"Dissemination of Education for Knowledge, Science and Culture"

-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE, KOLHAPUR

(AN EMPOWERED AUTONOMOUS INSTITUTE)

DEPARTMENT OF MATHEMATICS

Three/Four- Years UG Programme

Department/Subject Specific Core or Major (DSC)

NEP- Phase-II

Curriculum, Teaching and Evaluation Structure

(as per NEP-2020 Guidelines)

for

B.Sc.-II Mathematics

Semester-III & IV

(Implemented from academic year 2025-26 onwards)

Vivekanand College, Kolhapur (An Empowered Autonomous Institute)

Department of Mathematics
B.Sc. II

POs:

- **PO1: Disciplinary Knowledge:** Graduates will gain in-depth understanding in their specific major or discipline, mastering the foundational principles and theories, as well as advanced concepts. Execute strong theoretical and practical understanding developed from the specific programme in the area of work.
- **PO2: Problem-Solving Skills:** Graduates will learn to use their knowledge to identify, analyse, and solve problems related to their field of study Students should progress their vertical mobility
- **PO3: Analytical Skills:** Graduates will gain the ability to collect, analyse, interpret, and apply data in a variety of contexts. They might also learn to use specialized software or equipment
- **PO4: Research Skills and Scientific temper:** Depending on the field, graduates might learn how to design and conduct experiments or studies, analyse results, and draw conclusions. They might also learn to review and understand academic literature.
- **PO5: Communication Skills:** Many programs emphasize the ability to communicate effectively, both orally and in writing. Graduates may learn to present complex information clearly and succinctly, write detailed reports, and collaborate effectively with others.
- **PO6: Ethics and Professionalism**: Graduates may learn about the ethical and professional standards in their field, and how to apply them in real-world situations.

B.Sc. II Mathematics

PSOs:

- **PSO1:** Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.
- **PSO2:** The skills and knowledge gained has intrinsic beauty, which also leads to proficiency in analytical reasoning. This can be utilised in modelling and solving real life problems.
- **PSO3:** Students should be able to recall basic facts about mathematics and train the students to extract information, formulate and solve problems in systematic and logical manner.
- **PSO4:** Students will learn numerical aptitude applying both qualitative and quantitative knowledge for their further career.
- **PSO5:** This programme will also help students to enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

VIVEKANAND COLLEGE, KOLHAPUR (AN EMPOWERED AUTONOMOUS INSTITUTE)

Department of Mathematics

Teaching and Evaluation Scheme

Three/Four- Years UG Programme

Department/Subject Specific Core or Major (DSC)

Second Year Semester-III & IV

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks				Course Credits
				TH	PR	SEE	CIE	PR	Marks	
Semester-III										
Major										
1	DSC-V	2DSC03MAT31	Differential Equations – II	2	-	40	10	-	50	2
2	DSC-VI	2DSC03MAT32	Numerical Methods	2	-	40	10	-	50	2
3	VSC-PR-I	2VSC03MAT39	Introduction to Python	-	4	-	-	25	25	2
4	DSC-PR-III	2DSC03MAT39	DSC Mathematics Lab-III	-	8	-	-	50	50	4
Minor										
1	MIN-V	2MIN03MAT31	Computational Mathematics for Sciences- I	2	-	40	10	-	50	2
2	MIN-VI	2MIN03MAT32	Improper Integrals and Special Functions	2	-	40	10	-	50	2
3	MIN-PR-III	2MIN03MAT39	MIN Mathematics Lab-III	-	4	-	-	25	25	2
Open Elective										
1	OEC MTS-PR-III	2OEC03MTS31	Mathematical Science-III (Quantitative Analysis)	-	4	-	-	25	25	2
Semester –III Total				**8**	**20**	**160**	**40**	**125**	**325**	**18**
Semester-IV										
Major										
1	DSC-VII	2DSC03MAT41	Differential Calculus	2	-	40	10	-	50	2
2	DSC-VIII	2DSC03MAT42	Integral Calculus	2	-	40	10	-	50	2
3	VSC-PR-II	2VSC03MAT49	Data structure using Python	-	4	-	-	25	25	2
4	DSC-PR-IV	2DSC03MAT49	DSC Mathematics Lab-IV	-	8	-	-	50	50	4
Minor										
1	MIN-VII	2MIN03MAT41	Computational Mathematics for Sciences- II	2	-	40	10	-	50	2
2	MIN-VIII	2MIN03MAT42	Laplace Transform	2	-	40	10	-	50	2
3	MIN-PR-IV	2MIN03MAT49	MIN Mathematics Lab-IV	-	4	-	-	25	25	2
Open Elective										
1	OEC MTS-PR-IV	2OEC03MTS41	Mathematical Science-IV (Applied Quantitative Aptitude and Logical Thinking)	-	4	-	-	25	25	2
Semester –IV Total				**8**	**20**	**160**	**40**	**125**	**325**	**18**

Semester -III

B. Sc. Part – II Semester -III Mathematics

DSC-V: 2DSC03MAT31: Differential Equations-II
Theory: 30 hrs.
Marks-50 (Credits: 02)

Course Outcomes (COs):
On completion of the course, the students will be able to:

CO1: solve differential equations of the first order but not of the first degree.
CO2: identify types of higher order ordinary differential equations.
CO3: solve different types of higher order ordinary differential equations.
CO4: understand simultaneous differential equations.

UNIT	Contents	Hours Allotted
1	**1.1 Equations of the first order but not of the first degree** 1.1.1 Introduction 1.1.2 Method I: Equations solvable for p 1.1.3 Method II: Equations solvable for x 1.1.4 Method III: Equations solvable for y 1.1.5 Method IV: Equations in Clairaut's form 1.1.6 Method V: Equations reducible to Clairaut's form 1.1.7 Examples based on 1.1.2 to 1.1.6 **1.2 Homogeneous linear equations or Cauchy-Euler equations** 1.2.1 Homogeneous linear equation (Cauchy-Euler equation) 1.2.2 Method of solution of homogeneous linear differential equations 1.2.3 Working rule for solving linear homogeneous differential equations 1.2.4 Equations reducible to homogeneous linear form (Legendre's linear equations) 1.2.5 Working rule for solving Legendre's linear equations 1.2.6 Examples based on 1.2.3 and 1.2.5.	15
2	**2.1 Linear differential equations of second order** 2.1.1 The general (standard) form of the linear differential equation of the second order. 2.1.2 Complete solution of $y'' + Py' + Qy = R$ in terms of one known integral belonging to the complementary function (C.F.). 2.1.3 Rules for getting an integral belonging to C.F. of $y'' + Py' + Qy = R$. 2.1.4 Working rule for finding complete primitive (solution) when an integral of C.F. is known or can be obtained. 2.1.5 Removal of first derivative (Reduction to normal form or changing the dependent variable). 2.1.6 Working rule for solving problems by changing the dependent variable.	15

	2.1.7 Transformation of the equation by changing the independent variable. 2.1.8 Working rule for solving equations by changing the independent variable. 2.1.9 Examples based on 2.1.4, 2.1.6 and 2.1.8. **2.2** Simultaneous differential equations of the form $(dx)/P = (dy)/Q = (dz)/R$ 2.2.1 Introduction 2.2.2 The nature of solution of $(dx)/P = (dy)/Q = (dz)/R$ 2.2.3 Geometrical interpretation of $(dx)/P = (dy)/Q = (dz)/R$ 2.2.4 Rule I for solving $(dx)/P = (dy)/Q = (dz)/R$ 2.2.5 Rule II for solving $(dx)/P = (dy)/Q = (dz)/R$ 2.2.6 Rule III for solving $(dx)/P = (dy)/Q = (dz)/R$ 2.2.7 Rule IV for solving $(dx)/P = (dy)/Q = (dz)/R$ 2.2.8 Examples based on 2.2.4 to 2.2.7	

Recommended Books:

1. M. D. Raisinghania, Ordinary and Partial Differential Equations, Eighteenth revised edition 2016; S. Chand and Company Pvt. Ltd. New Delhi.

Reference Books:

1. D. A. Murray, Introductory course in Differential Equations, Khosla Publishing House, Delhi.
2. Shepley L. Ross, Differential Equations, Third Edition 1984; John Wiley and Sons, New York.
3. Ian Sneddon, Elements of Partial Differential Equations, Seventeenth Edition, 1982; Mc- Graw-Hill International Book Company, Auckland.

B. Sc. Part – II Semester -III Mathematics

DSC-VI: 2DSC03MAT32: Numerical Methods

Theory: 30 hrs.

Marks-50 (Credits: 02)

Course Outcomes (COs)

On completion of the course, the students will be able to:

CO1: solve algebraic and transcendental equations using numerical techniques.

CO2: apply various interpolation methods to approximate and compute numerical solutions.

CO3: compute numerical solutions for definite integrals and ordinary differential equations using appropriate methods.

CO4: utilize numerical methods to solve practical problems in real-life.

UNIT	Contents	Hours Allotted
1	**1.1 Solutions of Algebraic and Transcendental Equations:** 1.1.1 Introduction 1.1.2. Basic properties of equations 1.1.3 Synthetic division of a polynomial by a linear expression 1.1.4 Bisection Method 1.1.5 Method of False Position or Regula-Falsi Method 1.1.6 Newton- Raphson method 1.1.7 Examples based on art.1.1.2 to 1.1.6 **1.2 Interpolation** 1.2.1 Introduction 1.2.2 Finite differences 1.2.2.1 Forward and inverse forward difference operator 1.2.2.2 Backward and inverse backward difference operator 1.2.3 Shift and inverse shift operator 1.2.4 Relations between above operators 1.2.5 Interpolation with equal intervals 1.2.5.1 Newton's forward interpolation formula 1.2.5.2 Newton's backward interpolation formula 1.2.6 Interpolation with unequal intervals: Lagrange's interpolation formula 1.2.7 Examples based on art.1.2.2 to 1.2.6	15
2	**2.1 Numerical Integration** 2.1.1 Introduction 2.1.2 Newton-Cotes Quadrature Formula 2.1.3 Trapezoidal rule 2.1.4 Simpson's $1/3^{rd}$- rule 2.1.5 Simpson's $3/8^{th}$ - rule 2.1.6 Examples based on art. 2.1.3 to 2.1.5.	15

	2.2 Numerical Solutions of ODE: 2.2.1 Introduction 2.2.2 Picard's method 2.2.3 Taylor's series method 2.2.4 Euler's method 2.2.5 Modified Euler's method 2.2.6 Runge-Kutta methods 2.2.6.1 Runge-Kutta method of second order 2.2.6.2 Runge-Kutta method of fourth order 2.2.7 Examples based on art. 2.2.2 to 2.2.6.	

Recommended Books:

1. B. S. Grewal - Numerical Methods in Engineering and Science: C, C++, and MATLAB, Mercury Learning and Information, New Delhi.

Reference Books:

1. G. Haribaskaran, Numerical Methods, Laxmi Publications Pvt. Ltd, New Delhi, First Edition (2006).
2. H.C. Saxena, Finite Differences and Numerical Analysis, S. Chand & Company Ltd. (2005).
3. M.K. Jain, S.R.K. Iyengar & R.K. Jain, Numerical Methods (Problems and Solutions): Revised Second Edition, New Age International Pvt Ltd Publishers, Mumbai.
4. S. S. Sastry, Introductory Methods of Numerical Analysis: Fifth Edition, Prentice Hall India Learning Private Limited, New Delhi (2012).

B. Sc. Part – II Semester -III Mathematics
DSC-PR-III A: 2DSC03MAT39: DSC Practical – III A(Major)
Practical Four Lectures of 60 minutes per week per batch
Marks-25 (Credits: 02)

Course Outcomes (COs)

On completion of the course, the students will be able to:

CO1: solve differential equations of first order.

CO2: solve differential equations of Second order.

CO3: solve algebraic and transcendental equations using numerical methods.

CO4: compute numerical integrations and differentiation.

Sr. No	Title of the Practical	No. of Practical(s)
1	Equations solvable for p, x and y	1
2	Clairaut’s equation & equations reducible to Clairaut’s form	1
3	Homogeneous linear differential equations	1
4	Legendre’s linear equations	1
5	Solution of linear differential equation of second order when one integral is known	1
6	Solution of linear differential equation of second order by the change of dependent variable	1
7	Solution of linear differential equation of second order by the change of independent variable	1
8	Bisection method	1
9	Newton Raphson method	1
10	Newton’s forward and backward interpolation formula	1
11	Lagrange’s interpolation formula	1
12	Evaluation of Numerical integration by using Simpson’s $1/3^{rd}$ rule	1
13	Evaluation of Numerical integration by using Simpson’s $3/8^{th}$ rule	1
14	Numerical solutions of ordinary differential equations by Modified Euler's method.	1
15	Numerical solutions of ordinary differential equations by Runge-Kutta method of second and fourth order	1
	Total	15

Recommended Books:

1. M. D. Raisinghania, Ordinary and Partial Differential Equations, Eighteenth revised edition 2016; S. Chand and Company Pvt. Ltd. New Delhi.
2. B. S. Grewal, Numerical Methods in Engineering and Science: C, C++, and MATLAB, Mercury Learning and Information, New Delhi.

B. Sc. Part – II Semester -III Mathematics
DSC – III B: 2DSC03MAT39: Introduction to programming in Scilab
Practical Four Lectures of 60 minutes per week per batch
Marks-25 (Credits: 02)

Course Outcomes (COs)
On completion of the course, the students will be able to:

CO1: understand the basic concepts of programming.
CO2: perform basic mathematical operations using Scilab software.
CO3: solve algebraic and transcendental equations using Scilab.
CO4: do various operations on matrices using Scilab.

Sr. No	Title of the Practical	No. of Practical(s)
1	**Introduction to Scilab:** Overview of Scilab and its applications in mathematics. Installing Scilab, Scilab environment: Console window, Command History window, Variable Browser window, File Browser window, SciNotes window, Graphics window. Getting Help in Scilab. Use of Scilab as a calculator.	02
2	**Basics of Scilab:** Introduction, Character Set. **Data types**: Integer data type, Real data type, Complex data type, Boolean data type, String data type. Constants and Variables in Scilab, **Operators**: Arithmetic, Relational, Logical. Hierarchy of Operations, Scilab Expressions, Built-in Functions.	02
3	**Vectors and Matrices:** Introduction to Matrices and Arrays**,** Row matrix, column matrix, general matrix, empty matrix, operation on matrix addition, subtraction, product, element-wise operation, transpose, determinant, inverse, trace, rank, Matrix functions: eye(), zero(), ones().	04
4	**Polynomial:** Polynomial creation(poly), Polynomial evaluation(horner), Roots of a Polynomial(roots), coefficient(coeff), degree(degree) Polynomial Arithmetic Operations, polynomial division(pdiv) Polynomial Differentiation and Integration (derivate, integrate), deflation, GCD (pgcd), isreal(), ispoly(),	04
5	**Eigen Values and Eigen Vectors:** Introduction, definition, Calculation (spec, eigs), companion matrix using characteristic polynomial(companion), diagonalisable matrix	02

Reference Books:-

1) Chetana Jain, **Advanced Programming in SciLab**, Alpha Science International Ltd (2020).
2) Claude Gomez (Editor), C. Bunks (Contributor), J.-P. Chancelier (Contributor), F. Delebecque (Contributor), M. Goursat (Contributor), R. Nikoukhah (Contributor), S.Steer (Contributor), **Engineering and Scientific Computing with Scilab 1999th** Edition
3) Sandeep Nagar, **Introduction to Scilab**, For Engineers and Scientists Book.
4) **Official Scilab Documentation**: www.scilab.org.
5) Tejas Sheth (Author), **Scilab:** Practical Introduction to Programming and Problem Solving

Kindle Edition .

B. Sc. Part – II Semester -III Mathematics

MIN-V: 2MIN03MAT31: Computational Mathematics for Sciences- I
Theory: 30 hrs.
Marks-50 (Credits: 02)

Course Outcomes (COs):
On completion of the course, the students will be able to:

CO 1. learn the partial differentiation and Euler's theorem on homogeneous functions.
CO 2. learn the concept of Jacobian of a transformation.
CO 3. understand the concepts of gradient, divergence and curl of point functions in terms of cartesian co-ordinate system.
CO 4. evaluate the gradient, divergence and curl of point functions

UNIT	Contents	Hours Allotted
1	**Partial differentiation and Jacobians** 1.1. Partial differentiation 1.1.1. Revision of Partial derivatives 1.1.2. Partial derivatives of composite Functions 1.1.3. Homogeneous functions: definition 1.1.4. Euler's theorems on homogeneous functions 1.1.4.1. If z is a homogeneous function of degree n in x and y, then $$x\frac{\partial z}{\partial x}+y\frac{\partial z}{\partial y}=n\text{z}.$$ 1.1.4.2. If $z=f(x,y)$ is a homogeneous function of degree n, then $$x^2\frac{\partial^2 z}{\partial x^2}+2xy\frac{\partial^2 z}{\partial x\partial y}+y^2\frac{\partial^2 z}{\partial y^2}=n(n-1)z.$$ 1.1.4.3. If z is a homogeneous function of degree n in x and y and $z=f(u)$, then $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=n\frac{f(u)}{f'(u)}$. 1.1.4.4. If z is a homogeneous function of degree n in x and y and $z=f(u)$, then $$x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}=g(u)(g'(u)-1) \text{ where } g(u)=n\frac{f(u)}{f'(u)}.$$ 1.1.5. Examples based on 1.1.2, 1.1.3, 1.1.4 1.2. Jacobian 1.2.1. Definition of Jacobian 1.2.2. Properties of Jacobians. 1.2.2.1. If J is Jacobian of u, v with respect to x, y and J' is Jacobian of x, y with respect to u, v then $\mathrm{JJ'}=1$. 1.2.2.2. If J is Jacobian of u, v with respect to x, y and J' is Jacobian of x, y with respect to u, v then $\mathrm{JJ'}=1$. 1.2.2.3. If p,q are functions of u,v and u,v are functions of x,y then prove that $\frac{\partial(p,q)}{\partial(u,v)}=\frac{\partial(p,q)}{\partial(x,y)}\cdot\frac{\partial(x,y)}{\partial(u,v)}$.	15

	1.2.2.4. If p, q, r are functions of u, v, w and u, v, w are functions of x, y, z then prove that $\frac{\partial(p,q,r)}{\partial(u,v,w)} = \frac{\partial(p,q,r)}{\partial(x,y,z)} \cdot \frac{\partial(x,y,z)}{\partial(u,v,w)}$. 1.2.3. Jacobian of implicit functions (without proof) 1.2.4. Examples based on 1.2.1, 1.2.2, 1.2.3	
2	**Vector Calculus** **2.1 Partial differentiation of vectors** 2.1.1 The Scalar and Vector valued Point functions 2.1.2 The Operator ∇ 2.1.3 Gradient of a Scalar Point Function: definition 2.1.4 Directional derivatives of scalar and vector point functions 2.1.5 Geometrical Interpretation of grad $\emptyset$, where $\emptyset$ is a scalar point function 2.1.6 Divergence of vector point function: definition 2.1.7 Curl of vector point function: definition 2.1.8 Gradient, Divergence and Curl of sums i. $\text{grad}(\emptyset \pm \psi) = \text{grad}\,\emptyset \pm \text{grad}\,\psi$ ii. $\text{div}(\bar{f} \pm \bar{g}) = \text{div}\,\bar{f} \pm \text{div}\,\bar{g}$ iii. $\text{curl}(\bar{f} \pm \bar{g}) = \text{curl}\,\bar{f} \pm \text{curl}\,\bar{g}$ 2.1.9 Gradient, Divergence and Curl of Products i. $\text{grad}(\emptyset\psi) = \emptyset\,\text{grad}\,\psi + \psi\,\text{grad}\,\emptyset$ ii. $\text{div}(\emptyset\bar{f}) = \emptyset\,\text{div}\,\bar{f} + (\text{grad}\,\emptyset) \cdot \bar{f}$ iii. $\text{div}(\bar{f} \times \bar{g}) = \bar{g} \cdot \text{curl}\,\bar{f} - \bar{f} \cdot \text{curl}\,\bar{g}$ iv. $\text{curl}(\emptyset\bar{f}) = \text{grad}\,\emptyset \times \bar{f} + \emptyset\,\text{curl}\,\bar{f}$ 2.1.10 Second order differential operators i. $\text{div grad}\,\emptyset = \nabla \cdot \nabla\emptyset = \frac{\partial^2\emptyset}{\partial x^2} + \frac{\partial^2\emptyset}{\partial y^2} + \frac{\partial^2\emptyset}{\partial z^2}$ ii. $\text{curl grad}\,\emptyset = \nabla \times \nabla\emptyset = 0$ iii. $\text{div curl}\,\bar{f} = \nabla \cdot \nabla \times \bar{f} = 0$ 2.1.11 The Laplacian Operators ∇^2 2.1.12 Solenoidal and Irrotational vector fields 2.1.13 Examples based on 2.1.3, 2.1.4, 2.1.6, 2.1.7, 2.1.12	15

Recommended Books:

1. Differential Calculus, Shanti Narayan and P.K. Mittal, S. Chand publishing, 15th edition (2016) – For Unit 1 of the syllabus.
   [Scope: Chapter -11: 11.1, 11.6, 11.7, 11.8, Chapter -12: 12.1, 12.2, 12.3]
2. A text book of Vector Calculus, Shanti Narayan & P. K. Mittal, S. Chand & CO (Pvt) Ltd, Ram nagar, New Delhi-110055- For Unit 2 of the syllabus.
   [Scope: Chapter -6: 6.1 to 6.17]

Reference Books:

1. Differential Calculus, Gorakh Prasad, Pothishala Pvt. Ltd., 19th edition (2016).
2. Mathematical Physics, B. D. Gupta, Vikas Publishing House Pvt. Ltd Fourth edition (2022).
3. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, New Delhi-110002.
4. Advanced Engineering Mathematics R. K. Jain & S. R. K. Iyengar, fourth edition, Narosa Publishing House New Delhi.

B. Sc. Part – II Semester -III Mathematics

MIN-VI: 2MIN03MAT32: Improper Integrals and Special Functions

Theory: 30 hrs.

Marks-50 (Credits: 02)

Course Outcomes (COs)

On completion of the course, the students will be able to:

CO 1. analyse and evaluate improper integrals with infinite limits.

CO 2. apply Beta and Gamma functions to solve integrals and demonstrate their properties and interrelationships.

CO 3. evaluate parameter-dependent improper integrals and understand the conditions for interchanging limits, differentiation, and integration.

CO 4. interpret and apply the Error function in solving integrals and problems arising in applied mathematics and engineering contexts.

UNIT	Contents	Hours Allotted
1	**Improper Integrals** 1.1 Introduction 1.2 Improper Integrals of the First Kind (Range of Integration is Infinite) (Definition) 1.3 Improper Integral of the Second Kind (Definition) 1.4 Gamma Function 1.5 Some Identities of Gamma Function 1.5.1. $\Gamma(1) = 1$ 1.5.2. $\Gamma(n+1) = n\Gamma(n)$ 1.5.3. $\Gamma(n+1) = n!$, for any positive integer n. 1.5.4. $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$ 1.5.5. $\Gamma(n) = 2\int_0^\infty e^{-x^2} x^{2n-1}\, dx, n > 0$ 1.5.6. $\Gamma(n) = k^n \int_0^\infty e^{kx} x^{n-1}\, dx, n, k > 0$ 1.6 Beta Function 1.7 Some Identities of Beta function 1.7.1 $\beta(m,n) = \beta(n,m)$ 1.7.2 $\beta(m,n) = 2\int_0^{\frac{\pi}{2}} \sin^{2m-1}\theta \cos^{2n-1}\theta \; d\theta$ 1.7.3 $\beta(m,n) = \int_0^\infty \frac{x^{m-1}}{(1+x)^{m+n}}\, dx$ 1.7.4 $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ 1.7.5 $\beta(m,n) = \beta(m+1,n) + \beta(m,n+1)$ 1.7.6 Duplication formula of Gamma function (only statement)	15

	1.8 Examples on 1.4 to 1.7	
2	**Improper integrals involving a parameter and the Error functions** 2.1. Definition of improper integral involving a parameter 2.2. Integral with its limits as constants (Statement only) 2.3. Integral with limits as functions of the parameter (Leibnitz's Rule) (Statement only) 2.4. Examples on 2.2 and 2.3 2.5. Error Function Integral $\mathrm{erf}(x)$ 2.6. Complementary Error Function Integral $\mathrm{erf}_c(x)$ 2.7. Expression for $\mathrm{erf}(x)$ in series 2.8. Properties of error-integral functions 2.8.1. $\mathrm{erf}(-x) = -\mathrm{erf}(x)$ 2.8.2. $\mathrm{erf}(-x) = 1 + \mathrm{erf}(x) = 2 - \mathrm{erf}_c(x)$ 2.8.3. Derivative of error function: $\frac{d}{dx}[\mathrm{erf}(ax)] = \frac{2a}{\sqrt{\pi}} e^{-a^2x^2}$ 2.8.4. Integral of error function: $\int_0^u \mathrm{erf}(ax)\ dx = u\,\mathrm{erf}(au) + \frac{e^{-a^2x^2}}{a\sqrt{\pi}} - \frac{1}{a\sqrt{\pi}}$ 2.9. Examples on 2.5 to 2.7	15

Recommended Books:

1. **For Unit. 1 & Unit 2**: R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 4th Edition, Narosa Publishing House, New Delhi, Chenni, Mumbai, Kolkata.
   [**Scope:** Chapter 1: 1.4.1 to 1.4.6.]
2. **For Unit. 2**: P. N. Wartikar and J. N. Wartikar, A text Book of Applied Mathematics, Pune Vidyarthi Griha Prakashan, 1786, Sadashiv Peth, Pune-411030, Vol.I, 2011.
   [**Scope:** Chapter 19: 19.1 to 19.3 Chapter 21: 21.2 to 21.5.]

Reference Books:

1. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics, Pune Vidhyarthi Griha Prakashan, Pune. Vol. I, 2011.
2. Shanti Narayan and Dr. P. K. Mittal, Integral Calculus, S. Chand and Company, New Delhi, 2015.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Delhi, 2012.
4. Gorakh Prasad, Integral Calculus, Pothishala Pvt. Ltd., Allahabad
5. Dass H. K, Advanced Engineering Mathematics, 22e, S. Chand and Company, New Delhi, 2018.

B. Sc. Part – II Semester -III Mathematics
MIN-PR-III : 2MIN03MAT39: MIN Practical – III
Practical Four Lectures of 60 minutes per week per batch
Marks-25 (Credits: 02)

Course Outcomes (COs)

On completion of the course, the students will be able to:

CO 1. learn the concept of Jacobian of a transformation.

CO 2. understand the concepts of gradient, divergence and curl of point functions in terms of cartesian co-ordinate system.

CO3. apply Beta and Gamma functions to solve integrals and demonstrate their properties and interrelationships.

CO4. evaluate parameter-dependent improper integrals and understand the conditions for interchanging limits, differentiation, and integration.

Sr. No.	Title of the Practical	No. of Practical(s)
1	Euler's theorems on homogeneous functions	02
2	Jacobians	02
3	Curl, Divergence and Gradient	02
4	Solenoidal and Irrotational vector field.	01
5	Directional Derivatives	01
6	Gamma function	02
7	definition of beta function	01
8	Identities of Beta function	02
9	Differentiation under integral sign	02
	Total	15

Recommended Books:

1. Differential Calculus, Shanti Narayan and P.K. Mittal, S. Chand publishing, 15th edition (2016)
2. A text book of Vector Calculus, Shanti Narayan & P. K. Mittal:, S. Chand & CO (Pvt) Ltd, Ram nagar, New Delhi-110055.
3. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 4th Edition, Narosa Publishing House, New Delhi, Chenni, Mumbai, Kolkata.
4. P. N. Wartikar and J. N. Wartikar, A text Book of Applied Mathematics, Pune Vidyarthi Griha Prakashan, 1786, Sadashiv Peth, Pune-411030, Vol.I, 2011.

B. Sc. Part – II Semester -III Mathematics

OEC MTS PR – III: 2OEC03MTS31: Quantitative Analysis

Practical Four Lectures of 60 minutes per week per batch
Marks-25 (Credits: 02)

Course Outcomes (COs):
On completion of the course, the students will be able to:

CO1: understand the basic concepts of quantitative ability
CO2: familiarize basic concepts of number system.
CO3: solve quantitative problems by using short-cut method
CO4: compete in various competitive exams like CAT, CMAT, GATE, MPSC, UPSC, etc.

Sr. No.	Practicals:	No. of Practical(s)
1	Number system	2
2	Simplification	1
3	Square root and cube roots	2
4	Calendar	1
5	Clocks	1
6	Boat and Streams	2
7	Allegation or Mixture	1
8	Probability	2
9	Simple Interest	1
10	Compound Interest	2
	Total	15

Reference Books:

1. R. S. Aggarwal, Quantitative Aptitude, S. Chand Publications.
2. Arun Sharma, How to prepare for Quantitative Aptitude for CAT, Mc Graw Hill.

B. Sc. Part – II Semester -III Mathematics
VSC – I: 2VSC03MAT39: Introduction to Python
Practical Four Lectures of 60 minutes per week per batch
Marks-25 (Credits: 02)

Sr. No	Title of the Practical	No. of Practical(s)
1.	Introduction to Python	01
2.	Expressions and Operators	01
3.	Input Output Statements	01
4.	Conditional Statements	01
5.	Looping Statements	01
6.	Functions	01
7.	Modules and Packages	01
8.	Math, cmath, random modules and functions	02
9.	Roots of Equations: Bisection Method, Newton-Raphson Method	03
10.	Initial Value Problem-I: Euler's, Euler's Modified	03
	Total	15

Reference books:-

1. Mark Lutz, *Learning Python*, 2013, O'Reilly Media
2. Allen B. Downey, *Think Python: How to Think Like a Computer Scientist*, 2015, O'Reilly Media
3. Wes McKinney, *Python for Data Analysis*, 2018, O'Reilly Media
4. Al Sweigart, *Automate the Boring Stuff with Python*, 2015, No Starch Press
5. Eric Matthes, *Python Crash Course*, 2019, No Starch Press

Semester -IV

B. Sc. Part – II Semester -IV Mathematics

DSC-VII: 2DSC03MAT41: Differential Calculus

Theory: 30 hrs.

Marks-50 (Credits: 02)

Course Outcomes (COs)

On completion of the course, the students will be able to:

CO 1: evaluate the limit and examine the continuity of a function at a point.

CO2: understand conceptual variations while advancing from one variable to several variables in differential calculus.

CO3: set and solve optimization problems involving several variables.

CO4: learn the concept of Jacobian of a transformation.

UNIT	Contents	Hours Allotted
1	**Unit – 1: Limit, Continuity and Differentiability:** 1.1 Left hand and Right hand limits (do not use ε - δ definition). 1.2 Properties of limits 1.3 Evaluation of limit: Examples (using techniques like factorization, rationalization, Left hand and Right hand limits). 1.4 Continuous functions: definition of Continuity at a point, definition of continuity in an interval. 1.5 Properties of continuous functions. 1.6 Discontinuous functions: Definition, Types of discontinuities – (i) removable discontinuity (ii) discontinuity of first kind (iii) discontinuity of second kind. 1.7 Examples on 1.4 and 1.6 1.8 Differentiability at a point and Differentiability in an interval: definitions. 1.9 Examples on 1.10. 1.10 (Differentiability and continuity) Theorem: A function which is derivable at a point is necessarily continuous at that point.	15
2	**Unit – 2: Partial derivatives, Jacobian and Extreme values** **2.1 Partial derivatives:** 2.1.1 Total Differentials. 2.1.2 Differentiation of composite functions. 2.1.3 Homogeneous functions: definition. 2.1.4 Euler's theorems on homogeneous functions (Case of two and three variables) 2.1.5 Examples on 2.1.2, 2.1.3, 2.1.4. **2.2 Jacobian** 2.2.1 Definition of Jacobian and examples. 2.2.2 Jacobian of function of functions (proof of the corollary $J.J' = 1$ is expected). 2.2.3 Jacobian of implicit functions (without proof) 2.2.4 Examples on 2.2.2 and 2.2.3.	15

	2.3 **Extreme values** 2.3.1 Maxima and minima of functions of **two** variables: Sign of quadratic expression, Lagrange's condition for stationary value. 2.3.2 Lagrange's method of undetermined multipliers for three variables. 2.3.3 Examples on 2.3.1 and 2.3.2.	

Recommended Books:

1. S. C. Malik and Savita Arora, **Mathematical Analysis**, New Age International Publishers, 4th Edition (2012) – For Unit 1 of the syllabus.
2. Shanti Narayan and P.K. Mittal, **Differential Calculus,** S. Chand publishing, 15th edition (2016) – For Unit 2 of the syllabus.

Reference Books:

1. Gorakh Prasad, **Differential Calculus**, Pothishala Pvt. Ltd., 19th edition (2016).
2. Gabriel Klambauer, **Aspects of Calculus**, Springer-Verlag.(1986)
3. J. E. Marsden , A. J Tromba & A. Weinstein; **Basic Multivariable Calculus**, Springer Verlag, New New York, 1993.

B. Sc. Part – II Semester -IV Mathematics
DSC-VIII: 2DSC03MAT42: Integral Calculus
Theory: 30 hrs.
Marks-50 (Credits: 02)

Course Outcomes (COs):

Upon successful completion of the course students will able to:

CO1: understand special functions.
CO2: understand types of multiple integrals.
CO3: apply special functions to evaluate multiple integrals.
CO4: solve integrals using differentiation under the integral Sign

UNIT	Contents	Hours Allotted
1	**Gamma and Beta Function** **1.1 Gamma function.** 1.1.1 Definition of Gamma function and examples. 1.1.2 Properties of Gamma function. 1.1.2.1 $\Gamma(1) = 1$ 1.1.2.2 $\Gamma(n+1) = n\Gamma(n)$ in general. 1.1.2.3 $\Gamma(n+1) = n!$ if n is positive integer. 1.1.2.4 $\Gamma(0) = \infty,\ \Gamma(\infty) = \infty$ 1.1.2.5 $\Gamma(n) = 2\int_0^\infty e^{-x^2} x^{2n-1} dx,\ n > 0$ 1.1.2.6 $\Gamma(n) = k^n \int_0^\infty e^{-kx} x^{n-1} dx, n, k > 0$ 1.1.2.7 Examples based on article 1.1.2. **1.2 Beta function.** 1.2.1 Definition of Beta function and examples. 1.2.2 Properties of Beta function. 1.2.2.1 $\beta(m,n) = \beta(n,m);\ m,n \geq 0$ 1.2.2.2 $\beta(m,n) = 2\int_0^{\frac{\pi}{2}} \sin^{2m-1}\theta \cos^{2n-1}\theta d\theta;\ m,n \geq 0$ 1.2.2.3 $\int_0^{\frac{\pi}{2}} \sin^p\theta \cos^q\theta d\theta = \frac{1}{2}\beta\left(\frac{p+1}{2}, \frac{q+1}{2}\right)$ p, q > -1 1.2.2.4 $\int_0^{\frac{\pi}{2}} \sin^n\theta\ d\theta = \frac{1}{2}\ \beta\left(\frac{n+1}{2}, \frac{1}{2}\right)$ 1.2.2.5 $\int_0^{\frac{\pi}{2}} \cos^n\theta\ d\theta = \frac{1}{2}\ \beta\left(\frac{n+1}{2}, \frac{1}{2}\right)$ 1.2.2.6 $\int_0^{\frac{\pi}{2}} \sin^m\theta \cos^n\theta\ d\theta = \frac{1}{2}\ \beta\left(\frac{m+1}{2}, \frac{n+1}{2}\right)$ 1.2.2.7 Relation between Beta and Gamma function $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)},\ m, n > 0$ 1.2.2.8 $\Gamma(\frac{1}{2}) = \sqrt{\pi}$ 1.2.2.9 $\beta(m,n) = \int_0^\infty \frac{x^{m-1}}{(1+x)^{m+n}} dx$ 1.2.2.10 $\beta(m,n) = a^n b^m \int_0^\infty \frac{x^{m-1}}{(a+bx)^{m+n}} dx$ 1.2.2.11 $\beta(m,n) = \int_0^1 \frac{x^{m-1}+x^{n-1}}{(1+x)^{m+n}} dx$ 1.2.2.12 Duplication formula of Gamma function. 1.2.2.13 Examples based on 1.2.2	15

2	**Differentiation under integral sign and Multiple Integrals** **2.1 Differentiation under integral sign** 2.1.1 Leibnitz first rule of differentiation under integral sign. 2.1.2 Leibnitz second rule of differentiation under integral sign. 2.1.3 Examples based on articles 2.1.1 and 2.1.2. **2.2 Multiple Integrals** 2.2.1 Double Integral: Evaluation of double integrals. 2.2.2 Evaluation of double integrals in Cartesian form. 2.2.3 Evaluation of double integrals in Polar form. 2.2.4 Evaluation of double integrals in Cartesian form over the given region. 2.2.5 Evaluation of double integrals in Cartesian form by changing order of integration. 2.2.6 Evaluation of double integrals from Cartesian form to Polar form. 2.2.7 Triple integrals: Evaluation of triple integrals. 2.2.8 Proof of $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$, m, n > 0	15

Recommended Book:-

Unit. 1: Shanti Narayan and Dr. P. K. Mittal, Integral Calculus, S. Chand and Company, New Delhi, 2015.

Unit. 2: P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics, Pune Vidhyarthi Griha Prakashan, Pune. Vol. I, 2011.

Reference Books:-

1. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics, Pune Vidhyarthi Griha Prakashan, Pune. Vol. I, 2011.
2. Shanti Narayan and Dr. P. K. Mittal, Integral Calculus, S. Chand and Company, New Delhi, 2015.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Delhi, 2012.
4. Gorakh Prasad, Integral Calculus, Pothishala Pvt. Ltd., Allahabad
5. Dass H. K, Advanced Engineering Mathematics, 22e, S. Chand and Company, New Delhi, 2018.

B. Sc. Part – II Semester -IV Mathematics
DSC-PR-IVA: 2DSC03MAT49 : DSC Practical – IV(Major)
Practical Four Lectures of 60 minutes per week per batch
Marks-50 (Credits: 02)

Course Outcomes (COs)

On completion of the course, the students will be able to:

CO1: learn about limit and continuity.

CO2: **l**earn the concept of Jacobian of a transformation.

CO3: solve integrations using Beta and Gamma functions.

CO4: learn about multiple integrals and Differential under integral sign.

Sr. No.	Practical	No. of Practical(s)
1.	Evaluation of Limit.	1
2.	Continuity.	1
3.	Euler's theorems on homogeneous functions.	1
4.	Jacobian I.	1
5.	Jacobian II (Composite Rule).	1
6.	Extreme values of functions of two variables.	1
7.	Lagrange's method of undetermined multipliers.	1
8.	Gamma function – I.	1
9.	Gamma function – II.	1
10.	Beta function – I.	1
11.	Beta function – II.	1
12.	Differentiation under integral sign - I.	1
13.	Differentiation under integral sign – II.	1
14.	Evaluation of double integrals by changing order of integration.	1
15.	Evaluation of triple integrals.	1
	Total	15

Recommended Books:

1. S. C. Malik and Savita Arora, **Mathematical Analysis**, New Age International Publishers, 4th Edition (2012).
2. Shanti Narayan and P.K. Mittal, **Differential Calculus,** S. Chand publishing, 15th edition (2016).
3. Shanti Narayan and Dr. P. K. Mittal, **Integral Calculus**, S. Chand and Company, New Delhi, 2015
4. P. N. Wartikar and J. N. Wartikar, **A text book of Applied Mathematics**, Pune Vidhyarthi Griha Prakashan, Pune. Vol. I, 2011.

B. Sc. Part – II Semester -IV Mathematics
DSC – IV B: 2DSC03MAT49: Introduction to programming in Scilab
Practical Four Lectures of 60 minutes per week per batch
Marks-25 (Credits: 02)

Course Outcomes (COs)

On completion of the course, the students will be able to:

CO1: interpret and visualize simple mathematical functions and operations by using plots

CO2: execute loops and conditional statements using Scilab software.

CO3: solve Numerical Differentiation and Integration problems using Scilab.

CO4: solve Recursive problems using Scilab.

Sr. No	Title of the Practical	No. of Practical(s)
1	**Basic Elements of Scilab as a Programming Language:** Scilab Editor, Scilab Keywords, Predefined Variables, Input and Output Statements, Assignment statements, Simple Programs based on elementary operators. **Conditional structure:** if-else, if-elseif-else, select-case, Simple Programs based on conditional structure.	03
2	**Looping structure:** for loop, while loop, break and continue statement, Simple Programs based on Looping structure. **Functions:** Defining custom functions and Programs based on it.	02
3	**Recursive Functions:** Defining Recursive functions and Programs based on it. **Plotting graph:** Creating two dimensional graphs of simple functions.	02
4	Euler's, Euler's Modified, Runge-Kutta 2^{nd} Order and 4^{th} Order.	04
5	Trapezoidal, Simpson's $1/3^{rd}$ And $3/8^{th}$, Weddles.	04

Reference Books:-

1) Chetana Jain, **Advanced Programming in SciLab**, Alpha Science International Ltd (2020).
2) Claude Gomez (Editor), C. Bunks (Contributor), J.-P. Chancelier (Contributor), F. Delebecque (Contributor), M. Goursat (Contributor), R. Nikoukhah (Contributor), S.Steer (Contributor), **Engineering and Scientific Computing with Scilab 1999th** Edition
3) Sandeep Nagar **, Introduction to Scilab**, For Engineers and Scientists Book.
4) **Official Scilab Documentation**: www.scilab.org.
5) Tejas Sheth (Author), **Scilab:** Practical Introduction to Programming and Problem Solving Kindle Edition

B. Sc. Part – II Semester -IV Mathematics

MIN-VII: 2MIN03MAT41: Computational Mathematics for Sciences- II

Theory: 30 hrs.

Marks-50 (Credits: 02)

Course Outcomes (COs) : On completion of the course, the students will be able to:

- **CO 1.** apply various interpolation methods.
- **CO 2.** approximate polynomials for the real-life data.
- **CO 3.** construct and interpret finite difference tables for data analysis.
- **CO 4.** apply interpolation techniques in solving problems related to computer science, such as curve fitting and numerical estimation.

UNIT	Contents	Hours Allotted
1	**Interpolation on Evenly Spaced Points** 1.1 Introduction: Interpolation, Extrapolation, Interpolating polynomial. 1.2 Finite Differences: Forward Differences (Δ), Backward Differences (∇), Central Differences (δ). 1.3 Shift Operator (E) and means operator (μ). 1.4 Symbolic Relations and Separation of Symbols. 1.4.1. Show that $\Delta = \mathrm{E} - 1,\ \nabla = 1 - E^{-1},\ \delta = E^{\frac{1}{2}} - E^{-\frac{1}{2}},\ \mu = \left(\frac{1}{2}\right)\left(E^{\frac{1}{2}} + E^{-\frac{1}{2}}\right),\ \mu^2 = 1 + \left(\frac{1}{4}\right)\delta^2,\ \Delta = \nabla E = \delta E^{\frac{1}{2}}$. 1.4.2. Show that $E \equiv e^{hD}$, where $D \equiv \frac{d}{dx}$. 1.4.3. Show that $\Delta^n u_{x-n} = u_x - nu_{x-1} + \frac{n(n-1)}{2} u_{x-2} + \cdots + (-1)^n u_{x-n}$. 1.4.4. Show that $e^x \left(u_0 + x\Delta u_0 + \frac{x^2}{2!}\Delta^2 u_{0+\cdots}\right) = u_0 + u_1 x + u_2 \frac{x^2}{2!} + \cdots$ 1.5 Forward and Backward Differences of a polynomial. 1.6 Newton's Forward and backward Formulae for Interpolation. 1.7 Examples based on 1.1 to 1.6	15
2	**Interpolation on Unevenly Spaced Points** 2.1 Lagrange's Interpolation Formula. 2.2 Divided Difference and Their Properties. 2.3 Newton's General Interpolation Formula. 2.4 Method of successive approximations 2.5 Examples based on 2.1 to 2.4	15

Recommended Books:

1. S. S. Sastry - Introductory Methods of Numerical Analysis: Fifth Edition, Prentice Hall India Learning Private Limited, New Delhi (2012).

   Scope: Unit 1: Chapter 3 Section 3.1, 3.3, 3.5, 3.6 and 3.7.1, **Unit 2:** Chapter 3 Section 3.9 to 3.11

Reference Books:

1. B. S. Grewal - Numerical Methods in Engineering And Science: C, C++, and MatLab, Mercury Learning And Information, New Delhi (2012).
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publisher, Mumbai (2012).s

B. Sc. Part – II Semester -IV Mathematics
MIN-VIII: 2MIN03MAT42: Laplace Transform
Theory: 30 hrs.
Marks-50 (Credits: 02)

Course Outcomes (COs):

Upon successful completion of the course students will able to:

- **CO 1.** understand definitions and existence conditions of the Laplace transform
- **CO 2.** apply key properties of the Laplace transform
- **CO 3.** understand inverse Laplace transform
- **CO 4.** apply Laplace transform to solve differential equations.

UNIT	Contents	Hours Allotted
1	**Laplace Transform** 1.1 Definitions: Piecewise or Sectional Continuity, Function of Exponential Order, Function of Class 'A'. 1.2 The Transform Concept, Definition of Laplace Transform, Notation. 1.3 Existence of Laplace Transform (Statement only). 1.4 Linear Property, First Shifting Theorem, Second Shifting Theorem and Change of Scale Property. 1.5. Some Standard Results 1.6 Laplace transform of derivatives, Laplace transform of integrals. 1.7 Multiplication by powers of 't', Division by 't'. 1.8 Periodic functions. 1.9 Examples based on 1.1 to 1.8	15
2	**Inverse Laplace Transform** 2.1 Definitions of Inverse Laplace Transform and Null function. Uniqueness Theorem. 2.2 Linear property 2.3 First shifting theorem, second shifting theorem, Unit step function, change of scale property. 2.4 Inverse Laplace transform of derivatives, Division by 's', 2.5 The Convolution theorem, Multiplication by 's'. 2.6 Inverse Laplace by partial fractions, Heavi-side's Expansion formula. 2.7 Application to solve Ordinary Linear Differential Equations with constant and Variable Coefficients 2.8 Examples based on 2.1 to 2.7	15

Recommended Book:-

1. J. K. Goyal, K. P. Gupta, Integral Transforms, A Pragati Prakashan, Meerut, 21th edition, 2021.
   Scope: **Unit 1:** Chapter 1 Part I: 1.0 to 1.6, **Unit 2 :** Chapter 1 Part II: 1.0 to 1.3. Part III 1.0 to 1.1

Reference Books:-

1. Dr. S. Sreenadh, Fourier series and Integral Transform, S. Chand, New Delhi, 2021
2. 2. B. Davies, Integral Transforms and Their Applications, Springer Science, 2017.
3. 3. Murray R. Spiegel, Laplace Transforms, Schaum's outlines , 2018.

B. Sc. Part – II Semester -IV Mathematics
MIN-PR-IV: 2MIN03MAT39 : MIN Practical – IV
Practical Four Lectures of 60 minutes per week per batch
Marks-50 (Credits: 02)

Course Outcomes (COs)

On completion of the course, the students will be able to:

CO 1. approximate polynomials for the real-life data.
CO 2. construct and interpret finite difference tables for data analysis.
CO 3. apply key properties of the Laplace transform
CO 4. understand inverse Laplace transform

Sr.No.	Title	Practicals
1	Properties of Finite Differences	01
2	Forward and Backward Differences of a polynomial	01
3	Examples on Newton's forward difference formula	01
4	Examples on Newton's backward difference formula	01
5	Examples on Lagrange's interpolation formula.	01
6	Examples on Newton's general interpolation formula	01
7	Examples on Method of successive approximations	01
8	Laplace transform of Derivative and Integrals	02
9	Multiplication by powers of 't', and division by 't'.	02
10	Laplace transform of Periodic Functions	01
11	Inverse Laplace by Convolution theorem	01
12	Inverse Laplace by partial fractions	01
13	Application to Linear differential equations	01
	T O T A L	15

Recommended Books:

1. S. S. Sastry - Introductory Methods of Numerical Analysis: Fifth Edition, Prentice Hall India Learning Private Limited, New Delhi (2012).
2. J. K. Goyal, K. P. Gupta, Integral Transforms, A Pragati Prakashan, Meerut, 21th edition, 2021.

B. Sc. Part – II Semester -IV Mathematics

OEC MTS PR– IV: 2OEC03MTS41:

Applied Quantitative Aptitude and Logical Thinking

Practical Four Lectures of 60 minutes per week per batch
Marks-50 (Credits: 02)

Course Outcomes (COs):
On completion of the course, the students will be able to:

CO1: understand the basic concepts of quantitative ability
CO2: familiarize basic concepts of Logarithms.
CO3: solve quantitative problems by using short-cut method
CO4: compete in various competitive exams like CAT, CMAT, GATE, UPSC, MPSC etc.

Sr. No.	Practicals:	No. of Practical(s)
1.	Ages	1
2.	Surds and Indices	2
3.	Height and Distance	1
4.	Blood Relationship	1
5.	Arithmetic Progression	2
6.	Geometric Progression	2
7.	Area	1
8.	Volume and Surface Area	2
9.	Odd man Out and Series	1
10.	Permutations and Combinations	2
	Total	15

Reference Books:

1. R. S. Aggarwal, Quantitative Aptitude, S. Chand Publications.
2. Arun Sharma, How to prepare for Quantitative Aptitude for CAT, Mc Graw Hill.

B. Sc. Part – II Semester -IV Mathematics
VSC-PR-II: Data Structures Using Python
Practical Four Lectures of 60 minutes per week per batch
Marks-25 (Credits: 02)

Sr. No	Title of the Practical	No. of Practical(s)
1.	File Handling	01
2.	Python Data Structures – I: String, List and Tuples, and operations	02
3.	Python Data Structures – II: Dictionary, Sets and their operations	02
4.	Python Data Structures – III: Arrays and their Operations	02
5.	System Of linear algebraic equations: Guassian Elimination, LU Decomposition	02
6.	Initial Value Problem-II: RK-2, RK-4	02
7.	Magic Square	01
8.	Collatz Conjecture	01
9.	Graph Theory: Network	01
10.	Data Visualisation in Python	01
	Total	15

Recommended Book:

1. Mark Lutz, *Learning Python*, 2013, O'Reilly Media
2. Allen B. Downey, *Think Python: How to Think Like a Computer Scientist*, 2015, O'Reilly Media
3. Wes McKinney, *Python for Data Analysis*, 2018, O'Reilly Media
4. Al Sweigart, *Automate the Boring Stuff with Python*, 2015, No Starch Press
5. Eric Matthes, *Python Crash Course*, 2019, No Starch Press

Question Paper Format:

Seat No.	

Ques. paper code	

VIVEKANAND COLLEGE, KOLHAPUR

(AN EMPOWERED AUTONOMOUS INSTITUTE)

B.Sc. Part- II (Mathematics) (Semester-III/IV) Examination……………..

Course Code and Name: 2DSC03MAT21:

Day: Time: 2 hours

Date: --/--/---- Marks : 40

Instructions:

1) All the questions are compulsory.

2) Figures to the right indicate full marks.

3) Draw neat labelled diagrams wherever necessary.

4) Use of log table/calculator is allowed.

Q. 1. Select correct alternative (One mark each): **[8]**

i) --------------
a) -------- b) -------- c) -------- d) --------

ii) --------------
a) -------- b) -------- c) -------- d) --------

iii) --------------
a) -------- b) -------- c) -------- d) --------

iv) --------------
a) -------- b) -------- c) -------- d) --------

v) --------------
a) -------- b) -------- c) -------- d) --------

vi) --------------
a) -------- b) -------- c) -------- d) --------

vii) --------------
a) -------- b) -------- c) -------- d) --------

viii) --------------
a) -------- b) -------- c) -------- d) --------

Q.2. Attempt any TWO (Eight marks each): [16]

i) .

ii) .

iii) .

Q.3. Attempt any FOUR (Four marks each): [16]

i) .

ii) .

iii) .

iv) .

v) .

vi) .

Evaluation Pattern for practical Course:

Marks Distribution of Practical (LAB) course: Total Marks: 100

Course	Experimental work	Journal assessment	Seminar/ Mini Project	Total Marks
Major	20	05	-	25
OE	20	05	-	25

Equivalence of Courses:

B.Sc. Part II (Semester III and IV)

<table>
<tr><th rowspan="2">Semester</th><th colspan="3">Old Course</th><th colspan="3">Course in NEP Phase-II</th></tr>
<tr><th>Course code</th><th>Course Name</th><th>Credits</th><th>Course code</th><th>Course Name</th><th>Credits</th></tr>
<tr><td rowspan="2">I</td><td>DSC-1003C</td><td>Number Theory</td><td>2</td><td>2DSC03MAT31</td><td>Differential Equations – II</td><td>2</td></tr>
<tr><td>DSC-1003A</td><td>Integral Calculus</td><td>2</td><td>2DSC03MAT32</td><td>Numerical Methods</td><td>2</td></tr>
<tr><td rowspan="4">II</td><td>DSC-1003B</td><td>Discrete Mathematics</td><td>2</td><td>2DSC03MAT41</td><td>Differential Calculus</td><td>2</td></tr>
<tr><td>DSC-1003B</td><td>Integral Transform</td><td>2</td><td>2DSC03MAT42</td><td>Integral Calculus</td><td>2</td></tr>
<tr><td rowspan="2">DSC-1003(PR)</td><td rowspan="2">Computational Mathematics Lab</td><td rowspan="2">8</td><td>2DSC03MAT39</td><td>DSC Mathematics Lab-III</td><td>4</td></tr>
<tr><td>2DSC03MAT49</td><td>DSC Mathematics Lab-IV</td><td>4</td></tr>
</table>

Departmental Teaching and Evaluation scheme

Second Year Semester-III & IV

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks				Course Credits
				TH	PR	SEE	CIE	PR	Marks	
Semester-III										
Major										
1	DSC-V	2DSC03MAT31	Differential Equations – II	2	-	40	10	-	50	2
2	DSC-VI	2DSC03MAT32	Numerical Methods	2	-	40	10	-	50	2
3	VSC-PR-I	2VSC03MAT39	Introduction to Python	-	4	-	-	25	25	2
4	DSC-PR-III	2DSC03MAT39	DSC Mathematics Lab-III	-	8	-	-	50	50	4
Minor										
1	MIN-V	2MIN03MAT31	Computational Mathematics for Sciences- I	2	-	40	10	-	50	2
2	MIN-VI	2MIN03MAT32	Improper Integrals and Special Functions	2	-	40	10	-	50	2
3	MIN-PR-III	2MIN03MAT39	MIN Mathematics Lab-III	-	4	-	-	25	25	2
Open Elective										
1	OEC MTS-PR-III	2OEC03MTS39	Mathematical Science-III (Quantitative Analysis)	-	4	-	-	25	25	2
Semester –III Total				**8**	**20**	**160**	**40**	**125**	**325**	**18**
Semester-IV										
Major										
1	DSC-VII	2DSC03MAT41	Differential Calculus	2	-	40	10	-	50	2
2	DSC-VIII	2DSC03MAT42	Integral Calculus	2	-	40	10	-	50	2
3	VSC-PR-II	2VSC03MAT49	Data structure using Python	-	4	-	-	25	25	2
4	DSC-PR-IV	2DSC03MAT49	DSC Mathematics Lab-IV	-	8	-	-	50	50	4
Minor										
1	MIN-VII	2MIN03MAT41	Computational Mathematics for Sciences- II	2	-	40	10	-	50	2
2	MIN-VIII	2MIN03MAT42	Laplace Transform	2	-	40	10	-	50	2
3	MIN-PR-IV	2MIN03MAT49	MIN Mathematics Lab-IV	-	4	-	-	25	25	2
Open Elective										
1	OEC MTS-PR-IV	2OEC03MTS49	Mathematical Science-IV (Applied Quantitative Aptitude and Logical Thinking)	-	4	-	-	25	25	2
Semester –IV Total				**8**	**20**	**160**	**40**	**125**	**325**	**18**