem for homogeneous function.

b) If $z = f(x,y)$ where $x = e^u + e^{-v}$ and $y = e^{-u} - e^v$, then show that $\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x\frac{\partial z}{\partial x} - y\frac{\partial z}{\partial y}$.

c) Evaluate $\int ydx + xdy - z^2dz$ where c is curve given by $x = \sin t, y = \cos t, z = t^2$ and $0 \le t \le 1$.

d) Evaluate $\int_0^1 \int_0^1 \frac{dxdy}{\sqrt{(1-x^2)(1-y^2)}}$.

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586 103

DEPARTMENT OF MATHEMATICS

First Internal Assessment July-2024

Sem: IV | **Sub:** Partial Differential Equations and Integral Transforms | **Code:**21BSC4C4MAT2L

Date: 10 – 07 – 2024 | **Time:** 09:30 AM – 10:30 AM | **Max. Marks:** 30

Q.No.1. Answer any three of the following. 2×3=6

a) Solve $\frac{\partial^2 z}{\partial x^2}+6\frac{\partial^2 z}{\partial x \partial y}+9\frac{\partial^2 z}{\partial y^2}=0$.

b) Form the partial differential equation by eliminating arbitrary constant a & b from $z = ax + by + ab$.

c) Find $L[t^3 + 3t^2 - 6t + 8]$.

d) Find a_0 in the fourier series of $f(x) = x + x^2$ and $(-\pi, \pi)$.

Q.No.2. Answer any three of the following. 4×3=12

a) Solve $(D^3 - D^2D' - 8DD'^2 + 12D'^3)z = 0$.

b) Solve $(D^2 + 2DD' + D'^2)z = e^{2x+3y}$.

c) Derive the partial differential equation of the form $Pp + Qq = R$ by eliminating ø from $\phi(u, v) = 0$ where u, v are functions of x, y, z.

d) Solve $(xzp + yzq) = xy$.

Q.No.3. Answer any three of the following. 4×3=12

a) State and prove periodic function.

b) If $L[f(t)] = F(s)$ and $g(t) = \begin{cases} f(t-a) & if\ t > a \\ 0 & if\ t < a \end{cases}$, then $L[g(t)] = e^{-as}F(s)$.

c) Obtain the fourier series of $f(x) = x - 1$ when $-\pi < x < \pi$.

d) Obtain the fourier series of $f(x^2)$ where $-\pi < x < \pi$ and $f(x + 2\pi) = f(x)$ hence deduce that $1 - \frac{1}{4} + \frac{1}{9} - \frac{1}{16} + \text{--------} = \frac{\pi^2}{12}$.

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586103

DEPARTMENT OF MATHEMATICS

First Internal Assessment July-2024

Sem: VI **Sub:** Linear Algebra **Code:** 21BSC6C6MATMJ1L

Date: 11 – 07 – 2024 **Time:** 01:40 PM – 02:40 PM **Max. Marks:** 30

Q.No.1. Answer any three of the following. 2×3=6

a) Define subring and give an example.

b) Define vector space.

c) Define Linear Transformation.

d) Define homomorphism.

Q.No.2. Answer any three of the following. 4×3=12

a) Prove that a matrix of order $2 \times 2$is a ring.

b) Prove that a non empty subset S of a ring R is a subring of Riff(i) $a, b \in S \Rightarrow a - b \in S$(ii) $a, b \in S \Rightarrow ab \in S$.

c) Show that any field F forms a vector space over itself.

d) In any vector space V over a field F, then prove that

i. $c \cdot 0 = 0 \ \forall\, c \in F$.

ii. $0 \cdot \alpha = 0 \ \forall\, \alpha \in V$.

iii. $c \cdot (-\alpha) = -(c\alpha) \ \forall\, c \in F, \alpha \in V$.

iv. $(-c) \cdot \alpha = -(c\alpha) \ \forall\, c \in F, \alpha \in V$.

Q.No.3. Answer any three of the following. 4×3=12

a) Show that the mapping $T: v_3 \to v_2$ is defined by $T(x, y, z) = (x - y, x - z)$ is linear transformation.

b) Let T be a linear transformation from a vector space $u(F)$ into vector space $v(F)$. Then show that

i. $T(0) = 0$ where 0 is the Zero vector

ii. $T(c_1\alpha_1 + c_2\alpha_2 + \cdots .. + c_n\alpha_n) = c_1 T(\alpha_1) + c_2 T(\alpha_2) + \cdots .. c_n T(\alpha_n)$

iii. $T(-\alpha) = -T(\alpha)$

c) Prove that every n-dimensional vector space is isomorphic to $V_n(F)$.

d) If f is a homomorphism of $U(F)$ into $V(F)$, then prove that

i. $f(0) = 0'$where0 and $0'$ are zero vector of U and Vrespectively.

ii. $f(-\alpha) = -f(\alpha) \forall\, \alpha \in U$.

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586103

DEPARTMENT OF MATHEMATICS

First Internal Assessment July-2024

Sem: VI **Sub:**Numerical Analysis **Code:** 21BSC6C6MATMJ2L

Date: 15 – 07 – 2024 **Time:** 01:40 PM – 02:40 PM **Max. Marks: 30**

Q.No.1. Answer any three of the following. **2×3=6**

a) Explain secant method to find the real root of the equation $f(x) = 0$.

b) Explain the Gauss-Jordan method to solve the system of linear equations.

c) Write the Newton's forward interpolation formula.

d) Write the formula to find the first derivative using forward differences.

Q.No.2. Answer any three of the following. **4×3=12**

a) Find the real root of the equation $x^3 - 2x - 5 = 0$ by Regular-False method correct to three decimal places.

b) Find the real root of the equation $x\log_{10} x = 1.2$ by Newton-Raphson's method correct to three decimal places.

c) Apply Gauss-Jordan elimination method to solve the system of equations

$$x + y + z = 9$$
$$x - 2y + 3z = 8$$
$$2x + y - z = 3.$$

d) Solve by Triangularization method

$$3x + y + 2z = 16$$
$$2x - 6y + 8z = 24$$
$$5x + 4y - 3z = 2.$$

Q.No.3. Answer any three of the following. **4×3=12**

a) Derive Newton's Backward Interpolation formula.

b) Using forward difference formula, find $f(38)$.

x	40	50	60	70	80	90
f(x)	184	204	226	250	276	304

c) Find $f'(1.5)$ and $f''(1.5)$ from the following table.

x	1.5	2.0	2.5	3.0	3.5	4.0
f(x)	3.375	7.0	13.62	24.0	38.875	59.0

d) Find $f'(0.4)$ and $f''(0.4)$ from the following table.

x	0.1	0.2	0.3	0.4
f(x)	1.10517	1.22140	1.34986	1.49182

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586103

DEPARTMENT OF MATHEMATICS

Second Internal Assessment

Sem: II   **Sub:** Algebra-II and Calculus-II   **Code:** 21BSC1C1MAT1L

Date: 05- 08 -2024   **Time:** 9:30 AM – 10:30 AM   **Max. Marks:** 30

Q.No.1. Answer Any Three Questions $2\times3=6$

a) Define suprimum and infimum of a set.

b) Prove that every cyclic group is abelian.

c) Define Jacobian of two variables.

d) Evaluate $\int_0^1 \int_1^{y^2} e^{x/y}\, dxdy.$

Q.No.2. Answer Any Three Questions $4\times3=12$

a) Prove that the interval [0,1] is uncountable.

b) State and prove Archimedeans property of R.

c) Show that the group $(z_5, +_5)$ is a cyclic group and every non zero elements of z_5 is a generator.

d) A non empty subset H of a group $(G,*)$ is a subgroup of G iff

1) $\forall a, b \in H = a * b \in H$

2) $\forall a \in H = a^{-1} \in H.$

Q.No.3. Answer Any Three Questions $4\times3=12$

a) If $J = \frac{\partial(u,v)}{\partial(x,y)}, J' = \frac{\partial(x,y)}{\partial(u,v)}$ then prove that $JJ'=1$.

b) Expand $e^x \cos y$ by maclaurin series.

c) Evaluate $\int_0^1 \int_x^{\sqrt{x}} xy\ \ dxdy$ by changing the order of integration.

d) Evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} y^2\sqrt{x^2+y^2}dydx$ by transforming to the polar co-ordinate.

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586103

DEPARTMENT OF MATHEMATICS

Second Internal Assessment July-2024

Sem: IV	**Sub:** Partial Differential Equations and Integral Transforms	**Code:**21BSC4C4MAT2L
Date: 07 – 08 – 2024	**Time:** 09:30 AM – 10:30 AM	**Max. Marks: 30**

Q.No.1. Answer any three of the following. 2×3=6

a) Classify $\frac{\partial^2 z}{\partial x^2} + 4\frac{\partial^2 z}{\partial x \partial y} + 4\frac{\partial^2 z}{\partial y^2} = 0.$

b) Find the complete integral of $p^2 - q^2 = 1.$

c) Find the Laplace transform for $L[t.e^{at}].$

d) Define finite sine transform for $f(x)$ in (0,l).

Q.No.2. Answer any three of the following. 4×3=12

a) Reduce the $r + 2s + t = 0$ to canonical form.

b) Solve one-dimensional heat equation $u_t = c^2 u_{xx}$ by method of separation of variables.

c) Solve $z = px + qy + 3(pq)^{\frac{1}{3}}.$

d) Solve $p^3 + q^3 = 3pqz.$

Q.No.3. Answer any three of the following. 4×3=12

a) If $L[f(t)] = F(s)$ then $L\left[\frac{f(t)}{t}\right] = \int_s^{\infty} F(s)ds.$

b) Prove that $L\{U(t-a)\} = \frac{e^{-as}}{s}$

c) Find the half range sine and cosine series for the function f(x)=$(\pi - x)$in the interval $(0,\pi)$.

d) Find fourier finite cosine transforms of f(x)=2-x in (0,2).

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586103

DEPARTMENT OF MATHEMATICS

Second Internal Assessment -2024

Sem: VI **Sub:** Linear Algebra **Code:** 21BSC6C6MATMJ1L

Date: 03 – 08 – 2024 **Time:** 03:20 PM – 04:20 PM **Max. Marks:** 30

Q.No.1. Answer any three of the following. 2×3=6

a) Define Maximal Ideal and give an example.

b) Define Linear Combination of vector.

c) Define Nullity and rank of linear map.

d) Find the Eigen value of the matrix $= \begin{bmatrix} 5 & 4 \\ 5 & 6 \end{bmatrix}$.

Q.No.2. Answer any three of the following. 4×3=12

a) State and prove fundamental theorem of Homomorphism of ring.

b) Define homomorphism of ring R into R'. If $f: R \to R'$ is homomorphism, then prove that
i) $f(0) = 0'$
ii) $f(-a) = -f(a) \forall\, a \in R$ where $0'$ is the identity in R'.

c) Let V be a vector space over a field F and W be a non empty subset of V, then
W is a subspace of V iff $\alpha w_1 + \beta w_2 \in W \ \forall\ \alpha, \beta \in F, w_1, w_2 \in W$.

d) If $V(F)$ is finite dimensional vector space then any two basis of V have the same number of elements.

Q.No.3. Answer any three of the following. 4×3=12

a) State and prove Rank-Nullity theorem.

b) Describe explicitly the linear transformation $T: R^2 \to R^2$, such that $T(2,3) = (4,5)$ and $T(1,0) = (0,0)$.

c) State and prove fundamental theorem of Homomorphism of vector space.

d) Find all the Eigen values and corresponding Eigen vectors of the matrix $\begin{bmatrix} 2 & 2 & 1 \\ -4 & 8 & 1 \\ -1 & -2 & 0 \end{bmatrix}$.

B.L.D.E.A's

S.B. ARTS AND K.C.P. SCIENCE COLLEGE, VIJAYAPUR-586103

DEPARTMENT OF MATHEMATICS

Second Internal Assessment -2024

Sem: VI **Sub:**Numerical Analysis **Code:** 21BSC6C6MATMJ2L

Date: 07 - 08 - 2024 **Time:** 03:20 PM - 04:20 PM **Max. Marks:** 30

Q.No.1. Answer any three of the following. 2×3=6

a) Define absolute and relative error.

b) Solve by Gauss elimination method $3x - 2y = 5$ and $x + 3y = -2$.

c) Write the Langranges interpolation formula.

d) State trapezoidal rule to evaluate $\int_a^b f(x)dx$.

Q.No.2. Answer any three of the following. 4×3=12

a) Derive general error formula.

b) Obtain the approximation of $\log(1 + x)$ in the form of second degree polynomial. Hence evaluate $\log(1.2)$ and its maximum truncation error.

c) Apply Jacobi iteration method to solve $10x + y + z = 12$, $2x + 10y + z = 13$, $2x + 2y + 10z = 14$.

d) Explain the Gauss-Seidal method to solve the equations $a_1x + b_1y + c_1z = d_1$, $a_2x + b_2y + c_2z = d_2$, $a_3x + b_3y + c_3z = d_3$.

Q.No.3. Answer any three of the following. 4×3=12

a) Using divide and difference formula find y at $x = 9$.

x	5	7	11	13	17
$y = f(x)$	150	392	1452	2366	5202

b) Using Lagrange's interpolation formula find y at $x = 10$.

x	5	6	9	11
$y = f(x)$	12	13	14	16

c) State and prove general quadrature formula for equidistant ordinate.

d) Evaluate $\int_4^{5.2} \log(x)dx$ by using (i) trapezoidal rule (ii) Simpsons $1/3^{rd}$ rule (iii) Simpsons $3/8^{th}$ rule.