HAVERI UNIVERSITY , HAVERI.

B.Sc. (MATHEMATICS)

SYLLABUS

WITH EFFECT FROM 2024 - 25

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM III, IV, V & VI

AND OPEN ELECTIVE COURSES (OEC) FOR III, IV AND
SKILL ENHANCEMENT COURSE (SEC) FOR V SEM

AS PERNEP: 2020

Haveri University, Haveri

Three Years Under Graduate Program in Mathematics for B.Sc.
(Hons.)Effective from 2024-25

Sem.	Type of Course	Theory/ Practical	Course Code	Course Title	Instruction hour/ week	Total hours / sem	Duration of Exam	Marks			Credits
								Formative	Summative	Total	
III	DSCC - 5	Theory	033MAT011	Ordinary Differential Equations and Real Analysis – I	04hrs	56	02 hrs	40	60	100	04
	DSCC - 6	Practical	033MAT012	Practicals on Ordinary Differential Equations and Real Analysis – I	04 hrs	52	03 hrs	25	25	50	02
IV	DSCC - 7	Theory	034MAT011	Partial differential Equations and Integral Transforms	04hrs	56	02 hrs	40	60	100	04
	DSCC - 8	Practical	034MAT012	Practicals on Partial differential Equations and Integral Transforms	04 hrs	52	03 hrs	25	25	50	02
V	DSCC-9	Theory	035 MAT 011	Real Analysis-II and Complex Analysis	04hrs	56	02 hrs	40	60	100	04
	DSCC-10	Practical	035 MAT 012	Practicals on Real Analysis-II and Complex Analysis	04 hrs	56	03 hrs	25	25	50	02
	DSCC-11	Theory	035 MAT 013	Vector Calculus and Analytical Geometry	04hrs	56	02 hrs	40	60	100	04
	DSCC-12	Practical	035 MAT 014	Practicals on Vector Calculus and Analytical Geometry	04 hrs	56	03 hrs	25	25	50	02
	SEC-3	Practical	035 MAT 061	Programming with Python							
VI	DSCC-13	Theory	036 MAT 011	Algebra-III and Special Functions	04hrs	56	02 hrs	40	60	100	04
	DSCC-14	Practical	036 MAT 012	Practicals on Algebra-III and Special Functions and Special Functions	04 hrs	56	03 hrs	25	25	50	02
	DSCC-15	Theory	036 MAT 013	Numerical Analysis	04hrs	56	02 hrs	40	60	100	04
	DSCC-16	Practical	036 MAT 014	Practicals on Numerical Analysis	04 hrs	56	03 hrs	25	25	50	02
	Internship-1		036 MAT 091	Internship				50	0	50	02
	Total										

B.Sc. Semester – III

Discipline Specific Course(DSCC-5)

Course Title: Ordinary Differential Equations and Real Analysis
Course Code (Theory): 033MAT011

Course Code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessmen tMarks	Summative Assessmentt Marks	Total Marks
033MAT011	DSCC-5	Theory	04	04	56 hrs	2 hrs	40	60	100

At the end of the course students will be able to:

CO 1: Solve first-order non-linear differential equations and linear differential equations.

CO 2: To model problems in nature using Ordinary Differential Equations.

CO 3: Formulate differential equations for various mathematical models

CO 4: Apply these techniques to solve and analyze various mathematical models.

CO 5: Understand the fundamental properties of the real numbers that lead to define sequence and series in the formal development of real analysis.

CO 6: Learn the concept of Convergence and Divergence of a sequence.

CO 7: Able to handle and understand limits and their use in sequences, series, differentiation, and integration.

CO 8: Apply the ratio, root, alternating series, and limit comparison tests for convergence and absolute convergence of an infinite series.

Syllabus- Course (Theory) : DSCC-5 **Title- 033MAT011: Ordinary Differential Equations and Real Analysis – I**	**Total Hrs: 56**
Unit-I	**14 hrs**
Ordinary Differential Equations: Recapitulation of Differential Equations of the first order and first degree, Exact Differential equations, Necessary and sufficient condition for the equations to be exact, Reducible to the exact differential equations. Differential equations of the first order and higher degree: Equations solvable for p, x, y. Clairaut's equation and singular solution. Orthogonal trajectories of Cartesian and polar curves.	
Unit-II	**14 hrs**
Linear differential equations: Linear differential equations of the n^{th} order with constant coefficients. Particular Integrals when the RHS is of the form e^{ax}, sin(ax+b), cos(ax+b), x^n, e^{ax} V and x V (with proofs), where V is a function of x. Cauchy – Euler equations, Legendre differential equations, Method of variation of parameters. Simultaneous differential equations with two and more than two variables. Condition for integrability of total differential equations P dx +Q dy+ R dz = 0.	
Unit-III	**14 hrs**

Sequences: Sequences of real numbers, Bounded sequences. Limit of a sequence. convergent, divergent, and oscillatory sequences. Monotonic sequences. Algebra of convergent sequences. Limit points of a sequence. Bolzano Weierstrass theorem for sequence. Limit superior and limit inferior of sequences. Cauchy's first and second theorem on limits of a sequence. Cauchy's general principle for convergence of a sequence. Subsequence and their properties.	
Unit-IV	**14 hrs**
Infinite Series: Definition of convergent, divergent, and oscillatory series. Series of non-negative terms, Cauchy's general principle of convergence. Geometric series, P-series (Harmonic series). Comparison tests for positive term series. D'Alembert's ratio test, Raabe's test. Cauchy's Root test and Cauchy's integral test. Alternating series. Leibnitz's theorem. Absolute convergence and conditional convergence of a series. Summation of series: Binomial, exponential, and logarithmic.	

Books recommended:

1. M. D. Raisinghania, Ordinary Differential Equations & Partial Differential Equations, S.Chand & Company, New Delhi.
2. J. Sinha Roy and S Padhy: A course of Ordinary and Partial Differential Equation, Kalyani Publishers, New Delhi.
3. D. Murray, Introductory Course in Differential Equations, Orient Longman (India)
4. W. T. Reid, Ordinary Differential Equations, John Wiley, New Delhi.
5. M.L Khanna and L.S. Varhiney, Real Analysis by, Jai Prakash Nath & Co. Meerut.
6. M. L. Khanna, Differential Equations, Jai Prakash Nath & Co. Meerut
7. S. L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
8. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2015.
9. Gerald G. Bilodeau, Paul R. Thie, G.E. Keough, An Introduction to Analysis, 2nd Ed., Jones & Bartlett, 2010.
10. K. A. Ross, Elementary Analysis: The Theory of Calculus, (2^{nd} edition), Springer, 2013
11. S. K. Berberian, A First Course in Real Analysis, Springer Verlag, New York, 1994.
12. T. Apostol, Mathematical Analysis, Narosa Publishing House.
13. E. Kreyzig, Advanced Engineering Mathematics, John Wiley, New Delhi.

Formative Assessment for Theory	
Assessment Occasion / Type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/Assignment/Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – III

Subject: Mathematics
Discipline Specific Course (DSC)

Course Title.: Practicals on DSCC-6: Ordinary Differential Equations and Real Analysis –I
Course Code (Practical): 033MAT012

Course Code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assess ment Marks	Total Marks
033MAT012	DSCC-6	Practical	02	04	52 hrs	3 hrs	25	25	50

Course Outcome (CO):

At the end of the course (Practical), students will be able to:

This course will enable the students to gain hands-on experience of

CO 1: Free and Open Source software (FOSS)tools or computer programming.
CO 2: Solving exact differential equations
CO 3: Plotting orthogonal trajectories
CO 4: Finding complementary functions and particular integral of linear and homogeneous differential equations.
CO 5: Acquire knowledge of applications of real analysis and differential equations.
CO 6: Verification of convergence/divergence of different types of series

List of the Experiments for 52 hrs / Semesters

Introduction to the software and commands related to the topic.

Sl. No	Title: Practicals on Ordinary Differential Equations and Real Analysis –I	52. Hrs/Sem
1.	Fundamentals of Ordinary differential equations and Real analysis using FOSS.	
2.	Verification of exactness of a differential equation	
3.	Plot orthogonal trajectories for Cartesian and polar curves	
4.	Solutions of differential equations that are solvable for x, y, p.	
5.	To find the singular solution by using Clairaut's form.	
6.	Finding the Complementary Function and Particular Integral of linear and Homogeneous differential equations with constant coefficients and plot the solutions.	
7.	Finding the Particular Integral of differential equations up to second order and plot the solutions.	
8.	Solutions to the Total and Simultaneous differential equations and plot the solutions.	
9.	Test the convergence of sequences	

10.	Verification of exponential, logarithm, and binomial series.	
11.	Verification of geometric series, p-series, Cauchy's Integral test, root test, and D Alembert's Test	
12.	Examples on a series of positive terms.	
13.	Examples on alternating series using Leibnitz's theorem.	
14.	Finding the convergence of series using Cauchy's criterion for partial sums.	

Pedagogy

General instructions: Suggested Software: Maxima/Scilab/Maple/MatLab/Mathematica/Phython/R.

Practical Semester end Examination	
Assessment	**Marks**
Program writing and problem solving	10
Program Execution	10
Viva	03
Journal	02
Total	**25 Marks**
Formative Assessment as per guidelines.	

Note: Same Scheme may be used for IA (Formative Assessment) examination

Books recommended:

1. Scilab by example: M. Affouf 2012, ISBN: 978-1479203444
2. Scilab (A free software to Matlab): H. Ramchandran, A.S.Nair.2011S.Chand and Company
3. Scilab for very beginners. - www.scilab-enterprises.com
4. M. Kanagasabapathy, Introduction to Maxima for Scientific Computers, BPB Publishers.
5. Kalyanarao Takale, Computational Mathematics using Maxima Software, Nirali Publishers.
6. Vaisak Vena, Maxima, The Computer Algebra System, Notion Press.
7. M. D. Raisinghania, Ordinary Differential Equations & Partial Differential Equations, S.Chand & Company, New Delhi.
8. J. Sinha Roy and S Padhy: A course of Ordinary and Partial Differential Equation,Kalyani Publishers, New Delhi.
9. D. Murray, Introductory Course in Differential Equations, Orient Longman (India)
10. W. T. Reid, Ordinary Differential Equations, John Wiley, New Delhi.
11. M.L Khanna and L.S. Varhiney, Real Analysis, Jai Prakash Nath & Co. Meerut.
12. M. L. Khanna, Differential Equations, Jai Prakash Nath & Co. Meerut.

B.Sc. Semester – III

Subject: Mathematics

Open Elective Course (OEC-3)
(OEC for other students)

Title of the Course: **Quantitative Mathematics**
Course Code(OEC):): 003MAT051

Course Code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
003MAT051	OEC-3	Theory	03	03	42 hrs	2 hrs	40	60	100

OEC-3 (OEC for other students): 003MAT051

Course Outcome (CO):

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

CO 1: Understand number system and fundamental operations
CO 2: Understand the concept of linear quadratic and simultaneous equations and their applications in real-life problems.
CO 3: Understand and solve the problems based on Age.
CO 4: Solve Speed and Distance related problems.

Syllabus- 003MAT051: Title- Quantitative Mathematics	Total Hrs: 42
Unit-I	**14 hrs**
Number System: Numbers, Operations on Numbers, Tests on Divisibility, HCF, and LCM of numbers. Decimal Fractions, Simplification, Square roots, and Cube roots - Problems thereon. Surds and Indices. Illustrations thereon.	
Unit-II	**14 hrs**
Theory of equations Linear equations, quadratic equations, simultaneous equations in two variables, simple application problems - Problems on Ages, Problems on conditional Age calculations, Present &Past age calculations.	
Unit-III	**14 hrs**
Quantitative Aptitude Percentage, Average, Average Speed-problems. Time and distance, problems based on trains, problems on work and time, work and wages, clock and calendar.	

Books recommended:

1. R. S. Aggarwal, Quantitative Aptitude, S. Chand and Company Limited, New Delhi-110055.

2. Abhijit Guha, Quantitative Aptitude, 5th Edition, Mc. Graw hill publications.2014.
3. R. V. Praveen, Quantitative Aptitude and Reasoning, PHI publishers.
4. R. S. Aggarwal, Objective Arithmetic, S. Chand & Company Ltd.
5. Qazi Zameerddin, Vijay K. Khanna, S. K. Bhambri, Business Mathematics- II Edition, S. Chand & Company Ltd.
6. S. K. Sharma and Gurmeet Kaur, Business Mathematics, S. Chand & Sons.
7. Hazarika Padmalochan, A Text Book of Business mathematics for B. Com. and BBA Course, S. Chand & Company Ltd.
8. J. K. Thukrol, Business Mathematics, abci book: 2020, First Edition, The world book depot, India
9. N. G. Das and J.K.Das, Business Mathematics and Statics, McGraw Hill Education, 2017.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weightage for total marks

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Fieldwork / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
03 - Year UG Honors programme:2024-25

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-6 carries 2 marks each. Answer any 5 questions : 10marks

Part-B

2. Question number 7- 11 carries 5 marks each. Answer any 4 questions : 20 marks

Part-C

3. Question number 12-15 carries 10 marks each. Answer any 3 questions : 30 marks(

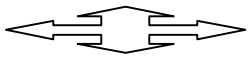
Total: 60 Marks

Format for Model question paper Unit wise
033MAT011: Ordinary Differential Equations and Real Analysis – I

Question Number	Number of questions to be set in Unit	Number of questions to be answered	Marks for each question	Max marks for the question
1	Unit-I ------2 Unit-II ------1 Unit-III------1 Unit-IV------2 Total: 6	5	2	10
2	Unit-I ------1 Unit-II ------2 Unit-III------1 Unit-IV------1 Total: 5	4	5	20
3	Unit-I ------1 Unit-II ------1 Unit-III------1 Unit-IV------1 Total: 4	3	10	30

003MAT051 Quantitative Mathematics

Question Number	Number of questions to be set in Unit	Number of questions to be answered	Marks for each question	Max marks for the question
1	Unit-I ------2 Unit-II ------2 Unit-III------2 Total: 6	5	2	10
2	Unit-I ------1 Unit-II ------2 Unit-III------2 Total: 5	4	5	20
3	Unit-I ------2 Unit-II ------1 Unit-III------1 Total: 4	3	10	30



B.Sc. Semester – IV

Subject: Mathematics

Discipline Specific Course (DSCC-7)

Course Title : Partial Differential Equations and Integral Transforms
Course Code (Theory): 034MAT011

Course Code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessmentt Marks	Total Marks
034MAT011	DSCC-7	Theory	04	04	56 hrs	2 hrs	40	60	100

Course Outcome (CO):

At the end of the course students will be able to:

- **CO 1:** Solve the Partial Differential Equations of the first order and second order.
- **CO 2:** Formulate, classify and transform partial differential equations into canonical form.
- **CO 3:** Solve linear and non-linear partial differential equations using various methods; and apply these methods to solving some physical problems.
- **CO 4:** Able to take more courses on wave equation, heat equation, and Laplace equation.
- **CO 5:** Solve PDE by Laplace Transforms and Fourier Transforms.

Syllabus-(Theory): DSCC-7 **Title-Partial Differential Equations and Integral Transforms**	**Total Hrs: 56**
Unit-I	**14 hrs**
Basic concepts–Formation of partial differential equations by elimination of arbitrary constants and functions, Solution of partial differential equations –Solution by Direct integration, Lagrange's linear equations of the form Pp + Qq = R, Standard types of first order non-linear partial differential equations. The integrals of the non-linear equation by Charpit's method	
Unit-II	**14 hrs**
Homogeneous linear partial differential equations with constant coefficients. Partial differential equations of the second order. Classification of second-order partial differential equations, canonical forms. Classification of second-order linear equations as hyperbolic, parabolic, and elliptic. Solutions of the Heat equation, Laplace equation, and Wave equation (using separation of variables).	
Unit-III	**14 hrs**

Laplace Transforms Definition**,** Basic Properties. Laplace transforms of some standard functions. Laplace transform of Periodic functions. Laplace transform of derivative and integral of a function. Heaviside function. Dirac-delta function. Convolution theorem. Inverse Laplace transforms and its properties. Solution of differential equations by using Laplace transforms	
Unit-IV	**14 hrs**
Fourier Series and Transforms: Periodic functions. Fourier Coefficients. Fourier series of functions with period 2π and period 2L. Fourier series of even and odd functions. Half range Cosine and Sine series. Fourier Transforms - Finite Fourier Cosine and Sine transform. Transforms of derivates**.** Applications of Fourier Transforms**.**	

Books recommended:

1. D. A. Murray, Introductory Course in Differential Equations, Orient and Longman
2. H.T.H.Piaggio, Elementary Treatise on Differential Equations and their Applications, CBS Publisher & Distributors, Delhi,1985.
3. G.F.Simmons, Differential Equations, Tata McGraw Hill.
4. S.L.Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India,2004.
5. M. D. Raisinghania, Ordinary Differential Equations & Partial Differential Equations, S.Chand & Company, New Delhi.
6. K. Sankara Rao, Introduction to Partial Differential Equations, PHI, Third Edition, 2015.
7. I.N.Sneddean, Elements of Partial differential equations, McGraw-Hill International Editions,1986.
8. Murray R. Spiegal (Schaum's Series), Laplace Transforms, McGraw-Hill International Editions.
9. Goel and Gupta, Laplace Transform, Pragati Prakashan, Meerut, India.
10. Sudhir Kumar Pundir, Integral Transform Methods in Science & Engineering, CBS Engineering Series, 2017, New Delhi.
11. Murray R.Spiegal (Schaum's Series), Fourier Transforms, McGraw-Hill International Editions.
12. Earl David Rainville and Philip Edward Bedient–A short course in Differential Equations, Prentice Hall College Div ;6th Edition.
13. Sathya Prakash, Mathematical Physics, S. Chand and Sons, New Delhi.

Formative Assessment for Theory	
Assessment Occasion / Type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/Assignment/Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – IV

Subject: Mathematics
Discipline Specific Course (DSCC-8)

Course Title: Partial Differential Equations and Integral Transforms

Course Code : 034MAT012

CourseCode	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative AssessmentMarks	Summative Assessment Marks	Total Marks
034MAT012	DSCC-8	Practical	02	04	52 hrs	3 hrs	25	25	50

Course Outcome (CO):

At the end of the course (Practical), students will be able to:

CO 1: Learn Free and Open Source software (FOSS) tools or computer programming.
CO 2: Solve problems on Partial Differential Equations and Integral Forms.
CO 3: To find Laplace transform of various functions.
CO 4: To find the Fourier Transform of periodic functions
CO 5: To solve partial differential equations by using Integral transforms.

List of the Experiments for 52 hrs / Semesters

Sl. No	Title: Partial Differential Equations and Integral Transforms	52. Hrs/Sem
1.	Solutions of Linear Partial differential equations of	
2.	Solutions of the partial differential equation using Charpit's method.	
3.	Solutions of Second-order homogenous partial differential equation with constant coefficients.	
4.	Solutions to the partial differential equations using the separation of variables method (Heat/ Wave/ Laplace).	
5.	Finding the Laplace transforms of some standard and periodic functions.	
6.	Finding the inverse Laplace transform of simple functions	
7.	Verification of Convolution Theorem.	
8.	To solve ordinary linear differential equations using Laplace transforms.	
9.	To solve the Integral equation using Laplace transform.	
10.	To find full range Fourier series of some simple functions with period 2π and $2L$	
11.	To find Half range sine and cosine series of some simple functions and ploting them.	
12.	To find Cosine Fourier transforms.	
13.	To find Sine Fourier transforms.	

General instructions: Suggested Softwares: Maxima/Scilab/Maple/MatLab/Mathematica/Phython/R.

Practical Semester end Examination	
Assessment	**Marks**
Program writing and problem solving	10
Program Execution	10
Viva	03
Journal	02
Total	**25 Marks**
Formative Assessment as per guidelines.	

Note: Same Scheme may be used for IA(Formative Assessment) examination

Books recommended.

1. Scilab by example: M. Affouf 2012, ISBN: 978-1479203444.
2. Scilab (A free software to Matlab): H. Ramchandran, A.S.Nair.2011S.Chand and Company.
3. Scilab for very beginners. - www.scilab-enterprises.com
4. M. Kanagasabapathy, Introduction to Maxima for Scientific Computers, BPB Publishers.
5. Kalyanarao Takale, Computational Mathematics using Maxima Software, Nirali Publishers.
6. Vaisak Vena, Maxima, The Computer Algebra System, Notion Press.
7. P.N.de Souza. R.J. Fateman, J.Moses and C. Yapp, The Maxima Book.
8. M. D. Raisinghania, Ordinary Differential Equations & Partial Differential Equations, S. Chand & Company, New Delhi.
9. I. N. Sneddean, Elements of Partial differential equations, McGraw-Hill International Editions, 1986.
10. Murray R.Spiegal (Schaum's Series), Laplace Transforms, McGraw-Hill International Editions.
11. Murray R.Spiegal (Schaum's Series), Fourier Transforms, McGraw-Hill International Editions.

B.Sc. Semester – IV

Subject: Mathematics Open Elective Course (OEC-4) (OEC for other students

Title of the Course: **Mathematical Finance**

Course Code(OEC): 004MAT051

CourseCode	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
004MAT051	OEC-4	Theory	03	03	42 hrs	2 hrs	40	60	100

OEC-4 (for other students): 004MAT051:

Course Outcome (CO):

At the end of the course, students will be able to:

CO 1: Understand how to compute profit and loss, discount, and Banker's discount.

CO 2: Understand the concept of Linear equations and inequalities and their use in the Solving the Linear Programming Problems.

CO 3: Formulation of Transportation Problem and its application in the routing problem Integrate the concept in business concept with the functioning of global trade.

CO 4: Understand commercial arithmetic.

CO 5: Apply decision-support tools to business decision-making.

CO 6: Apply knowledge of business concepts and functions in an integrated manner.

Syllabus- OEC **Title- 004MAT051: Mathematical Finance**	**TotalHrs: 42**
Unit-I	**14 hrs**
Commercial Arithmetic Bill of exchange, Bill of the discounting procedure. Basic formula related to profit, loss, discount and brokerage, Successive discount, True discount, Banker's discount.	
Unit-II	**14 hrs**
Linear Programming Linear equations and inequalities- Rectangular coordinates, straight line, parallel and intersecting lines, and linear inequalities. Introduction to linear programming, Mathematical formulation of LPP, Solution of an LPP by graphical method, special cases in the graphical method.	

Unit-III	**14 hrs**
Transportation problem Introduction, Formulation of Transportation problem, Initial basic feasible solution, Steps in solving a transportation problem, optimality check, special cases in Transportation problem. The Traveling salesman Problem (Routing Problem).	

Books recommended:

1. R. S. Aggarwal, Objective Arithmetic, S.Chand & Company Ltd.
2. A. Mizrahi and M. Sullivan, Mathematics for Business and Social Sciences and Application approach, JohnWiley and Sons, India.
3. Qazi Zameeruddin, Vijay K. Khanna, S. K. Bhambri, Business Mathematics- II Edition, Vikas Publishing House.
4. S.Kalavathy, Operation Research, Fourth edition, Vikas publication house Pvt. Ltd.
5. Sreenivasa Reddy M, Operations Research, 2nd edition, Sanguine Technical publishers Bangalore.
6. S.D.Sharma, Operation Research, Kedar Nath Ram Nath, Meerut.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weightage for total marks

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
03 - Year UG Honors programme:2024-25

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-6 carries 2 marks each. Answer any 5 questions : 10marks

Part-B

2. Question number 7- 11 carries 5Marks each. Answer any 4 questions : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 3 questions : 30 marks

   (Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

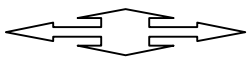
Format for Model question paper Unit wise

DSCC Theory: 034MAT011: Partial Differential Equations and Integral Transforms

Question Numbers	Number of questions to be set in Unit	Number of questions to be answered	Marks for each question	Max marks for the question
1	Unit-I: ------ 2 Unit-II ------ 1 Unit: III-------1 Unit: IV-------2 Total: 6	5	2	10
2	Unit-I ------1 Unit-II ------1 Unit-III -----2 Unit-IV ------1 Total: 5	4	5	20
3	Unit-I ------1 Unit-II ------1 Unit-III------1 Unit-IV------1 Total: 4	3	10	30

OEC 4 : 004MAT051: Mathematical Finance

Question Number	Number of questions to be set in Unit	Number of questions to be answered	Marks for each question	Max marks for the question
1	Unit-I ------2 Unit-II ------2 Unit-III ------2 Total: 6	5	2	10
2	Unit-I ------2 Unit-II ------1 Unit-III------2 Total : 5	4	5	20
3	Unit-I ------1 Unit-II ------2 Unit-III------1 Total: 4	3	10	30



B.Sc. Semester – V

Discipline Specific Course (DSC)-9

Course Title: Real Analysis-II and Complex Analysis

Course Code: 035 MAT 011

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-9	**Theory**	**04**	**04**	**56 hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):At the end of the course students will be able to:

CO 1: Carry out certain computations such as computing upper and lower Riemann sums as well integrals

CO 2: Describe various criteria for the Integrability of functions.

CO 3: Exhibit certain properties of mathematical objects such as integrable functions, analytic functions, harmonic functions and so on.

CO 4: Prove some statements related to Riemann integration as well as in the complex analysis

CO 5: Carry out the existing algorithms to construct mathematical structures such as analytic functions

CO 6: Applies the gained knowledge to solve various other problems.

Unit	Title: Real Analysis-II and Complex Analysis	56. hrs/ sem
Unit I	**Riemann Integration-I**: Definition & examples for partition of an interval, refinement of a partition and common refinement. Riemann Darboux Sums - Upper and lower (Darboux) sums –definition, properties & problems. Riemann Integral – Upper and Lower integrals (definition & problems), Darboux's theorem and Criterion for Integrability, Integrability of sum, difference, product, quotient and modulus of integrable functions. Integral as a limit of sum (Riemann sum) – Problems. Some integrable functions – Integrability of continuous functions, monotonic functions, bounded functions with finite number of discontinuity.	14 hrs
Unit II	**Riemann-Stieltjes Integral and Improper Integral:** Fundamental theorem of Calculus–related problems, change of variables, integration by parts, first and second mean value theorems of integral calculus. Riemann-Stieltjes Integral– Definition & examples. Riemann Integral as a special case. Improper Integral-Improper integrals of the first, second and third kind with examples. Improper integral has the limit of the proper integral. Comparison test, Abel's test and Dirichlet's test for the convergence of the integral of a product of two functions.	14 hrs
Unit III	**Complex numbers and functions of complex variables:** Recaptulations(Complex numbers-Cartesian and polar form - geometrical representation - complex - Plane - Euler's formula - $e^{iz} = \cos z + i \sin z$.) Functions of a complex variable - limit, continuity and differentiability of a complex function. Analytic function, Cauchy-Riemann equations in Cartesian and Polar forms – Sufficient conditions for analyticity (Cartesian form only)-Harmonic function - standard properties of analytic functions - construction of analytic functionwhen the real or imaginary part is given -	14 hrs

	Milne Thomson method.	
Unit IV	**Transformations and Complex integration**: Transformations: Definition - Jacobian of a transformation - Identity transformation – Reflection – Translation – Rotation – Stretching – Inversion - Linear transformation – Definitions - Bilinear transformations – Cross-ratio of four points – Cross-ratio preserving property - Preservation of the family of straight lines and circles - Conformal mappings – Discussion of the transformations $w = z^2$, $w = \sin z$, $w = e^z$, $w = \frac{1}{2}\left(z + \frac{1}{z}\right)$. Complex integration – definition, Line integral, properties and problems. Cauchy's Integral theorem - proof using Green's theorem - direct consequences. Cauchy's Integral formula with proof - Cauchy's generalized formula for the derivatives with proof and applications for evaluation of simple line integrals.	14 hrs

References:

1. S.C Malik, *Real Analysis,* New Age International (India) Pvt. Ltd.
2. S.C.Malik and Savita Arora, *Mathematical Analysis*, 2nd ed. New Delhi, India: New Age international (P) Ltd.
3. Richard R Goldberg, *Methods of Real Analysis*, Oxford and IBH Publishing
4. Ajit Kumr and S. Kumaresan - *A Basic Course in Real Analysis,* Taylor and FrancisGroup.
5. L. V. Ahlfors, *Complex Analysis,* 3rd Edition, McGraw Hill Education
6. Bruce P. Palka , *Introduction to the Theory of Function of a Complex Variable*, Springer
7. Serge Lang, *Complex Analysis*, Springer
8. Shanthinarayan, *Theory of Functions of a Complex Variable,* S. Chand Publishers.
9. S. Ponnuswamy, *Foundations of Complex Analysis,* 2nd Edition, Alpha Science International Limited.
10. R.V. Churchil & J.W. Brown, *Complex Variables and Applications*, 5th ed, McGraw Hill Companies

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – V

Discipline Specific Course (DSC)-10

Course Title: Practicals on Real Analysis-II and Complex Analysis

Course Code: 035 MAT 012

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-10	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Learn *Free and Open Source Software (FOSS)* tools for computer programming.

CO 2: Solve problems on Real Analysis and Complex Analysis studied in **035MAT011** by using FOSS softwares

CO 3: Acquire knowledge of applications of Real Analysis and Complex Analysis through FOSS

Expt. No,	Title: Practicals on Real Analysis-II and Complex Analysis	56. hrs/ sem
1	Program to check whether a given set of real numbers attains supremum or infimum.	
2	Program to find upper and lower Riemann sums with respect to a given partition	
3	Program to test Riemann Integrability.	
4	Program to evaluate Riemann integral as a limit of sum.	
5	Program on verification of Cauchy – Riemann equations (Cartesian form) or test for analyticity.	
6	Program on verification of Cauchy – Riemann equations (Polar form) or test for analyticity.	
7	Program to check whether a function is harmonic or not.	
8	Program to construct analytic functions (through Milne–Thompson method)	
9	Program to find Cross-ratio of points and related aspects.	
10	Program to find fixed points of bilinear transformations.	
11	Program to verify De Moivre's theorem.	

Instruction to the Examiner:

1. In case the University question papers are not available the external examiner shall prepare question papers for all the experiments, in consultation with the internal examiner.
2. No students shall be allowed for the examination without their Journal / Practical records, certified by the Staff in charge and Head / Principal. If the Journal/ Practical record is not presented by the student, the Head/Principal shall issue a certificate stating that he/she has attended the regular practicals and his/her attendance is satisfactory (not less than 75% including 10% of extracurricular activities if applicable) and the candidate shall then be allowed to appear for examination. In such cases, the marks reserved, for the journal shall be deducted.
3. Candidates having an attendance record of less than 75 % (including 10% of extracurricular activities, if applicable) in that practical paper shall not be allowed to take the practical examination.
4. The Principal shall permit the students to take the examination as out of turn in any other batches only on technical reasons like overlapping of the timings with other subjects but not for any other personal reasons of the candidate including medical grounds.
5. No practical examination shall be conducted in the absence of an external examiner. Absence of external examiner if any is to be brought to the notice of the principal by the internal examiner to enable alternative arrangements to be made. The Principal shall appoint external examiners as per the instruction already given. If the internal examiner remains absent, the principal shall appoint another internal/external examiner. Under any circumstances, there shall not be two internal examiners for a given batch but two external examiners shall be allowed.

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Practicals Semester-end Examination	
Assessment	**Distribution of Marks**
Program Writing and Problem Solving	10
Program Execution	10
Viva	03
Journal	02
Total	**25 Marks**

Note: Same scheme may be used for IA(Formative Assessment) examination.

B.Sc. Semester – V

Discipline Specific Course (DSC)-11

Course Title: Vector Calculus and Analytical Geometry

Course Code: 035 MAT 013

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-11	**Theory**	**04**	**04**	**56 hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Get introduced to the fundamentals of vector differential and integral calculus.

CO 2: Get familiar with the various differential operators and their properties.

CO 3: Get acquainted with the various techniques of vector integration.

CO 4: Learn the applications of vector calculus.

CO 5: Recollect the fundamentals of Analytical Geometry in 3D.

CO 6: Interpret the geometrical aspects of planes and lines in 3D.

Unit	Title: Vector Calculus and Analytical Geometry	56.hrs/ sem
Unit I	**Vector Algebra** –Recapitulation (Scalar and Vector triple products, geometrical interpretation). Vector function of a scalar variable – interpretation as a space curve, derivative, tangent, normal and binormal vectors to a space curve; Curvature and Torsion of a space curve-definitions, derivation and problems, Serret- Frenet formulae. **Scalar field** - Gradient of a scalar field, geometrical meaning, directional derivative, unit normal using surfaces - tangent plane and normal to the surface; Vector field – divergence and curl of a vector field, geometrical meaning, solenoidal and irrotational fields; Laplacian of a scalar field; Vector identitRecapitulationies.	14 hrs
Unit II	**Vector Integration** – Definition and basic properties, vector line integral, surface integral and volume integral; Green's theorem in the plane – Proof and related problems, Direct consequences of the theorem; Gauss' Divergence theorem – Proof and related problems, Direct consequences of the theorem; Stokes' theorem – Proof and related problems, Direct consequences of the theorem.	14 hrs
Unit III	**Planes, Straight Lines and Spheres Planes:** Distance of a point from a plane, Angle between two planes and pair of planes. Bisectors of angles between two planes; Straight lines: Equations of straight lines, Distance of a point from a straight line, Distance between two straight lines, Distance between a straight line and a plane; Spheres: Different forms, Intersection of two spheres, Orthogonal intersection, Tangents and normal, Radical plane, Radical line, Coaxial system of spheres, Pole, Polar and Conjugacy.	14 hrs
Unit IV	Locus, Surfaces, Curves and Conicoids Space curves, Algebraic curves, Ruled surfaces, Some standard surfaces, Classification of quadric surfaces, Cone, Cylinder, Central conicoids, Tangent plane, Normal, Polar planes, and Polar lines.	14 hrs

References:

1. Robert J. T. Bell (1994). An Elementary Treatise on Coordinate Geometry of Three Dimensions. Macmillan India Ltd.
2. D. Chatterjee (2009). Analytical Geometry: Two and Three Dimensions. Narosa Publishing House.
3. Shanthi Narayan and P. K. Mittal, *Analytical Solid Geometry*, S. Chand Publications.
4. A. N. Das, *Analytical Geometry of Two and Three Dimensions*, New Central Book Agency Pvt. Ltd.
5. M. D. Raisinghania, *Vector Calculus*, S Chand Co. Pvt. Ltd., 2013.
6. M. Spiegel, *Vector Analysis*, 2nd Edition, Schaum's Outline Series, Mc-Graw Hill, Education, 2017.
7. C. E. Weatherburn, *Elementary Vector Analysis*, Alpha edition, 2019.
8. P. N. Wartikar and J. N. Wartikar, *A Textbook of Applied Mathematics*, Vol. II, Pune Vidyarthi Griha Prakashan, Pune, 2009.
9. C. E. Weatherburn, *Differential Geometry of Three Dimension*, Khosla Publishing House, 2020.
10. B. S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers.
11. G. B. Thomas and R. L. Finney, *Introduction to Calculus and Analytical Geometry*, Narosa Publishing House, 2010.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – V

Discipline Specific Course (DSC)-12

Course Title: Practicals on Vector Calculus and Analytical Geometry

Course Code: 035 MAT 014

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-12	Practical	02	04	56 hrs.	3hrs.	25	25	50

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Learn *Free and Open Source Software (FOSS)* tools for computer programming

CO 2: Solve problems related to Analytical Geometry usingFOSS software.

CO 3: Solve problems related to Vector Calculus usingFOSS software.

CO 4: Aquire the knowledge of applications of Analytical Geometry and Vector Calculus.

Expt. No,	Title: Practicals on Vector Calculus and Analytical Geometry	56.hrs/ sem
1	Program on multiple product of vectors – Scalar and Cross product.	
2	Program on vector differentiation and finding unit tangent.	
3	Program to find curvature and torsion of a space curve.	
4	Program to find the gradient and Laplacian of a scalar function, divergence and curl of a vector function.	
5	Program to demonstrate the physical interpretation of gradient, divergence and curl.	
6	Program to evaluate a vector line integral.	
7	Program to evaluate a surface integral.	
8	Program to evaluate a volume integral.	
9	Program to verify Green's theorem.	
10	Program to find equation and plot sphere, cone and cylinder	
11	Program to find distance between a straight line and a plane.	
12	Program to construct and plot some standard surfaces.	

Instruction to the Examiner:

1. In case the University question papers are not available the external examiner shall prepare question papers for all the experiments, in consultation with the internal examiner.
2. No students shall be allowed for the examination without their Journal / Practical records, certified by the Staff in charge and Head / Principal. If the Journal/ Practical record is not presented by the student, the Head/Principal shall issue a certificate stating that he/she has attended the regular practicals and his/her attendance is satisfactory (not less than 75% including 10% of extracurricular activities if applicable) and the candidate shall then be allowed to appear for examination. In such cases, the marks reserved, for the journal shall be deducted.
3. Candidates having an attendance record of less than 75 % (including 10% of extracurricular activities, if applicable) in that practical paper shall not be allowed to take the practical examination.
4. The Principal shall permit the students to take the examination as out of turn in any other batches only on technical reasons like overlapping of the timings with other subjects but not for any other personal reasons of the candidate including medical grounds.
5. No practical examination shall be conducted in the absence of an external examiner. Absence of external examiner if any is to be brought to the notice of the principal by the internal examiner to enable alternative arrangements to be made. The Principal shall appoint external examiners as per the instruction already given. If the internal examiner remains absent, the principal shall appoint another internal/external examiner. Under any circumstances, there shall not be two internal examiners for a given batch but two external examiners shall be allowed.

Practicals Semester-end Examination	
Assessment	**Distribution of Marks**
Program Writing and Problem Solving	10
Program Execution	10
Viva	03
Journal	02
Total	**25 Marks**

Note: Same scheme may be used for IA(Formative Assessment) examination.

B.Sc. Semester – V

Skill Enhancement Course: SEC-3

Course Title: Programming with Python

Course Code: 035 MAT 061

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
SEC-3	Practical	02	04	56 hrs.	3hrs.	25	25	50

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Learn the syntax and semantics of Python programming language.

CO 2: Write Python functions to facilitate code reuse and manipulate strings.

CO 3: Understand the use of built-in functions to navigate the file system

CO 4: Apply the concepts of file handling.

Unit	**Title: Programming with Python**	**56 hrs/ sem**
Unit I	**Introduction, Basics and Program flow:** Python character set, Tokens, Variables and assignments, print statement, comments, Python data structure and data types, string operation in Python, Simple input and output including simple output-formatting, operators in Python, expressions, standard library modules, Debugging, indentation, Flow of control (if, if-else, if-elif, nested if), range function, iteration/looping statements, String and list manipulation, Tuples, dictionaries, sorting techniques.	
Unit II	**Functions, libraries and File handling:** Understanding and creating your own functions, Function parameters, Flow of execution in a function call, passing parameters, Returning values from functions, Scope of a function, Importing modules in a Python using standard library functions and Modules, Creating a Python library, Data files, Operating and closing files, working with text files, Standard input, output and error streams, Working with binary and CSV files.	
Expt. No	**Title of the Experiment**	
1	Programs to demonstrate the usage of operators and Input / Output statements	
2	Programs to demonstrate the usage of conditional statements	
3	Programs to demonstrate usage of control structures	
4	Programs to demonstrate the usage of Functions	
5	Programs to demonstrate the usage of recursion functions	
6	Programs to demonstrate the usage of String functions	
7	Programs to demonstrate the usage of lists.	

8	Programs to demonstrate the usage of dictionaries	
9	Programs to demonstrate the usage of tuples.	
10	Programs to apply the concepts of file handling and regEx using packages.	
11	Programs to search and sort the numbers	
12	Programs to demonstrate the working of scraping websites with CSV	

References:

1. Automate the Boring Stuff with Python - Al Sweigart, Willam Pollock, 2015
2. Python Cook Book- David Beazely and Brain K. Jones 2022.
3. Basic Python Programming for Beginners - Varada Rajkumar, Marapalli Krishna, Jaya Prakash, Blue Rose Publishers, 2022.
4. Python- John Shovic and Alan Simpson, Paperback, 2020.
5. Learning Python - Mark Lutz, O'Reilly Media, Paperback, 2nd edition, 2020.
6. Programming and Problem Solving Through Python- Satish Jain and Shashi Singh, BPB Publications, 2020

Instruction to the Examiner:

1. Students have to explain in brief of the problem and model to be used with the Python algorithm.
2. Out of the above 12 Program's, students have to pick any one and answer it.
3. Execute the program and write the output.

Practicals Semester-end Examination	
Assessment	**Distribution of Marks**
Program Writing and Problem Solving	10
Program Execution	10
Viva	03
Journal	02
Total	**25 Marks**

Note: Same scheme may be used for IA(Formative Assessment) examination.

B.Sc. in Mathematics

VI Semester

W. e. f.: 2023-24

B.Sc. Semester – VI

Discipline Specific Course (DSC)-13

Course Title: Algebra-III and Special Functions

Course Code: 036 MAT 011

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-13	Theory	04	04	56 hrs.	2hrs.	40	60	100

Course Outcomes (COs): At the end of the course students will be able to:

CO 1: Understand the concepts of Rings, Integral Domains, Fields
CO 2: Become familiar with the concepts Principal, Prime and Maximal ideals
CO 3: Learn properties of Beta-Gamma functions
CO 4: Realise the importance of Bessel's and Legendre's Functions

Unit	Title: Algebra-III and Special Functions	56.hrs/ sem
Unit I	**Rings, Integral Domains, Fields :** Rings – definition and properties of rings, Rings of integers modulo n, Subrings, Ideals - Principal, Prime and Maximal ideals in a commutative ring - examples and standard properties. Fields – properties, Every field is an integral domain, Every finite integral domain is a field with examples.	14 hrs
Unit II	**Vector spaces** - Definition, examples and properties; Subspaces - Examples, criterion for a subset to be a subspace and some properties; Linear Combination - Linear span, Linear dependence and Linear independence, basic properties of linear dependence and independence, techniques of determining linear dependence and independence in various vector spaces and related problems; Basis and dimension - Co-ordinates, ordered basis, some basic properties of basis and dimension and subspace spanned by given set of vectors.	14 hrs
Unit III	**Beta-Gamma Functions:** Definitions, Properties and examples, relations between beta and gamma functions, standard theorems, applications of evaluations of definite integrals, duplication formula and applications.	14 hrs
Unit IV	**Bessel's and Legendre's Functions:** Solution to differential equation - Ordinary, singular and regular points of second order linear differential equation, series solution when $x = 0$ is an ordinary point, Frobenious method**.** Bessel's differential equation- Definition and discussion of its solutions; Bessel's function $Jn(x)$ - Definition, various recurrence relations for Bessel function (derivation), Generating function for $Jn(x)$ (derivation), value of $J_{1/2}$ and expansions for J_0 and J_1 and related problems. Legendre function - Discussion of solutions to Legendre's differential equation and Legendre polynomials $Pn(x)$ - Various recurrence relations (derivations), Generating function for $Pn(x)$ (derivation) –Orthogonality of Legendre Polynomials.	14 hrs

References:

1. I. N. Herstein, *Topics in Algebra*, 2nd Edition, Wiley.

2. Vijay K Khanna and S K Bhambri (1998), A Course in Abstract Algebra, Vikas Publications.

3. Michael Artin (2015), Algebra, 2nd ed., Pearson.

4. Joseph A, Gallian (2021), Contemporary Abstract Algebra, 10th ed., Taylor and Francis Group.

5. Stephen H. Friedberg, Arnold J. Insel & Lawrence E. Spence (2003), Linear Algebra (4th Edition), Printice-Hall of India Pvt. Ltd.

6. F. M. Stewart, *Introduction to Linear Algebra*, Dover Publications.

7. S. Kumaresan, *Linear Algebra*, Prentice Hall India Learning Private Limited.

8. Kenneth Hoffman & Ray Kunze (2015), Linear Algebra, (2nd Edition), PrenticeHall India Leaning Private Limited.

9. G. E. Andrews, R. Askey and R. Roy, Special Functions, Cambridge University Press

10 S. Kanemitsu and H. Tsukada, Vistas of special functions, World Scientific.

11. G. B. Thomas, Thomas Calculus, 13th Edition, Pearson publication.

12. B. S. Grewal, Higher Engineering mathematics, Khanna Publications

13. K. F. Riley, M. P. Hobson and S. J. Bence, Mathematical Methods for Physics and Engineering, Third Edition, Cambridge University Press.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – VI

Discipline Specific Course (DSC)-14

Course Title: Practicals on Algebra-III and Special Functions

Course Code: 036 MAT 012

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-14	Practical	02	04	56 hrs.	3hrs.	25	25	50

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Learn *Free and Open Source Software (FOSS)* tools for computer programming

CO 2: Solve problem on Linear Algebra studied in 036MAT011 by using FOSS software's.

CO 3: Acquire knowledge of applications of Linear Algebra through FOSS.

Expt. No,	Title: Practicals on Algebra-III and Special Functions	56.hrs/ sem
1	Program on Rings of integers modulo n,	
2	Prime and Maximal ideals in a commutative ring	
3	Programm on Integral Domain	
4	Program on linear combination of vectors.	
5	Program to verify linear dependence and independence.	
6	Program to find basis and dimension of the subspaces.	
7	Program on solutions of Beta-Gamma functions	
8	Programm to solutions of definite integrals	
9	Program to find ordinary, singular and regular points.	
10	Program to solve the Bessel's differential equation	
11	Program to evaluate $Jn(x)$	
12	Program to solve the Legendre's differential equation	

Instruction to the Examiner:

1. In case the University question papers are not available the external examiner shall prepare question papers for all the experiments, in consultation with the internal examiner.
2. No students shall be allowed for the examination without their Journal / Practical records, certified by the Staff in charge and Head / Principal. If the Journal/ Practical record is not presented by the student, the Head/Principal shall issue a certificate stating that he/she has attended the regular practicals and his/her attendance is satisfactory (not less than 75% including 10% of extracurricular activities if applicable) and the candidate shall then be allowed to appear for examination. In such cases, the marks reserved, for the journal shall be deducted.
3. Candidates having an attendance record of less than 75 % (including 10% of extracurricular activities, if applicable) in that practical paper shall not be allowed to take the practical examination.
4. The Principal shall permit the students to take the examination as out of turn in any other batches only on technical reasons like overlapping of the timings with other subjects but not for any other personal reasons of the candidate including medical grounds.
5. No practical examination shall be conducted in the absence of an external examiner. Absence of external examiner if any is to be brought to the notice of the principal by the internal examiner to enable alternative arrangements to be made. The Principal shall appoint external examiners as per the instruction already given. If the internal examiner remains absent, the principal shall appoint another internal/external examiner. Under any circumstances, there shall not be two internal examiners for a given batch but two external examiners shall be allowed.

Practicals Semester-end Examination	
Assessment	**Distribution of Marks**
Program Writing and Problem Solving	10
Program Execution	10
Viva	03
Journal	02
Total	**25 Marks**

Note: Same scheme may be used for IA(Formative Assessment) examination.

B.Sc. Semester – VI

Discipline Specific Course (DSC)-15

Course Title: Numerical Analysis

Course Code: 036 MAT 013

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-15	Theory	04	04	56 hrs.	2hrs.	40	60	100

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Describe various operators arising in numerical analysis such as differenceoperators, shift operators and so on.

CO 2: Articulate the rationale behind various techniques of numerical analysis such as infinding roots, integrals and derivatives.

CO 3: Reproduce the existing algorithms for various tasks as mentioned previously innumerical analysis.

CO 4: Apply the rules of calculus and other areas of mathematics in justifying thetechniques of numerical analysis.

CO 5: Solve problems using suitable numerical technique

CO 6: Appreciate the profound applicability of techniques of numerical analysis in solving real life problems and also appreciate the way the techniques are modifiedto improve the accuracy.

Unit	Title: Numerical Analysis	56.hrs/ sem
Unit I	**Algebraic and Transcendental Equations:** Errors - Significant digits, absolute, relative, percentage errors, rounding off and truncation errors (meanings and related problems), general error formula (derivation of formula and problems based on it), error in series approximation: Taylor series approximations (problems only), Solutions to algebraic and transcendental equations - Bisection method, Regula-Falsi method, iterative method Newton-Raphson method and secant method (Plain discussion of the rationale behind techniques and problems on their applications).	14 hrs
Unit II	**System of Linear Algebraic Equations:** Direct Methods – Gauss elimination method, Gauss-Jordan elimination method and Tringularization method; Iterative methods – Jacobi method, Gauss-Jacobi method, Gauss- Seidal method, Successive-Over Relaxation method (SOR) method.	14 hrs
Unit III	**Polynomial Interpolations:** Finite differences. Forward, backward and central differences and shift operators: definitions, properties and problems; Polynomial interpolation – Newton - Gregory forward and backward interpolation formulas, Gauss's Forward and backward interpolation formulas, Lagrange interpolation polynomial, Newton's divided differences and Newton's general interpolation formula (Discussion on setting up the polynomials, differences between them and problems on their applications).	14 hrs

Unit IV	**Numerical Differentiation and Integration:** Formula for derivatives (till second order) based on Newton-Gregory forward and backward interpolations (Derivations and problems based on them). Numerical Integration - General quadrature formula, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule and Weddell's rule (derivations for only general quadrature formula, trapezoidal rule and Simpson's $1/3^{rd}$ rule and problems on the applications of all formulas).	14 hrs

References:

1. E. Isaacson and H. B. Keller, *Analysis of Numerical methods*, Dover Publications.
2. S. S. Sastry, *Introductory methods of Numerical Analysis*, 5th Edition, PHI Learning Private Limited.
3. E Kreyszig, *Advanced Engineering Mathematics*, Wiley India Pvt. Limited
4. B. S. Grewal, *Numerical Methods for Scientists and Engineers*, Khanna Publishers.
5. M. K. Jain, S. R. K. Iyengar and R. K. Jain, *Numerical Methods for Scientific and Engineering computation*, 4th Edition, New Age International
6. H. C. Saxena, *Finite Difference and Numerical Analysis*, S. Chand Publishers
7. B. D. Gupta, *Numerical Analysis*, Konark Publishers Pvt. Ltd.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – VI

Discipline Specific Course (DSC)-16

Course Title: Practicals on Numerical Analysis

Course Code: 036 MAT 014

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-16	Practical	02	04	56 hrs.	3hrs.	25	25	50

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Learn *Free and Open Source Software (FOSS)* tools for computer programming

CO 2: Solve problem on Numerical Analysis studied in 036MAT013 by using FOSS software's.

CO 3: Acquire knowledge of applications of Linear Algebra through FOSS.

Expt. No,	Title: Practicals on Numerical Analysis	56.hrs/ sem
1	Program to find the root of an equation using bisection and Regula-Falsi methods.	4
2	Program to find the root of an equation using Newton-Raphson and Secant methods.	4
3	Program to solve the system of algebraic equations using the Gauss-elimination method.	4
4	Program to solve the system of algebraic equations using the Gauss-Jordan method.	4
5	Program to solve the system of algebraic equations using the Gauss-Jacobi method.	4
6	Program to solve the system of algebraic equations using the Gauss-Seidel method.	6
7	Program to solve the system of algebraic equations using the SOR method	4
8	Program to evaluate integral using Simpson's 1/3 and 3/8 rules.	6
9	Program to evaluate integral using Trapezoidal and Weddle rules	6
10	Program to find the sums of powers of successive natural numbers using the Newton – Gregory technique.	6
11	Program to find differentiation at specified point using the Newton-Gregoryinterpolation method.	4
12	Program to find the missing value of the table using the Lagrange method.	4

Instruction to the Examiner:

6. In case the University question papers are not available the external examiner shall prepare question papers for all the experiments, in consultation with the internal examiner.
7. No students shall be allowed for the examination without their Journal / Practical records, certified by the Staff in charge and Head / Principal. If the Journal/ Practical record is not presented by the student, the Head/Principal shall issue a certificate stating that he/she has attended the regular practicals and his/her attendance is satisfactory (not less than 75% including 10% of extracurricular activities if applicable) and the candidate shall then be allowed to appear for examination. In such cases, the marks reserved, for the journal shall be deducted.
8. Candidates having an attendance record of less than 75 % (including 10% of extracurricular activities, if applicable) in that practical paper shall not be allowed to take the practical examination.
9. The Principal shall permit the students to take the examination as out of turn in any other batches only on technical reasons like overlapping of the timings with other subjects but not for any other personal reasons of the candidate including medical grounds.
10. No practical examination shall be conducted in the absence of an external examiner. Absence of external examiner if any is to be brought to the notice of the principal by the internal examiner to enable alternative arrangements to be made. The Principal shall appoint external examiners as per the instruction already given. If the internal examiner remains absent, the principal shall appoint another internal/external examiner. Under any circumstances, there shall not be two internal examiners for a given batch but two external examiners shall be allowed.

Practicals Semester-end Examination	
Assessment	**Distribution of Marks**
Program Writing and Problem Solving	10
Program Execution	10
Viva	03
Journal	02
Total	**25 Marks**

Note: Same scheme may be used for IA(Formative Assessment) examination

B.Sc. Semester – VI

INTERNSHIP

Course Title: INTERNSHIP

Course Code: 036 MAT 091

Type of Course	Theory / Practical	Credits	Instruction hour/ week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
INTERNSHIP	Practical	02			3hrs.	50	0	50

Course Outcomes (COs): At the end of the course students will be able to:

CO 1: Conduct the field visit based on the objectives of the internship

CO 2: Participate in a professional activity and gain practical work experience.

CO 3: Learn the behavioural approach and fascinate in communication.

CO 4: Interact with the different personalities of local agencies.

CO 5: Prepare the report with sound techniques/ technology

Whenever an internship is not feasible, the students can choose the Project work

Project Work: Short-term work in the college/other Institutions: The project work may include in Educational Institutions /R & D organizations/review of current literature/ theoretical methods/ Mathematical applications.

Practical work may involve the execution of programs/ studies on properties/characterizations/ applications/activities for reported/unreported research or any suitable combination thereof. In the case of the students who would work outside the campus, the Supervising Staff member may visit him/her/them.

Formative Assessment for Internship	
Assessment	**Distribution of Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Case Study/ Assignment/ Field activity/Project, etc	10
Report Prsentation and Discussion	10
Viva-Voce	10
Total	**50 Marks**
Formative Assessment as per guidelines.	

Internship:

A course requiring students to participate in a professional activity or work experience or cooperative education activity with an entity external to the education institution, normally under the supervision of an expert of the given external entity. A key aspect of the internship is induction into actual work situations for 2 credits. Internships involve working with local industry, local governments (such as panchayats, and municipalities)or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in on-site experiential learning.

Note;

1. 1 credit internship is equal to 30hrs on field experience.
2. Internship shall be Discipline Specific of 45-60 hours (2 credits) with a duration 1-2 weeks.
3. Internship may be full-time/part-time (full-time during the last 1-2 weeks before the closure of the semester or weekly 4 hrs in the academic session for 13-14 weeks). The college shall decide the suitable method for programme-wise but not subject-wise.
4. Internship mentor/supervisor shall avail work allotment during the 6^{th} semester for a maximum of 20 hours.
5. The student should submit the final internship report (45-60 hours of Internship) to the mentor for completion of the internship.
6. Method of evaluation: Presentations/Report submission/Activity etc.

GENERAL PATTERN OF THEORY QUESTION COURSE FOR DSCC/ OEC

(60 marks for semester-end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10 marks

Part-B

2. Question number 07- 11 carries 05 marks each. Answer any 04 questions : 20 marks

Part-C

3. Question number 12-15 carries 10 marks each. Answer any 03 questions : 30 marks
(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on the number of hours Prescribed

Format for Model question paper Unit wise

Question Numbers	Number of questions to be set in Unit	Number of questions to be answered	Marks for each question	Max marks for the question
1	Unit-I ------2 Unit-II ------1 Unit-III -----1 Unit-IV ------2 Total : 6	5	2	10
2	Unit-I ------1 Unit-II ------1 Unit-III -----2 Unit-IV ------1 Total: 5	4	5	20
3	Unit-I ------1 Unit-II ------1 Unit-III------1 Unit-IV------1 Total: 4	3	10	30