25.07.2025.

ಇವರಿಗೆ
ಕುಲಸಚಿವರು (ಆಡಳಿತ)
ಬೀದರ ವಿಶ್ವವಿದ್ಯಾಲಯ
ಬೀದರ.

ಮಾನ್ಯರೆ,

ವಿಷಯ: BOS ನ ಆಂತರಿಕ ಸಭೆಯನ್ನು ಕೈಗೊಂಡು 3ನೇ ಸೆಮಿಸ್ಟರ್ ರಿಂದ 6ನೇ ಸೆಮಿಸ್ಟರ್‌ನ ವರೆಗೆ ಪಠ್ಯಕ್ರಮ ಸಲ್ಲಿಸುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. BUBidar/ADM/BOS/2025-26 Date 13.06.2025.
2. ಬಿ.ವಿ.ಬೀದರ/ಆಡಳಿತ/ಸಿ.ಆರ್-/2024-25/160 ದಿ/03-07-2025

ಮೇಲಿನ ವಿಷಯಕ್ಕೆ ಹಾಗೂ ಉಲ್ಲೇಖಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಗಣಿತಶಾಸ್ತ್ರ ವಿಭಾಗದ BOS ಆಂತರಿಕ ಸಭೆಯನ್ನು ದಿನಾಂಕ-21-07-2025ರಿಂದ 22-07-2025ರ ವರೆಗೆ ಕೈಗೊಂಡು 3ನೇ ಸೆಮಿಸ್ಟರ್‌ರಿಂದ 6ನೇ ಸೆಮಿಸ್ಟರ್ ಪಠ್ಯಕ್ರಮವನ್ನು [illegible] ಸಿದ್ಧಪಡಿಸಿ ಹಾಗೂ ಮೌಲ್ಯಮಾಪನದ ಪ್ರಾಧ್ಯಾಪಕರ ಪಟ್ಟಿ [List of. Examinars] ಸಿದ್ಧಪಡಿಸಿ ತಮ್ಮ ಸೂಕ್ತ ಕ್ರಮಕ್ಕಾಗಿ ಸಲ್ಲಿಸಲಾಗಿದೆ.

ವಂದನೆಗಳೊಂದಿಗೆ

ತಮ್ಮ ವಿಶ್ವಾಸಿ

8/8/2025

ಅಡಕಗಳು:
1. 3ನೇ ಸೆಮಿಸ್ಟರ್‌ರಿಂದ 6ನೇ ಸೆಮಿಸ್ಟರ್‌ನ ಪಠ್ಯಕ್ರಮ.
2. ಪರೀಕ್ಷಾ ಮೌಲ್ಯಮಾಪಕರ ಪ್ರಾಧ್ಯಾಪಕರ ಪಟ್ಟಿ.
3. BOS ಸಭೆಯ ನಡವಳಿ.

ಬೀದರ ವಿಶ್ವವಿದ್ಯಾಲಯ
No. 523
Date: 8/8/25

ಬೀದರ ವಿಶ್ವವಿದ್ಯಾಲಯ
BIDAR UNIVERSITY
ಜ್ಞಾನ ಕಾರಂಜಿ ಹಾಲಹಳ್ಳಿ (ಕೆ), ಬೀದರ 585 414 ಕರ್ನಾಟಕ ಭಾರತ
Department of Mathematics

No.BUBidar/MATHS/2025-26/ Date.18.07.2025

Meeting Notice

Subject: Under Graduate Meeting reg
Reference: 1. No.BUBidar/ADM/BOS/2025-26 D:13.06.2025
2. No.BUBidar/ADM/C.R/2024-25/160 D:03.07.2025

Sir,

In reference to the aforementioned subject, the meeting of the Under Graduate Board of Studies is scheduled on 21.07.2025 at 10:30 AM in the Department of Mathematics at Bidar University, Bidar. I kindly request that you make arrangements to attend the same. You will receive TA/DA in accordance with the regulations of Bidar University. A confirmation via Email or WhatsApp at your earliest convenience would be greatly appreciated.

AGENDA

1. Approval of UG Mathematics syllabus of **SEP** for B.Sc III, IV, V & VI semester.
2. Review of previous year U.G. Mathematics question papers.
3. Preparation of list of Examiners for the U G Mathematics Examinations for the academic year 2025-26
4. Any other mater (relevant to academic) with the permission of the Chairman.

Thanking You

Yours Sincerely
(Dr. Channakeshava Murthy)

To, (All UG BOS Members)

1. Dr. Shivakumar Biradar, G.F.G.C. Manhalli, Bidar.
2. Dr. Navrang, G.F.G.C. Manhalli, Bidar.
3. Dr. Hemawati, G.F.G.C. Bhalki, Bidar.
4. Dr. Elisha Devidas, G.F.G.C. Bidar.

Copy to:

1. The Registrar, Bidar University, Bidar for information.
2. The Finance officer, Bidar University, Bidar for information and necessary action.

ಬೀದರ **BIDAR**
ವಿಶ್ವವಿದ್ಯಾಲಯ **UNIVERSITY**
ಜ್ಞಾನ ಕಾರಂಜಿ ಹಾಲಹಳ್ಳಿ (ಕೆ), ಬೀದರ 585 414 ಕರ್ನಾಟಕ ಭಾರತ
Department of Mathematics

No. GUK/MATHS/2025-26/ Date:21.07.2025

Proceeding of the Under Graduate Board of Studies in Mathematics meeting held on 21.07.2025 at 10.30 AM in the department of Mathematics, Bidar University Bidar

Member Present:

1.	Dr. Channakeshva Murthy G.F.G.C.Bidar.	Chairman
2.	Dr. Shivkumar Biradar, G.F.G.C. Manhalli, Bidar.	Member
3.	Dr. Navrang, G.F.G.C. Manhalli, Bidar.	Member
4.	Dr. Hemawati, G.F.G.C. Bhalki, Bidar.	Member
5.	Dr. Elisha Devidas, G.F.G.C. Bidar.	Member

The meeting commenced with a welcome address by the chairman of the Board of Studies, Dr. Channakeshava Murthy, who extended a warm welcome to all members of the newly formed Undergraduate Board of Studies. He requested their cooperation and constructive feedback for the development of the Undergraduate Curriculum contents in accordance with the recommendations of the State Education Commission. Additionally, he elaborated on the guidelines, curriculum, and credit frameworks for the B.Sc. Programme, with three major systems, as issued by the Government.

Item No 1: Approval of UG Mathematics Syllabus for B.Sc III, IV, V & VI semester.

The board has engaged in a comprehensive discussion regarding the guidelines provided by the Government. It has been resolved to implement THREE Major systems for the B.Sc. Program as recommended by the University through its guidelines. Consequently, the curriculum content has been developed and approved for the B.Sc. III, IV, V, and VI semester Mathematics major, effective from the academic year 2025-26 and beyond.

Additionally, the board has finalized the titles and syllabus for the B.Sc. III, IV, V, and VI semesters at the same time in the UG I & II semesters practical's software has updated by from SciLab to Maxima/Phyton/ SciLab. The model for the question papers for all semesters has also been deliberated upon and approved.

Item No 2: Review of previous year U.G. Mathematics question papers.

Board has reviewed the previous year question paper (both NEP & SEP) of B.Sc Mathematics and found as correct

Item No 3: Preparation of list of Examiners for the U.G. Mathematics Examinations for the Academic Year 2025-26.

It has been decided to compile the list of Examiners associated with the colleges affiliated to Bidar University. Consequently, the board has formulated and prepared the list of Examiners for the U.G. Mathematics Examinations scheduled to take place during the academic year 2025-26.

Dr. Chamake [illegible]

1) Dr. Shivkumar Biradar

2) Dr. Hemawati

3) Dr. Elisha Devdas

ಬೀದರ ವಿಶ್ವವಿದ್ಯಾಲಯ BIDAR UNIVERSITY
ಜ್ಞಾನ ಕಾರಂಜಿ ಹಾಲಹಳ್ಳಿ (ಕೆ), ಬೀದರ 585 414 ಕರ್ನಾಟಕ ಭಾರತ
ಶೈಕ್ಷಣಿಕ ವಿಭಾಗ/Academic Section E-Mail: registrarbidar@gmail.com

No.BUBidar/ADM/BOS/2025-26/ Date: 13.06.2025

NOTIFICATION

Sub : Constitution of Board of Studies in **Mathematics** (UG)-reg.
Ref: 1. Syndicate Resolution No. 5 Dated. 12.06.2025
2. Vice-Chancellor's approval Dated: 13.06.2025.

* * * * *

As per the report given by the committee constituted for preparing seniority list in each subject, the Board of Studies in Under Graduate is to be constituted under section 33 of KSOU Act 2000, for the academic year 2024-25 and 2025-26 As per the provision under the statue 4(III) governing the council of Board of Studies with following Members :

	UNDER GRADUATE (UG)	
1.	**Chanakeshave Murthy** Associate Professor, Govt. First Grade College Noubad Bidar	Chairman
2.	**Dr. Shivakumar Biradar** Associate Professor, Govt. First Grade College Manhalli	Member
3.	**Dr. Navrang** Associate Professor, Govt. First Grade College Manhalli	Member
4.	**Dr. Hemawati** Associate Professor, Govt. First Grade College Bhalki	Member
5.	**Dr. Elisha Devdas** Associate Professor, Govt. First Grade College Noubad Bidar	Member

13/6/202

Registrar

Registrar
Bidar University
Gnyana Karanji, Halhalli (K)-585415
BIDAR, Karnataka

Copy:
1)The Chairman & Member of the Board of Studies
2)The Registrar(Academic), Bidar University, Bidar
3)The Registrar(Evaluation) Bidar University, Bidar
4)The Finance Officer, Bidar University, Bidar
5)The PS to Vice-Chancellor/PA to Registrar Bidar University, Bidar

BIDAR UNIVERSITY, BIDAR

DEPARTMENT OF MATHEMATICS

BIDAR UNIVERSITY

SYLLABUS FOR

B. Sc. (Mathematics)

With Effect From
I & II Semester 2024 - 2025 and Onwards
III & IV Semester 2025 -2026 and onwards
V & VI Semester 2026-2027 and onwards

1) Dr Shivkumar Biradar

2) Dr. Hemavathi

3) Dr. Elisha Devdas.

(Dr. Chamakeshwaraty
Chairman
Dept of Mathematics)

B.Sc. (Mathematics) Syllabus
(III, IV, V & VI Semester)

Sem	Course code	Course Title	Type of instruction & hours Per week	No. of Credits	Hours of Exam (SEE)	Max. Marks for IA	Max. Marks for SEE	Max Marks
I	MATDSC 1T	Algebra and Calculus	T4	4	3	20	80	100
	MATDSC 1P	Practical-I	P4	2	3	10	40	50
II	MATDSC 2T	Real Analysis and Differential Calculus	T4	4	3	20	80	100
	MATDSC 2P	Practical-II	P4	2	3	10	40	50
III	MATDSC 3T	Modern Algebra and Integral Calculus	T4	4	3	20	80	100
	MATDSC 3P	Practical-III	P4	2	3	10	40	50
IV	MATDSC 4T	Differential Equations	T4	4	3	20	80	100
	MATDSC 4P	Practical-IV	P4	2	3	10	40	50
V	MATDSC 5T	Vector Calculus and Complex Analysis	T4	4	3	20	80	100
	MATDSC 5P	Practical-V	P4	2	3	10	40	50
VI	MATDSC 6T	Numerical Analysis	T4	4	3	20	80	100
	MATDSC 6P	Practical-VI	P4	2	3	10	40	50

NOTE: Use the Maxima / SciLab/ Python software to execute the practical problems and verify manually for I semester to VI semester

Approved in BoS Meeting

Dr. Hemavathi

Dr Shivkumar B[illegible]

Dr. Elisha Devdas

ELECTIVE PAPERS FOR III & IV SEMESTERS

(Students have to choose any one out of the two elective courses for Sem. III & Sem. IV)

Sem	Course code	Course Title	Type of instruction & hours Per week	Credits	Hours of Exam(SEE)	Marks IA	Max Marks for SEE	Max Marks
III	MATE1-3T1	Graph Theory	T2	2	2	10	40	50
	MATE1-3T2	Linear Programming and Game Theory	T2	2	2	10	40	50
IV	MATE2-4T1	Riemann Integration and Improper Integrals	T2	2	2	10	40	50
	MATE2-4T2	Integral Transforms	T2	2	2	10	40	50

Approved in BOS meeting

(Dr. Channakshimath)
Chairman

Dr Shivkumar Biradar

Dr. Hemavati

Dr. Elisha. Dardas

SEMESTER-III

MATDSC3T: Modern Algebra and Integral Calculus	
Teaching Hours: 4 hours/ week	**Credits:04**
Total Teaching Hours:56 hours	**Max.Marks:100 (SEE 80+IA-20)**

COURSE LEARNING OBJECTIVES:

Course Objectives:

The main objectives of this course are

1. The **object of modern algebra** is primarily focused on the study of algebraic structures such as groups, rings, fields, modules.
2. These structures provide a foundation for understanding mathematical operations and their properties in a more abstract and generalized way than traditional algebra.
3. Studying groups helps us understand how objects can be transformed while preserving their structure.
4. Understanding rings helps in solving equations and understanding algebraic structures that do not necessarily have multiplicative inverses (which fields require).
5. The course objectives of **Integral Calculus** typically focus on developing a deep understanding of the theory and applications of integration.
6. The main goals are to introduce students to the concepts, techniques, and applications of integration, while also emphasizing problem-solving and mathematical thinking.

Course Outcomes:

1. The Study of **rings, groups, and fields** focus on ensuring that students develop both theoretical and practical knowledge of abstract algebraic structures
2. It typically designed to help students gain an understanding of the properties, operations, and applications of these structures, as well as to prepare them for advanced mathematical topics.
3. The Study of an **Integral Calculus** course aim to ensure that students not only learn how to compute integrals but also understand their theoretical foundations, applications, and significance in various fields
4. The Integral Calculus help students apply the principles of integral calculus to solve and develop advanced mathematical skills.

Unit I:Groups:

Definition of Groups, subgroups, cyclic groups Lagrange's theorem and its consequences, Fermat's Euler's theorems, homomorphism and Isomorphism, Normal subgroups, Quotient groups. The fundamental theorem of homomorphism, Permutation Co-set, decomposition of group's kernel homomorphism.

(14Hrs)

Approved in BOS meeting

Dr. Chamalakshmi Mutty

Dr. Elisha. D

Dr. Hemavati

Dr Shivkumar Biradar

Unit II: Rings, Integral Domains, Fields:

Rings, types of rings, properties of rings, rings of integers modulo n-Subrings. Ideal-principle and maximal ideal in a communicative rings-examples and standard properties Homomorphism and Isomorphism properties of Homomorphism. Quotient rings, Integral domain-fields-properties.

(14Hrs)

Unit III: Integral Calculus

Recapitulation of definitions of integration, Standard reduction formulae with examples. Applications of integration to find area bounded by curve, Surface area, length of an arc and volumes of solids of revolution for standard curves, Cartesian and polar forms like ellipse, parabola, cardioid, Lemniscate Bernoulli's cycloid, cissoids.

(14Hrs)

Unit IV: Line and Multiple Integral

Definition of line integral, basic properties. Examples on evaluation of line integrals, examples on differentiation under integral sign and integration under differentiation sign. Definitions of double integral: It's conversion to iterated integrals. Evaluation of double integral.

i) Under given limits ii) In regions bounded by given curve-change of variables, surface areas as double integrals.

Definition of triple integral and evaluation, change of variable, volume as triple integrals.

(14Hrs)

REFERENCES BOOKS:

1. Hertein I. N: Topic in Algebra (Wiley Student Edition)
2. Farleigh J.B: A first course in Abstract Algebra (PEARSON Education)
3. D.C Pavate: Modern College calculus (MacMillan and Company Limited)
4. Shanti NarayanIntegral Calculus (S Chand and Company Limited)
5. Mury R Spigel: Advanced Calculate (Schaum's outline series)
6. Rudraiah et.al: College Mathematics vol-I (Sapna Book House Bangalore)
7. Sokoilnikoff I.S: Advanced Calculus (McGraw Hill)
8. Vashistha: Modern Algebra
9. Ray and Sharma: Higher Algebra (S Chand and Company)
10. SC Malik: Mathematical Analysis (Wiley Eater)

Approved in BOS meeting

(Dr. Channakeshavmurthy)

Dr. Hemavathi

Dr Shivkumar B. N.

Dr. Elisha. D

PRACTICALS-III

MATDSC3P: Practical's on Modern Algebra and Integral Calculus	
Teaching Hours: 4 hours/ week	**Credits:02**
Total Teaching Hours:56 Hours	**Max.Marks:50 (SEE 40+IA-10)**

COURSE LEARNING OBJECTIVES:

This course will enable the students

1. Learn free and Maxima /SciLab/ Python software.
2. Tool for computer programming.
3. Solve problem on Modern Algebra and Integral Calculus theory studied in MATDSC3T by Maxima / SciLab/ Python software.
4. Acquire knowledge of application of Modern Algebra and Integral Calculus through Maxima / SciLab/ Python software.

*** Introduction to Maxima / SciLab / Python software and commands related to the topic.**

1.Program for verification of binary operations
2. Program to construct Cayley's tables and test abelian for given finite set
3. program to find all possible Cosets of the given finite group.
4. Program to verification of Lagrange's theorem with suitable examples.
5. Program to find Generators and corresponding possible subgroup of a Cyclic Group.
6.Program to verify the illustrative examples on ring, integral domain and fields,
7. Program to verify the illustrative examples on Subrings and Ideals.
8. Program to verify the illustrative examples on Homomorphism and Isomorphisms of rings
9. Evaluation of definite integrals and Reduction formulae.
10. Computation of Surface area (Cartesian, parametric and polar form)
11. Computation of Volume (Cartesian, parametric and polar form)
12. Program to evaluate the line Integrals with constants and variable limits.
13. Program to evaluate the Double Integrals with constants and variable limits
14. Program to evaluate the Triple Integrals with constants and variable limits

NOTE: Use the Maxima / SciLab/ Python software to execute the practical problems and verify manually

Approved in BOS meeting

(Dr. Chanakeshava Murty)

Dr. Hemavathi

Dr. Shivkumar Biradar

Dr. Elisha. D

SEMESTER–III
ELECATIVE PAPER FOR III SEM

MATE1-3T1: GRAPH THEORY	
Teaching Hours: 2 Hours/Week	**Credits: 2**
Total Teaching Hours: 28 Hours	**Max. Marks: 50 (SEE 40+I.A-10)**

Course Learning Objectives:

The main objective of this course is to

1. The **course objectives** of **Graph Theory** aim to equip students with the foundational knowledge and skills required to understand, analyze, and apply graph-theoretic concepts in various real-world scenarios
2. Provide students with a foundational understanding of graphs and key concepts and define basic terminology such as vertices, edges, paths, and cycles
3. Study specific types of graphs and their properties and learn about **trees**, **binary trees**, and **spanning trees.**
4. Study **cut vertices**, **bridges**, and **articulation points** in graphs and their significance in maintaining connectivity.
5. Learn about different matrix representations, such as **adjacency matrices**, **incidence matrices.**

Course outcomes:

1. Identify different types of graphs
2. To understand to apply to fundamental concepts, theorems and logrithms
3. To solve optimize problems using graphs

Unit-I : Graphs

Introduction, Definition of graph, finite and null graphs, loops, multiple of graphs, pseudo graph, simple graph, degree of a vertex, isolated and pendent vertices connectedness and complete graph minimum and maximum degree $\sum \deg(vi) = 2q$. The number of vertices of odd degree is even, isomorphism, line and total graphs (definition and examples only)

(Lecturer hours – 12)

Unit – II: Subgraphs, Paths, Cycles and Trees

Introduction of subgraphs and induced subgraphs, walk, trail, path, cycle, the shortest – path problems, bipartite graph, characterization of bipartite graphs in terms of its cycles.

Matrix Representation of Graphs: Incidence matix, Adajency matrix and Cyclic Matrix on examples.

Trees: Introduction to tree, cut vertex, bridge, block, tree, spanning tree, rooted and binary trees, properties of trees.

(Lecturer hours – 16)

Approved in BOS meeting

Dr. Elisha. D

Dr. Hemavati

Dr. Shivkumar Biradar

Reference Books

1. V. R. Kulli : Graph theory(Vishwa International Publications)
2. B. Sooryanarayana and G.K Ranganath : Graph theory and its applications(S.Chand)
3. R.Balkrishan and K.Ranganath an spiringerDat Ed^{n}: A Text book of Graph Theory:
4. W.D wallis an spiringer Dat Ed^{n} : A Begznners Guide to Graph Theory
5. V.K.Balkrishan Tata Mcgraw- Hill Ed^{n} - Graph Theory
6. Harary-Narora-publishing House- Graph Theory
7. S,Arumugan and S.Rahchandraw-scitech : Graph Theory

Approved in BOS meeting

(Dr. Umakeshavamurty)

Dr. Elisha. D

Dr. Hemavati

Dr Shivkumar B.V.

SEMESTER –III
ELECATIVE PAPER FOR III SEM

MATE1 – 3T2: Linear Programming and Game theory	
Teaching Hours: 2 Hours/Week	**Credits: 2**
Total Teaching Hours: 28 Hours	**Max. Marks: 50** **(SEE 40+I.A-10)**

Course Learning Objectives:

The main objective of this course is to

1. The **course objectives** of **Linear Programming Problems (LPP)** focus on equipping students with the techniques and methodologies to model, formulate, and solve optimization problems using linear programming.
2. The course aims to provide students the theoretical understanding to solve optimization problems efficiently.
3. Equip students with the skills to translate real-world problems into linear programming models & learn how to formulate problems in terms of linear equations and inequalities.
4. Provide students with the ability to solve simple two-variable linear programming problems using the graphical method, Big-M-Method, Simplex method and others
5. The **study of Game Theory** typically focus on equipping students with the tools to understand and analyze strategic decision-making in competitive environments

Course Outcomes:

1. Define Linear Programming and explain basic terminology.
2. Formulate mathematical model of a real-life problem
3. Solve LPP by Graphical method
4. Solve LPP by Simplex method
5. Solve games with no saddle point using mixed strategies, including solving algebraic equations to find optimal strategies.
6. Use the graphical method to solve 2×n and m×2 games,

Unit-I : Linear Programming: Basic Concepts

Introduction, Basic terminology: decision variables, non-negativity conditions, Slack variable, Surplus variable, objective function, constraints, feasible region, Basic solution, Basic feasible solution, optimal solution; Requirements for a linear programming problem (LPP), Assumptions in LPP, Areas of Applications of LPP, Mathematical formulation of LPP: Examples of Production allocation problem, Diet problem, Blending problem, Media selection problem, Inspection problem, Investment problem, Product mix problems etc.; Advantages and limitations of LPP.

(Lecturer hours – 12)

Unit-II: Solving Linear Programming Problems

Graphical method of solving LPP: Statement of theorems (Corner Point Method) without proof, Problems-Production allocation problem, Diet problem, Blending problem, Media selection

Approved in BOS meeting.

Dr. Chandrakant

Dr. Elisha 'D

Dr. Hemavathi

Dr. Shivkumar Biradar

problem, Inspection problem, Investment problem, Product mix problems etc. Discussion of Special cases: infeasibility, unbounded solutions, multiple optimal solutions.

Simplex Method of solving LPP: General form of LPP, Canonical and standard form of LPP, theory of the Simplex method, Algorithm of Simplex method, Big-M-Method, Two-Phase Method, Problems.

Game Theory :Introduction, Maximin-Minimax, saddle point, principles mixed strategies, graphical solutions of 2XN and MX2 games.

(Lecturer hours – 16)

References Books:

1. Prem Kumar Gupta & D S Hira: Operations Research (S Chand & Co.)
2. Dr. U S Rana: Mathematics for Degree Students (B.Sc. Third Year)(S Chand & Co.)
3. Richard Bronson & Govindasami Naadimuthu: Schaum's Outline of Operations Research (McGraw Hill Publications)
4. Hamdy A. Taha: Operations Research: An Introduction (Pearson Publications)
5. Dimitris Bertsimas & John N. Tsitsiklis : Introduction to Linear Optimization (Dynamic Ideas & Athena Scientific Publications)
6. S Kalavati: Game theory
7. S D Sharma: Operations Research

Dr. Chakravarty

Approved in BOS meeting

Dr. Elisha. D

Dr. Hemavathi

Dr Shivkumar Biradar

SEMESTER-IV

MATDSC4T: Differential Equations	
Teaching Hours: 4 hours/ week	**Credits:04**
Total Teaching Hours: 56 Hours	**Max.Marks:100 (SEE 80+IA-20)**

COURSE LEARNING OBJECTIVES:

Course Objectives:

The main objectives of these course are to

1. Introduce students to be fundamental technique for solving ordinary and partial differential equations
2. Focuses on analytical methods
3. Solve the Higher order linear differential equations with constant coefficients

Course Outcomes:

After the completion of this course student will be able to

1. Solve First order linear and non-linear differential equations
2. To Model problems in nature using ordinary differential equations
3. Formulate differential equations for various mathematical models.
4. Apply these technique to solve and analysis various mathematical models

Unit I: Ordinary Differential Equation

Recapitulation of differential equations, exact equations, equations reducible to exact form,Linear and Bernoulli's equations. Differential equations of first order and higher degree equations solvable for p, x, y and Clairaut's equations - General and Singular solutions. Higher order differential equations: Linear differential equations with constant coefficients, find the complementary functions and particular integrals (when RHS function of form e^{ax},x^n $\sin ax$, $\cos ax$, e^{av} where v is a function of x.

(Lecturer hours – 14Hrs)

Unit II: Linear Differential Equations

Linear differential equations with variable coefficient, Cauchy-Euler differential equations, Legendre-Linear differential equations, solution of second order linear differential equations with variable coefficients by the method of variation of parameters.

(Lecturer hours – 14Hrs)

Unit III: Total Differential Equations

Integrability, Necessary Condition for Integrability, Conditions for Exactness. Solutions by Inspection Method, Simultaneous Differential Equation:

$$\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$$

(Lecturer hours – 14Hrs)

Unit IV: Partial Differential Equations

Formation of Partial differential equations, Lagrange's equations $Pp + Qq=R$ First order non-linear partial differential equation, finding their complete integral by reducing to standard forms $f(p, q) =0$,$f(p, q, z) =0$, $f(x, y) =g(y, x)$ Clairaut's form, Charpit's method (without proof).

Approved in BOS meeting **(Lecturer hours – 14Hrs)**

(Dr. Chanakcharnt)

Dr Elisha.D

Dr. Hemavathi

Dr. Shivkumar Biradar

REFERENCES BOOKS:

1. Daniel Murray: Introductory course in differential equation.
2. BS Grewal: Engineering Mathematics (Khanna publisher)
3. Charlton: ordinary Differential Equation (Von-Nor stand)
4. Raisinghania M D: Ordinary and Partial differential equation (S Chand and Company)
5. Simmons G F: Differential Equation (TNH)
6. Ayres F: Differential Equation Schum's outline series
7. I N Snaddean: Element of partial differential equations (McGrawHill)
8. Mahantesh S Swami: UG mathematics-IV

Approved in BOS meeting

Dr. Chanakeshava Murthy

Dr. Hemavati

Dr Shivkumar Biradar

Dr. Elisha D

PRACTICALS-IV

MATDSC4P: Practical's on Differential Equations	
Teaching Hours: 4 hours/ week	**Credits:02**
Total Teaching Hours:56 Hours	**Max.Marks:50** **(SEE 40+IA-10)**

COURSE LEARNING OBJECTIVES:

This course will enable the students to

1. Learn free and Maxima / SciLab/Python software.
2. Tool for computer programming.
3. Solve problem on Ordinary Differential Equations theory studied in MATDSC4T by using Maxima / SciLab/ Python software.
4. Acquire knowledge of application of Differential Equationsthrough Maxima / SciLab/ Python software.

***Introduction to Maxima / SciLab/ Python software and commands related to the topic.**

1. Solution of differential equations which are soluble for p, x, y
2. To find singular by using Clairaut's form,
3. Finding the CF of Linear differential equation with constant coefficient and Plot the solutions
4. Finding CF of Homogeneous linear differential equation and Plot the solutions
5. Find the PI of differential equation up to second order and Plot the solutions
6. Verify Cauchy-Euler's differential equation
7. Solution of Total and Simultaneous differential equations and Plot the solutions
8. Verification of Exactness of a differential equation.
9. Verify Linear partial differential equation of the form $Pp+Qq=R$
10. Verify first order non-linear partial differential equation of the form $f(p, q)=0, f(p, q, z)=0, f(x, p)=g(y,q)$
11. Verify first order non-linear partial differential equation by Charpit's method.
12. Solution of standard forms $f(p, q)=0, f(p, q, z)=0, f(x, p)=g(y,q)$

NOTE: Use the Maxima / SciLab/ Python software to execute the practical problems and verify manually

Approved in BOS meeting

(Dr. Chanakeshavath)

Dr. Elisha. D

Dr. Hemavathi

Dr Shivkumar Biradar

SEMESTER –IV
ELECATIVE PAPER FOR IV SEM

MATE2 – 4T1: RIEMANN INTEGRATION AND IMPROPER INTEGRALS	
Teaching Hours: 2 Hours/Week	**Credits: 2**
Total Teaching Hours: 28 Hours	**Max. Marks: 50** **(SEE 40+I.A-10)**

Course Learning Objectives:

The main objective of this course is to

1. **studying Riemann Integration** focus on understanding the foundational concepts of integration, which is one of the core topics in calculus.
2. students will learn how to approximate the area under a curve using **Riemann sums** and it introduce **partitioning** of the interval and the concept of **upper** and **lower sums.**
3. Help students connect the concept of the Riemann sum to the Riemann integral and learn to compute Riemann sums for different functions and partitions.
4. The study of **Beta and Gamma functions** focus on understanding their definitions, properties, applications and how they generalize certain integral formulas.

Course outcomes: After the completion of this course the students will

1. Become familiar with Riemann integrals and their properties
2. Carry out certain computations such as computing upper and lower Reiman sums as well Integrals.
3. Describe various criteria for integrability of functions
4. Exhibit certain properties of mathematical Objectives such as integrable functions.

Unit – I: Riemann Integration

Lower and Upper Riemann sums, lower and upper Riemann Integrals, Necessary and Sufficient conditions for Riemann Integrabilities, Riemann integrals, properties of Riemann-integrable functions

(i) Upper R- Integral exceeds the lower R-Integrals
(ii) R – Integral lies between m(b-a) and M(b-a), R-Integrabilities of
    (i) continuous function (ii) monotonic function.

Fundamental theorem of integral calculus, first and second mean value theorem of integral calculus, Leibnitz's result to evaluate the examples of differentiation under the integral sign

(Lecturer hours – 16)

Unit – II: Improper Integrals

Beta and Gamma functions, normal probabilities integral and error functions, results following the definitions – connection between two functions, application to evaluation of integrals, Duplication formulae, sterling formulae (statement only)

(Lecturer hours – 12)

Approved in BOS meeting

Dr Chanabasayya

Dr. Elisha.D

Dr Shivkanya Biradar

Dr Hemavathi

Reference Books

1. S. C. Malik: Mathematical Analysis (Wiley Eastern)
2. Shanti Narayan (S. Chand and Co.): Differential Calculus.
3. Arora : Riemann Integration.
4. Mahantesh S.Swamy: UG Mathematics – III
5. S.C Malik: Real Analysis, New Age International(India)Pvt.Ltd.
6. S.C.Malik and Savita Arora: Mathematical Analysis, 2nd ed.New Delhi, India: New Age international(P)Ltd.
7. Richard R Goldberg: Methods of Real Analysis, Oxford and IBH Publishing.

Approved in BOS meeting

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Dr. Elisha.D

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Dr. Hemavati

Semester - IV
ELECATIVE PAPER FOR IV SEM

MATE2 – 4T2: Integral Transforms	
Teaching Hours: 2 Hours/Week	**Credits: 2**
Total Teaching Hours: 28 Hours	**Max. Marks: 50** **(SEE 40+I.A-10)**

Course Learning Objectives:

The main objective of this course is to

1. Familiarize students with the concept, properties, and applications of Laplace transforms.
2. Show students how Laplace transforms are used to solve differential equations.
3. The **study of** Fourier **Series** and **Fourier Transforms** focus on equipping students with the necessary tools to analyze periodic functions.
4. Enable students to express periodic functions as a sum of sines and cosines (or complex exponentials).
5. Student will learn the general form of Fourier series, including both sine-cosine and exponential forms.

Course Outcomes:

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

1. Find Laplace transform of some basic functions.
2. Apply Convolution theorem for solving problems.
3. Find Laplace transform of various functions
4. Find the Fourier Transform of periodic functions
5. Solve differential equations by using Integral transforms.

Unit I: Laplace transforms

Definition and basic properties. Laplace transforms of some common functions, Laplace transforms of the derivatives and the integral of the function, Convolution theorem (without proof).

Inverse Laplace transforms

Application to ordinary linear differential equation of first and second order with constant co-efficient.

(Lecturer hours-16)

Unit II: Fourier Series and Fourier transforms

Periodic function, Fourier series of function with period 2π and period 2L. Half range cosine and sine series, Complex form of Fourier series.

Fourier transforms: Definition and basic properties. Fourier integrals, Fourier sine and cosine integral, Fourier sine and cosine transforms. Properties of Fourier Transforms.

(Lecturer hours-12)

Approved BOS meeting

Dr. Chandrakeshamurthy

Dr. Shivkumar Birad

Dr. Hemawati

Dr. Elisha D

References Books:

1. Murry. R. Spiegel: Laplace transforms (schaum's Outline Series)
2. Dr.B.S.Grewal: Higher Engineering Mathematics, Khanna Publishers
3. Laplace transforms by S K Anand (Sarup and Sons New Delhi)
4. Fourier Transforms by Ian. Sneddon (Dover Publications)

Approved in BOS meeting

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Dr. Hemavati

Dr. Elisha

Dr. Channakeshava Murthy

SEMESTER-V

MATDSC5T: Vector Calculus and Complex Analysis	
Teaching Hours: 4 hours/ week	**Credits:04**
Total Teaching Hours:56 hours	**Max.Marks:100 (SEE 80+IA-20)**

COURSE LEARNING OBJECTIVES:

The main objectives of this course are

1. To help the students to understand and apply concepts from vector fields and applications.
2. To covers topics related to vector functions, derivatives, integrals, and theorems that describe the behavior of fields in space.
3. To provide students with a deep understanding of the theory and applications of functions of a complex variable.
4. To develop both the theoretical and practical aspects of complex analysis.
5. To understand the Cauchy-Riemann equations and their role in determining whether a function is analytic.

COURSE OUT COMES:

After the completion of this course the students will be able to

1. Understand the theoretical concepts of complex analysis and also acquire practical skills in applying these concepts to solve problems.
2. Understand the modulus, argument, and complex conjugates of complex numbers.
3. Understand the conditions for a function to be analytic and be able to derive and apply the Cauchy-Riemann equations\
4. Become familiar with Vector Calculus focusing on a comprehensive understanding of vector fields, operations on vectors, and their applications
5. Define and analyze vector fields. They will understand How to calculate and interpret the gradient, divergence, and curl of a vector field

Unit I: Vector Analysis

Scalar field, gradient of a scalar field, geometrical meaning, directional derivatives, vector field, divergence and curl of a vector field, Solenoidal and Irrotational field, Laplacian of a scalar field, vector identities expressions for $\nabla \emptyset$, and div$f$and curl$f$in orthogonal curve linear coordinates and Specialization to Cartesian, cylindrical and spherical coordinates, Greens Gauss and Stoke's theorem (Statement only) simple examples. **(14Hrs)**

Approved in BOS meeting

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Dr Hemavathi

Dr. Elisha.D

Dr. Chanakeshmurthy

Unit II: Complex Numbers and Functions of Complex Variables

Complex numbers - Cartesian and polar form, Geometrical representation Complex. Plane - Euler's formulae. Functions of a complex variable – limit, continuity and differentiability of a complex function, analytic function, Cauchy-Riemann equations in Cartesian and polar form- sufficiency condition **for** analyticity (Cartesian form only). Harmonic functions - standard properties of analytic function, construction of analytic function when real or imaginary part is given- Milne Thomson method

(14 Hrs)

Unit III: Transformation of Complex Number

Transforms: Definitions - Jacobian of a transformation, identity transformation, reflection - stretching, inversion, linear transformation: definition of bilinear transformation, Cross- ratio of four points- Cross ratio preserving property- preservation of the family of straight line and circular. Conformal mappings - discussions of the transformation w, $1/z$,$w=\sin z$, $w=e^z$, $w=(1/z)\ (1+1/z)$.**(14 Hrs)**

Unit IV: Complex Integration

Definition, line integral, properties and problems for Cauchy's integral theorem-proof using Green's theorem-direct consequences, Cauchy's integral formula with proof Cauchy's integral generalized formula for derivatives with proof and applications for evaluation of simple line integral. **(14 Hrs)**

References Books:

1. R.V. Churchill and J.W. Brown, Complex Variables and Applications (Fifth Edition), McGraw-Hill Intnl. Edn.(1990)
2. M. J. Ablowitz and A.S. Fokas, Complex Variables :Introduction and Applications (Second Edition), Cambridge University Press (2003).
3. H. K. Pathak, Complex Analysis, Shree Shiksha Sahitya Prakashan.
4. M. L. Khanna and S. K. Pudir, Functions of a Complex Variables, (Eighteenth Edition)Jai Prakash Nath & Co., Meerut (2014-2015)
5. ML. Khanna, Vector analysis, Vector calculus, Integral calculus PDE, Complex variable Linear Algebra, Modern Algebra, Jaya Prakashan Meerut.
6. S Ponnausany, Foundation of Complex Analysis, Narosa Publishing House.
7. J. N. Sharma, Functions of complex variable, Krishna Prakashan Meerut.

Approved by BOS meeting

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Dr. Elisha. D

Dr. [illegible]

PRACTICALS-V

MATDSC5P: Practical's on Vector Calculus and Complex Analysis	
Teaching Hours: 4 hours/ week	Credits:02
Total Teaching Hours:56 Hours	Max.Marks:50 (SEE 40+IA-10)

COURSE LEARNING OBJECTIVES:

This course will enable the students

1. Learn free and Maxima / SciLab / Python software.
2. Tool for computer programming.
3. Solve problem on Vector calculus and Complex analysis studied in MATDSC5T by using Maxima / SciLab/Python software.
4. Acquire knowledge of application of Vector Calculus and Complex Analysis through Maxima / SciLab/Python software.

*Introduction to Maxima / SciLab / Python software and commands related to the topic.

1. Program to find the gradient and Laplacian of a scalar function, divergence and curl of a vector function.
2. Program to demonstrate the physical interpretation of gradient, divergence and curl.
3. Program to verify Green's theorem.
4. Program on verification of Cauchy – Riemann equations (Cartesian form) or test for analyticity.
5. Program on verification of Cauchy – Riemann equations (Polar form) or test for analyticity.
6. Program to check whether a function is harmonic or not
7. Program to construct analytic functions (through Milne–Thompson method).
8. Program to find Cross ratio of points and related aspects.
9. Program to find fixed points of bilinear transformations.
10. Program to draw graphical representation of w=1/z and w=z+1/z
11. Program to draw graphical representation of w=sinz and w=coshz
12. Program to draw graphical representation of w=e^z and w=logz

NOTE: Use the Maxima / SciLab/ Python software to execute the practical problems and verify manually

Approved in BOS meeting

(Dr. Chandrakhant[illegible])

Dr. Hemawathi

Dr Shivkumar Biradar

Dr. Elisha D

SEMESTER-VI

MATDSC 6T: Numerical Analysis	
Teaching Hours: 4 Hours/ Week	**Credits : 04**
Total Teaching Hours: 56 Hours	**Max. Marks: 100** **(SEE 80+IA-20)**

COURSE LEARNING OBJECTIVES:

The main objectives of this course is to

1. Tech the principal of numerical approximation and error analysis
2. To Study different types of errors
3. To Study polynomial interpolation
4. To use numerical integration techniques
5. To solve differential equations numerically.

COURSE OUTCOMES :

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

1. Understand difference operators, shift operators, and other related operators in numerical analysis.
2. Grasp the reasoning behind techniques for finding roots, integrals, and derivatives.
3. Implement existing algorithms for tasks like root-finding, integration, and differentiation.
4. Use calculus and other mathematical principles to justify numerical analysis techniques.
5. Apply appropriate numerical methods to solve problems effectively.

UNIT I: Errors, Solution of Nonlinear Equation

Classification of errors (absolute rounding, relative and percentage errors relation connecting the errors), Relations connecting the errors with illustration.

Solution of Nonlinear Equation: Method of successive bisection method of false position Newton Rapson's iterative method and secant method. **(14 Hours)**

UNIT II: Solution of System of Equation and Finite Difference

Gauss elimination method Jacobi method Gauss Seidal method. Finite difference: Definition and properties of ∇, Δ and E and relations between them, the nth difference of a polynomial. **(14 Hours)**

UNIT III: Interpolation

Interpolation – Newton Gregory forward and backward interpolation formulae, Lagrange's and Newton's interpolation formula for unequal intervals, inverse interpolation.

Numerical differentiation using forward and backward difference formulae, computation of first and second order derivatives. **(14 Hours)**

Approved in BOS meeting

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Dr. Hemawati

Dr. Shivkumar Biradar

Dr. Elisha D

Unit IV: Numerical Integration

General quadrature formulae, Trapezoidal rule, Simpsons 1/3rd and 3/8th rule Weddle's rule, problems, theorem, solution of initial value problem for ordinary linear first order differential equations by Piccard, Taylor, Euler's and Euler's modified methods and second and fourth order Runge Kutta method. **(14 Hours)**

References Books:

1. S. S. Sastry, Numerical analysis (Prentice Hall of India Pvt. Ltd.)
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, (New Age International (P) Ltd. Publishers).
3. Richard L. Burden and J. Douglas Faires, Numerical Analysis (Seventh Edition), Thomson Brooks/Cole, U.K. (2005).
4. P. Thangaraj, Computer Oriented Numerical Methods, PHI, (2008).
5. V. Rajaramanna, Computer oriented Numerical Methods , PHI (1988).
6. E. Balaguru Swami, Numerical Methods (Tata McGraw Hill).

Approved in BOSmeeting

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Dr. Chamalachum ra

Dr. Elisha.D

PRACTICALS-VI

MATDSC6P: PRACTICALS ON NUMERICAL ANALYSIS	
Teaching Hours: 4 hours/ week	**Credits:02**
Total Teaching Hours:56 Hours	**Max.Marks:50** **(SEE 40+IA-10)**

COURSE LEARNING OBJECTIVES:

This course will enable the students

1. Learn free and Maxima / SciLab / Python software.
2. Tool for computer programming.
3. Solve problem on Numerical Analysis studied in MATDSC6T by using Maxima / SciLab / Python software.
4. Acquire knowledge of application of Numerical analysis through Maxima / SciLab software.

***Introduction to Maxima / SciLab / Python software and commands related to the topic.**

1. Determination of derivative of a function at the given point using numerical differentiation formula.
2. Numerical integration by Trapezoidal rule.
3. Numerical integration by Simpson 1/3 rd rule.
4. Numerical integration by Simpson 3/8 Th rule.
5. Numerical integration by Waddles rule.
6. Solution of initial value problem by Picard's method.
7. Solution of initial value problem by Taylor's method.
8. Solution of initial value problems by Euler's modified method.
9. Solution of initial value problems by RK second order method.
10. Solution of initial value problems by RK fourth order method.

NOTE: Use the Maxima / SciLab/ Python software to execute the practical problems and verify manually

Approved in BoS meeting

Dr. Channakeshwa Murthy

Dr. Heemavathi

Dr. Shivkumar Biradar

Dr. Elsha D

BIDAR UNIVERSITY, BIDAR
Department of Mathematics
Panel of Examiners for B.Sc. Mathematics Examinations for the Academic Year 2025-26

Sl. No.	Name and Address of the Teacher	Designation	Mobile Number	Date of joining	Date of Birth	No. of Time B.O.E. Chairman	No. of Time B.O.S. Member	No. of Time Examiner	Date of Retirement
1	**Mr. Channakeshava Murthy** G. F.G.College, Bidar.	Associate Professor	9611626961	24/12/2007	20/05/1977	3	2	10	31/05/2037
2	**Dr Nanda Warad** **Govt F.G.Colleg , Humanada.**	Associate Professor	9481538701	24/12/2007	07/05/1968	3	0	10	31/05/2028
3	**Sri. Navarang Manikrao** Govt. F. G. College, Manahalli.	Associate Prof.	9886287476	07/01/2008	06/08/1967	No	No	1	31/08/2027
4	**Dr.Hemawati Patil** G.F.G.College , Bhalki	Asst. Prof.	8970051323	05/09/2009	21/07/1970	N0	No	1	31/7/2030
5	**Dr. Sivakumar Biradar** Govt. F. G. College, Manahalli Dis:Bidar.	Associate Professor	9980094246	05/09/2009	24 /01/1980	No	01	No	31/012040
6	**Elisha D** Govt First Grade College Bidar	Asst. Prof	8951235780	05/09/2009	29/06/1981	NO	No	No	30/06/2041
7	**Smt. Meenakshi** Govt First Grade College, Chitguppa, Dist: Bidar	Asst. Prof.	7411223606	07/09/2009	22/10/1982	No	No	No	30/10/2042
8	**Dr Gousia Begum** **G.F.G.C Chitguppa.**	Associate Professor	9611712931	07/09/2009	01/06/1977	5	10	15	31/05/2037

9	**Dr. Samrat** BVB College , Bidar	Asst Prof	9980456451	23/01/2023	16/02/1990	No	No	No	
10	**Robert** C.B.Degree College , Bhalki	Asst Prof	9972522337	29/03/2023	03/09/1990	No	No	No	

Part Time/ Guest Lecturers (Non-UGC)

Sl.No	Name and Address of the Teacher	Designation	Mobile Number	Date of joining	Date of Birth	No. of Time B.O.E. Chairman	No. of Time B.O.S. Member	No. of Time Examiner	Date of Retirement
1	**Kaveri B** GFGC Humanbad	11 Years	8197167163	08/08/2014	15/06/1990	No	No	No	--
2	**Sri. Sachin Bidave** GFGC Hulsoor	10 Years	9008584082	03/09/2015					
3	**Jyoti D** GFGC B-kalyan	8 Years	8861057588	01/07/2015					
4	**Mrs. Zeenath Mahajabeen** Royal Degree College, Bidar	8 Years	9880887158	21/01/2017					
5	**Swapna** GFGC Bhalki	7 years	9620512004	01/07/2018					
6	**Monica Biradar** Jasmine Degree College Bidar	05Years Guest Lecture	9538288329	22/09/2018	14/08/1992	No	No	No	--
7	**Deepak** S S K B College , B-Kalyan	07 years	9620853680						

8	**Nilkant shetkar** B.V. B.College Bidar	05 years	9008009711	29/07/2015	09/07/1990	No	No	No	--
9	**Smt. Padmini** Karnataka Arts & Science Commerce College Bidar.	11 Years Guest Lecture	8151811052	01/07/2012	10/12/1989	No	No	No	--
10	**Archana Patil** Karnataka Arts & Science Commerce College Bidar.	11 Years Guest Lecture	9739877402	01/07/2012	04/04/1988	No	No	No	--
11	**Dr Dhanraj M** Gurunanak.First Grade College, Bidar	13 years	8105478099	2009	18/07/1981	No	No	No	---
12	**Smt. Pooja** **Karnataka** Arts & Science Commerce College Bidar.	06 Years Guest Lecture	8050641530	01/07/2016	02/05/1994	No	No	No	--
13	**Bandeppa Gurunath Balkunde** GFGC Aurad(B)	06 years Guest Lecture	9972437899	05/11/2016	09/02/1988	No	No	No	
14	**Sir. Javid** GFGC Aurad(B)	06 Years Guest Lecture	8453950672	20/03/2018	01/06/1990	No	No	No	
15	**Roopa S** G.F.G.C Bidar	06 Years	9972794432	26/08/2016	01/06/1991	No	No	No	--
16	**Dr.Chaitan** Govt .F.G .college, Manahalli Dist: Bidar	06 years Guest Lecture	9535817888	01/01/2018	06/08/1990	No	No	No	--
17	**Mrs. Jyoti Siddanna** Vidyaniketan Degree College, Bhalki.	07 Years Guest Lecture	9740466775	21/06/2016	05/09/1991	No	No	No	--
18	**Dange Ashwini** Vidya Niketan Degree College Bhalki	08 Years Guest Lecture		01/08/2015		No	No	No	--

19	**Dr.Vinod Kumar** Karnataka Arts & Science Commerce College Bidar.	10 Years Guest Lecture	97426961463	01/01/2015	06/07/1989	No	No	No	--
20	**Ashwini** GFGC Aurad(B)	7 Years	8970602631						
20	**Sunitha B** GFGC Aurad(B)	7 Years	8904818998						
21	**Eshwari** GFGC Aurad(B)	6 years	9380173030						

Dr. Shivkumar

(Dr. Chandrachakravarty)
Chairman

Dr. Elisha Devdas.