Deccan Education Society's

Fergusson College (Autonomous) Pune

Learning Outcomes-Based Curriculum

for 3/4 years B. Sc. / B. Sc. (Honours) Programme
as per guidelines of NEP-2.0
for
S. Y. B. Sc. (Applied Mathematics)

With effect from Academic Year

2026-2027

Deccan Education Society's
Fergusson College (Autonomous), Pune-4
Department of MATHEMATICS

Syllabi NEP 2.0 Implemented from Academic Year 2025-26
S.Y. B.Sc. (Applied Mathematics)
Semester: III & IV
Program Specific Outcomes (PSO's)

PSO	Outcomes
PSO1	Bachelor's degree in mathematics is the culmination of in-depth knowledge of algebra, calculus, geometry, differential equations and several other branches of Mathematics. This also leads to study of related areas like Computer science and Statistics. Thus, this programme helps learners in building a solid foundation for higher studies in Mathematics.
PSO2	The skills and knowledge gained have intrinsic beauty, which also leads to proficiency in analytical reasoning. This can be utilized in modelling and solving real life problems.
PSO3	Students undergoing this programme learn to logically question assertions, to recognize patterns and to distinguish between essential and irrelevant aspects of problems. They also share ideas and insights while seeking and benefitting from knowledge and insight of others. This helps them to learn to behave responsibly in a rapidly changing interdependent society.
PSO4	Students completing this programme will be able to present mathematics clearly and precisely, make vague ideas precise by formulating them in the language of Mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of mathematics to non-mathematicians.
PSO5	Completion of this programme will also enable the learners to join teaching professions in primary and secondary schools.
PSO6	This programme will also help students to enhance their employability for government jobs, jobs in banking, insurance and investment sectors, and data analyst jobs and jobs in various other public and private enterprises.

S. Y. B. Sc. (Applied Mathematics) NEP 2.0

Semester	Paper	Paper Code	Paper Title	Type	Credits	Exam Type
III	Major	MAM-2003	Multivariable Calculus	Theory	2	CE+ESE
		MAM-2013	Applied Linear Algebra	Theory	2	CE+ESE
		MAM-2023	Applied Mathematics Practical 7	Practical	2	CE+ESE
	Minor	MAM-2113	Data Structures and Algorithms	Theory	2	CE+ESE
		MAM-2123	Applied Mathematics Practical 8	Practical	2	CE+ESE
	OE (For Other Faculty)	MAM-2203	Cyber Awareness	Theory	2	CE
	VSC	MAM-2303	Statistical Inference	Theory	2	CE
	SEC	MAM-2403	Differential Equations	Theory	2	CE
	CEP	MAM-2453	Community Engagement Program	Theory/ Practical	2	CE
	AEC	AEC-2003	AEC-2003	AEC	2	CE
		CC-2013	NSS III	CC	2	CE
		CC-2023	NCC III	CC	2	CE
		CC-2033	Sports III	CC	2	CE
		CC-2043	Cultural III	CC	2	CE
		CC-2053	Yoga III	CC	2	CE
IV	Major	MAM-2004	Group Theory	Theory	2	CE+ESE
		MAM-2014	Numerical Analysis	Theory	2	CE+ESE
		MAM-2024	Applied Mathematics Practical 9	Practical	2	CE+ESE
	Minor	MAM-2114	Design and Analysis of Algorithm I	Theory	2	CE+ESE
		MAM-2124	Applied Mathematics Practical 10	Practical	2	CE+ESE
	OE (For Other Faculty)	MAM-2204	Web Designing	Theory	2	CE
	VSC	MAM-2304	Introduction to Computer Networks	Theory	2	CE
	SEC	MAM-2404	Fundamentals of Go Language	Theory	2	CE
	FP	MAM-2454	Field Project	Practical	2	CE
	AEC	AEC-2004	AEC-2004	AEC	2	CE
	CC	CC-2014	NSS IV	CC	2	CE
		CC-2024	NCC IV	CC	2	CE
		CC-2034	Sports IV	CC	2	CE
		CC-2044	Cultural IV	CC	2	CE
		CC-2054	Yoga IV	CC	2	CE

	MAM-2003 Multivariable Calculus **Major-Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (CO's) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recall and recognize the definitions of multivariable calculus concepts, such as partial derivatives, gradients, and multiple integrals.	1
CO2	Explain the geometric interpretation of partial derivatives and gradients in three dimensions. Demonstrate an understanding of the concept of multiple integration and its applications. Interpret the meaning of line integrals and surface integrals.	2
CO3	Solve problems involving partial derivatives and gradients, including optimization problems. Apply multiple integration techniques to find volumes, surface areas, and the center of mass. Utilize vector calculus concepts to solve problems related to curves and surfaces in space.	3
CO4	Analyze and interpret the significance of critical points and saddle points in multivariable functions. Break down a complex region into simpler parts for the purpose of integration. Examine the properties and applications of vector fields.	4
CO5	Evaluate the appropriateness of different methods for solving multivariable calculus problems. Assess the validity of mathematical proofs related to multivariable calculus theorems. Critically evaluate the importance of multivariable calculus in various fields (physics, economics, and engineering).	5
CO6	Formulate and solve real-world problems using multivariable calculus concepts. Design applications that involve the use of partial derivatives and multiple integrals in modelling physical phenomena.	6

MAM-2003 Multivariable Calculus I
(Major- Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Vector Functions of one variable:** Vector Functions and Space Curves, Derivatives and Integrals of Vector Functions, Arc Length and Curvature, Velocity and Acceleration	5
2	**Partial Derivatives:** Functions of Several Variables, Limits and Continuity, Partial Derivatives, Tangent Planes, The Chain Rule, Directional Derivatives and the Gradient Vector, Maximum and Minimum Values, Lagrange's multiplier	8
3	**Multiple Integrals:** Double Integrals over Rectangles, Iterated Integrals, Double Integrals over General Regions, Surface Area, Triple integrals, Change of Variables, Cylindrical and Spherical Coordinates	10

4	**Vector Integrals:** Line Integrals, Green's Theorem, Curl and Divergence, Surface Integrals, Stokes' Theorem, The Divergence Theorem	7

Learning Resources- References

Sr. No.	References
1	Stewart James, Daniel K. Clegg, and Saleem Watson. *Multivariable calculus*. Cengage Learning, 2020.
2	G B Thomas, M. D. Weir, J. Hass, Thomas' Calculus: Multivariable, Pearson
3	Michael Spivak Calculus, Publish or Perish, Year: 1994
4	Robert Wrede, Murrey R. Speigel, Theory And Problems of Advanced Calculus, Schaum's Outline Series, Mc GRAW Hill
5	J E Marsden, A. J. Tromba, A. Weinstein, Basic Multivariable Calculus, Springer Verlag

	MAM-2013 Applied Linear Algebra **Major-Theory**	
	Number of Credits: 2 **No. of. Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Describe the key concepts associated with vector spaces	**1**
CO2	Illustrate mathematical properties of inner products and solve examples to justify the properties	**2**
CO3	Apply Gram-Schmidt process to find an orthogonal basis to use it in applications	**3**
CO4	Identify the role of Linear algebra in various applications like image processing.	**4**
CO5	Determine the concept of Linear Transforms to solve real life problems	**5**
CO6	Formulate the concept of Matrix Decompositions to discuss the problems in Engineering and Data Science	**6**

MAM-2013 Applied Linear Algebra
Major -Theory

Unit No.	Title of Unit and Contents	No. of hours
I	**Linear Algebraic Systems:** Solutions to linear systems, Matrix inverses, practical linear algebra, General linear systems	**4**
II	**Vector Spaces and Bases:** Real vector spaces, subspaces, Span and Linear Independence, Linear Dependence, Bases and Dimensions, Fundamentals of Matrix Subspaces	**6**
III	**Inner Products and Norms:** Inner products, inner products on function spaces, inequalities, Norms, Positive definite matrices, Gram Matrices, completing the square.	**10**
IV	**Orthogonality:** Orthogonal and Orthonormal bases, Gram-Schmidt Process, Orthogonal Matrices, QR Factorization	**6**
V	**Introduction to Linearity:** Linear Functions, Linear operators, Linear Transformations and corresponding properties.	**4**

Learning Resources: References

Sr. No.	References
1	Peter Olver, Chehrzad Shakiban, Applied Linear Algebra, Springer (2nd Edition)
2	David Lay, Linear Algebra with Applications, Pearson Edition
3	Gilbert Strang, Linear Algebra and its applications (4th Edition)
4	Kenneth Hoffman and Ray Kunze, Linear Algebra, PHI India Private Limited
5	Ajit Kumar and S. Kumerasan, A First Course on Real Analysis, CRC Press.
6	A.G. Hamilton, Linear Algebra, Cambridge University Press

	MAM-2023 Applied Mathematics Practical 7 **Practical Based on Calculus I and Applied Linear Algebra** **Major-Practical**	
	Number of Credits: 2 **No. of. Hours:30**	
	Course Outcomes (COs) **On completion of the course, the students will be able to:**	**Bloom's cognitive level**
CO1	Recall fundamental concepts of multivariable calculus and linear algebra, including partial derivatives, gradients, matrices, vectors, and vector spaces, and identifying their computational representations using appropriate tools.	1
CO2	Explain the computational procedures for evaluating partial derivatives, multiple integrals, vector operations, and matrix transformations, and interpret their outputs in practical scenarios.	2
CO3	Solve numerical and computational problems involving optimization using partial derivatives, multiple integrals for area/volume, and linear algebra techniques such as systems of equations, orthogonalization, and matrix operations.	3
CO4	Analyze datasets and mathematical models using vector calculus and linear algebra methods, including examining critical points, vector fields, and transformations in applied contexts.	4
CO5	Evaluate the efficiency and suitability of different computational methods and algorithms (e.g., numerical integration, matrix decomposition techniques) for solving real-world problems.	5
CO6	Formulate and implement computational models integrating multivariable calculus and linear algebra concepts to solve real-world problems in domains such as data science, physics, and engineering.	6

MAM-2023 Applied Mathematics Practical 7
Practical Based on Calculus I and Applied Linear Algebra
Major-Practical

Sr. No.	**Practical**
1.	Practical 1
2.	Practical 2
3.	Practical 3
4.	Practical 4
5.	Practical 5
6.	Practical 6
7.	Practical 7
8.	Practical 8
9.	Practical 9
10.	Practical 10

MAM-2113 Data Structures and Algorithms
(Minor-Theory)

	MAM-2113 Data Structures and Algorithms **Minor Theory**	
	Number of Credits – 02 **No. of Hrs.: 30**	
Course Outcomes (CO's) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Understand fundamental data organization techniques.	1
CO2	Analyze time and space complexity using mathematical tools.	2
CO3	Apply discrete mathematics concepts in algorithm design.	3
CO4	Implement data structures using a programming language	4
CO5	Develop problem-solving skills using structured approaches.	5
CO6	Develop problem-solving skills using structured approaches.	6

MAM-2113 Data Structures and Algorithms
Minor Theory

Unit No.	Title of Unit and Contents	No. of hours
1	**Basics of Data Structures:** Definition and classification, Primitive and non-primitive data structures, Abstract Data Types (ADT), Algorithm design principles	**4**
2	**Mathematical Foundations:** Asymptotic notation: Big-O, Big-Ω, Big-Θ, Growth of functions, Recurrence relations	**6**
3	**Complexity Analysis:** Time complexity, Space complexity, Best, worst, and average cases	**6**
4	**Linear Data Structures:** Arrays -Representation in memory, Operations (insertion, deletion, traversal), Sparse matrices, Sorting and Searching Linked Lists: Singly, Doubly, Circular, Applications (Polynomial representations etc.) Stacks: Array and linked implementations, Applications: Expression ,evaluation, Infix to postfix conversion, Recursion implementation, Queues: Linear queue, Circular, Priority, Applications of Queue	**7**
5	**Non-Linear Data Structures:** Trees - Basic terminology, Binary trees, Tree traversals (Inorder, Preorder, Postorder), Binary Search Tree (BST), Expression trees, Height-balanced trees (AVL – basic idea), Graphs : Representation - Adjacency matrix, Adjacency list, Graph traversal- BFS, DFS, Shortest path Dijkstra's algorithm	**7**

Learning Resources: References

Sr. No.	References
1	Horowitz & Sahni – Fundamentals of Data Structures
2	Fundamentals of Algorithms, Horowiitz, Sahani and Rajasekeran
3	Mathematics for Analysis of Algorithms, Donald Knuth and H.Green
4	Algorithm Design, Eva Tardos, Jon Klienberg
5	An Introduction to Analysis of Algorithms, Micheal Soltys
6	The Algorithm Design Manual, Steven Skiena

MAM-2123 Applied Mathematics Practical 8 Practical Based on Data Structures and Algorithms Minor-Practical		
	Number of Credits:02 **No. of Hours: 60**	
Course Outcomes (CO's) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Implement linear data structures and perform basic operations using Python.	1
CO2	Analyze time and space complexity using asymptotic notations.	2
CO3	Implement trees and graphs with traversal and shortest path algorithms.	3
CO4	Apply data structures to solve problems like expression evaluation and polynomial representation.	4

MAM-2123 Applied Mathematics Practical 8
Practical Based on Data Structures and algorithms
(Minor-Practical)

Unit No.	Title of Unit and Contents
1	Stack implementation
2	Queue implementation
3	Linked list implementation
4	Searching techniques
5	Sorting Techniques
6	Stack applications
7	Queue applications
8	Trees
9	Graphs
10	Case study

MAM-2203 Cyber Awareness (OE Theory)		
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (CO's) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Define basic concepts of cyberspace, internet usage, cyber threats, and digital footprint.	1
CO2	Explain different types of cyber crimes, social media risks, and relevant provisions of Information Technology Act 2000.	2
CO3	Apply safe practices such as strong password creation, two-factor authentication, and secure browsing in real-life situations.	3
CO4	Analyze online content to identify phishing attempts, fake news, and potential cyber threats.	4
CO5	Evaluate the security and privacy of digital platforms, apps, and online transactions.	5
CO6	Design awareness strategies or guidelines to promote safe and responsible use of digital technologies.	6

MAM-2203 Cyber Awareness
(OE - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Introduction to Cyber World** Introduction to Cyber Space, Internet basics, Digital life and online presence, Importance of cyber awareness, Real-life cybercrime cases, Types of cyber threats, Digital footprint and online identity	3
2	**Cyber Crimes & Laws** Common cyber crimes, Identity theft and online fraud, Cyberbullying, Social media crimes, Fake profiles and harassment, Cyber laws in India, Information Technology Act 2000 basics, Reporting cyber crimes, Cyber cells and complaint portals	3
3	**Passwords & Authentication** Strong passwords, Weak vs strong passwords, Password management, Risks of password reuse, Two-factor authentication (OTP, biometrics), Safe login practices, Public Wi-Fi risks	4
4	**Social Media Safety** Safe use of social media, Privacy settings, Fake news and misinformation, Identifying fake content, Cyberbullying awareness, Prevention methods, Digital etiquette (netiquette), Responsible online behavior	4

5	**Safe Internet Practices** Safe browsing, Secure websites (HTTPS), Email safety, Phishing email detection, Online shopping safety, Secure payment methods, Mobile safety, App permissions and updates	4
6	**Malware & Cyber Attacks** Types of malware, Virus, Worm, Trojan, Ransomware attacks, Spyware and adware, Privacy risks, Cyber attack prevention, Antivirus and system updates	4
7	**Data Protection & Privacy** Personal data protection, Sensitive data awareness, Privacy settings in apps, Social media privacy controls, Data backup, Recovery methods	4
8	**Emerging Threats & Awareness** Cyber awareness in banking, ATM frauds, UPI scams, Awareness for students, Safe online learning, Future of cybersecurity, AI-based threats, Deepfakes basics	4

Learning Resources- References

Sr. No.	References
1	Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2	Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
3	Introduction to Cyber Security , Chwan-Hwa(john) Wu,J.David Irwin.CRC PressT&FGroup

MAM-2303 Statistical Inference VSC -Theory		
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (CO's) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Define key concepts of statistical inference.	1
CO2	Illustrate the process of Hypothesis testing for practical applications.	2
CO3	Implement the process of Hypothesis testing for practical applications.	3
CO4	Analyze the process of Estimation and Testing of Hypothesis. Identify the key concepts in estimation of parameter estimation	4
CO5	Justify hypothesis testing techniques to solve various problems on data and different techniques that leads to the best performance among the choices	5
CO6	Generate a model on a random dataset and interpret the inference.	6

MAM-2303 Statistical Inference
(VSC – Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	Simulation of Random Variables, Generate random samples from normal, binomial, and uniform distributions. Compute mean and variance and compare with theoretical values.	**3**
2	Point estimation, Given a dataset, compute point estimates such as sample mean, variance, and proportion. Compare estimates with population values (simulated data).	3
3	Confidence Interval Estimation, compute confidence intervals for mean (σ known and unknown), Visualize how interval changes with sample size.	3
4	Testing hypothesis. hypothesis testing for population mean using Z-test and t-test,Display p-value and decision.	3
5	Fitting Distributions to Data, normal and exponential distributions. Plot histogram with fitted curve.	3
6	Transformation of random variables., Simulate two random variables and compute distribution of: Sum, Product, Ratio	3
7	Central Limit Theorem Demonstration, Simulate sampling from any distribution and show that sample mean follows normal distribution for large n., Plot histogram of sample means.	3
8	Method of Moments and ML, Estimate parameters of a distribution (e.g., normal or exponential) using: Method of moments, Maximum likelihood estimation and compare the results ,Concept of Bayesian and Frequentist Inference and conceptual difference, Prior and Posterior	3

9	Chi-Square Goodness of Fit Test, Test whether given data follows a specified distribution using Chi-square test, Display test statistic and conclusion.	3
10	Correlation and Association, Compute covariance and correlation between two variables. Plot scatter diagram and interpret association.	3

Learning Resources: References-

Sr. No.	References
1	Vijay Rohatgi, Statistical Inference, Dover Publications
2	Robert Hogg, Elliot Tannis, Jagan Mohan Rao, Probability and Statistical Inference, Pearson Edition
3	George Casella, Roger Berger, Statistical Inference, Duxbury Advanced Series, Cenage Learning

	MAM-2403 Differential Equations (SEC-Theory)	
	Number of Credits: 02 No. of Hours:30	**Bloom's cognitive level**
CO1	Recall fundamental concepts of differential equations, including first-order, second order, and systems of differential equations, along with standard solution methods and basic models**.**	1
CO2	Explain the behavior and interpretation of solutions to differential equations, including direction fields, population models, electrical circuits, and mechanical systems such as vibrations.	2
CO3	Solve first-order, second order, and systems of differential equations using appropriate analytical methods such as separation of variables, integrating factors, undetermined coefficients, and variation of parameters.	3
CO4	Analyze the qualitative behavior of solutions of differential equations, including stability of equilibrium points, phase portraits, and the nature of critical points in linear and nonlinear systems.	4
CO5	Evaluate the suitability and effectiveness of different methods for solving differential equations and assess the accuracy and applicability of solutions in modelling real-world phenomena.	5
CO6	Formulate mathematical models using differential equations to represent real-world systems such as population dynamics, electrical circuits, and mechanical vibrations, and interpret their solutions.	6

MTS-2403 – Differential Equations
(SEC-Theory)

Unit No.	**Title of Unit and Contents**	**No. of hours**
1	**First order differential equations:** Modelling with differential equations, Direction field and Euler's method, Separable equations, Homogeneous equation, integrating factors, Orthogonal trajectories, Mixing problems, Models for population growth, Linear equations and applications to electric circuits, Predator-Prey systems	10
2	**Second Order Differential Equations:** Second Order Linear equations, Initial value problems, linearly, independent solutions, Second-order nonhomogeneous equations, Method of undetermined coefficients, Method of variation of parameter, Applications: Vibrating spring, Damped vibrations, Forced vibrations, Electric Circuits	10
3	Systems of first-order equations: Basic Theory of Systems first order equations, Solution of linear systems, homogeneous linear systems with constant coefficients, Types of critical points and phase portrait for linear and nonlinear systems	10

Learning Resources: References

Sr. No.	References
1	James Stewart, Single Variable Calculus, Early Transcendentals (Chapter 9)
2	James Stewart, Multivariable Calculus (Chapter 17)
3	William E. Boyce, Richard C. DiPrima, Elementary Differential Equations, Wiley
4	G. F. Simmons, Differential Equations with Applications and Historical Notes, CRC Press (Third Edition).
5	James C. Robinson, In Introduction to Ordinary Differential Equations, Cambridge University Press.
6	George B. Thomas, Thomas' Calculus, Pearson (Fourteenth Edition)
7	Morris Hirsch, Stephen Smale and Robert Devaney, Differential Equations, Dynamical Systems and An introduction to Chaos, Elsevier

	MAM-2453 - Community Engagement Program CEP-Practical	
	Number of Credits: 02 No. of Hours:30	

1.1 Introduction:

Higher Educational Institutions (HEIs) can play an important role to achieve the objectives of socio-economic development of New India through their active community engagement. Thisapproach will also contribute to improve the quality of both teaching and research in HEIs as they will develop a better understanding of issues in the society. There is a need to focus on improving societal linkages and enabling students to become socially productive [1].

The goals of 'fostering social responsibility and community engagement' comprise of:

1. Improving the quality of teaching/learning, by bridging the gap between theory and practice through community engagement;
2. Promoting deeper interactions between higher educational institutions and local communities for identification and solution of real-life problems faced by the communities in a spirit of mutual benefit;
3. Facilitating partnerships between local communities and institutions of higher education so that students and teachers can learn from local knowledge and wisdom;
4. Engaging higher education institutions with local communities in order to makecurriculum, courses and pedagogies more appropriate to achieve the goals of national development;
5. Catalysing acquisition of values of public service and active citizenship amongst students and youth, which would also encourage, nurture and harness the natural idealism of youth;
6. Undertaking research projects in partnership with local community through community-based research methods.

1.2 Forms of Community Engagement

a) Linking learning with community service

In this approach, students and teachers apply their knowledge and skills in a chosen community to improve the lives of people in that community. This can be achieved through the model of 'service- learning' (a globally accepted best practice), providing engagement opportunities to students from various disciplines and courses to apply their knowledge to address the challenges of a specific community. For example, students of chemistry can conduct water and soil testing in local areas and share the results with the local community.

b) Linking research with community knowledge

In this approach, various faculties and programmes of HEIs devise joint research projects in partnership with the communities and local agencies. The community's ownknowledge is integrated into the design and conduct of the research. New research by students helps them to complete their academic requirements, and at the same time the community's knowledge is systematized. Community-based Participatory Research (CBPR) approaches are gaining recognition in this regard.

Students of engineering, for example, can undertake research in partnership with the community on solid and liquid waste disposal.

c) Knowledge sharing and knowledge mobilization

The knowledge available with students and teachers in various disciplines is made available to the local community to realize its developmental aspirations, secure its entitlements and access its benefits from various agencies and schemes. These can take the forms of enumerations, surveys, awareness camps and campaigns, training, learning manuals/films, maps, study reports, public hearings, policy briefs, cleanliness and hygiene teachings, legal aid clinics, etc. For example, students can undertake a 'swachhta survekshana' and/or nutrition survey for mothers and children, and educate them about hygiene and nutrition.

d) Devising new curriculum and courses

Many institutions of higher education develop new curricula in existing courses as wellas design new courses to engage with the community. This enriches the curriculum of existing courses through locally-appropriate subject matter. It also creates new, locally appropriate educational programmes that interest a new generation of students. For example, new courses on financial inclusion, entrepreneurship development and nutritional value of local produce can improve knowledge and business opportunities forstudents.

e) Including practitioners as teachers

Local community elders, women leaders, tribals, entrepreneurs and civil society practitioners have enormous practical knowledge of a wide variety of issues—from agriculture and forestry to child-rearing, micro- planning, water-harvesting and project management. This expertise can be tapped by inviting such practitioners to co-teach courses both in the classrooms and in the field. Such instructors should be duly recognized, compensated and respected for their practical experience and knowledge.

1.3 f) Social innovations by students

The students can be encouraged to initiate learning projects with a social impact and supported by HEIs. Incubation of such social innovation projects by students can also have meaningful links to existing curriculum and courses. Some competitions for socialinnovation are being organized by some HEIs; they should be integrated into the curriculum.

1.4 Community Engagement and Social Responsibility (CESR) Course

The Community Engagement and Social Responsibility course is an immersive and transformative learning experience designed for second-year undergraduate students. In an era where the intersections of diverse disciplines are more critical than ever, thiscourse stands at the forefront of transdisciplinary and multidisciplinary education. As the heartbeat of societal progress, this compulsory course seeks to connect students withtheir communities, fostering a deep sense of social responsibility. Rooted in the belief that academic knowledge should transcend classroom walls, the aim is to equip students with the tools to

analyses, comprehend, and address pressing social issues. Through dynamic and interactive learning methods, students will not only explore the complexities of community dynamics but also actively contribute to the development of sustainable solutions.

1.5 General guidelines -

1. The implementation mechanism of CESR Course is to be decided by respective departments.
2. Each department should ensure collaborations/Tie-ups (in terms of MoU/LoI) with relevant industries/organizations/NGOs as per project requirements.
3. Expertise of Local community elders, women leaders, tribals, entrepreneurs and civil society practitioners can be tapped by inviting them to co-teach courses both in the classrooms and in the field. Such instructors should be duly recognized, compensated and respected for their practical experience and knowledge.
4. The CESR course must be implemented ONLY through the department. Students cannot approach NGOs /Organizations individually for the same. All communication to the NGOs/Organizations should be done through the department.
5. Departments should maintain the relevant documents (such as attendance records, proposals, CESR diary, MoUs/ LoI etc.) and correspondence regarding CESR course.

1.6 Objectives:

1. CESR Theory
   a) To develop an understanding of community needs and challenges.
   b) To equip students with skills to identify problem areas within the community.
   c) To guide students in creating effective project proposals.
   d) To apply classroom knowledge of courses to field realities and thereby improve the quality of learning.
2. CESR Field Work:
   a) To provide practical experience in implementing community projects.
   b) To assess students' ability to apply theoretical knowledge in real-world situations.
   c) To develop skills in project management, teamwork, and communication.

1.7 *Course outcomes should be designed at departmental level in alignment with above course objectives

Course structure

MAM-2453 Community Engagement Program [Credits-2]

- As per the NEP guidelines, the UG students are expected to complete this program in their **third semester** from the academic year 2024-25.
- The academic schedule must be planned by the departments, 1 credit to be allotted to classroom and tutorials (15 hours) and 1 credit to field engagement – students learning hours (30 hours)
- **Classroom Engagement and Field Engagement**:
  2 credits of classroom engagement and field Engagement comprise of following components:
  - Understanding Community Needs
  - Identifying Project Opportunities
  - Crafting and Finalizing Effective Project Proposals
  - Lectures on community sociology and challenges.
  - Case studies and discussions on successful community engagement projects.

Foundations of Community Engagement [Credits-2]	
Community engagement –Basics (1 Credit)	
Topics Covered	**Activities**
Introduction to Community Engagement	- Overview of theories and models - Importance of interdisciplinary approaches
Social Issues Analysis	- Guest lectures by a social scientist or experts from diverse sectors - Group discussion and analysis of contemporary social issues
Community Needs Assessment	- Theory on needs assessment methodologies - Field visit for practical application
Stakeholder Engagement	- Guest lecture from a community organizer - Simulated stakeholder engagement role-play
Community engagement –Field Work (1 Credit)	
Topics Covered	**Activities**
Cultural Competence in Community Work	- Cultural sensitivity training - Case studies on community engagement
Writing Project Proposal and finance resource management	- Develop a community project proposal and finance resource management - Timeline for implementation
Field Work Skills Training	- Training in data collection, interviewing, and observation - Practical exercises in the community
Ethical Considerations in Community Engagement	- Guest lecture on ethical dilemmas in community work - Case studies and group discussions

	Credit	Contact/Learning Hours	Course Component
Sem III	1	15 hrs.	Classroom engagement and tutorials
	1	30 (student learning hrs.)	Field Engagement (Requirement Gathering)

1.8 Note: Class engagement: 1 Credit = 1 Hour

For field engagement/ Field Project: 1 Credit = 2 Hours Evaluation of Classroom Engagement and Field Engagement (Sem. III)

- Evaluate each student for 50 marks per semester at department level
  20 marks for Continuous evaluation (CE)
  - Participation in class activities and discussions.
  - Submission of reflective essays.
  - 30 marks for End Semester Examination (ESE)
- Based on evaluation of Project Proposal.

……

Reference:

1. **Guidelines on "Fostering Social Responsibility & Community Engagement in Higher Education Institutions in India 2.0 (https://www.ugc.gov.in/publication/ebook)**

S. Y. B. Sc. (Applied Mathematics) SEM IV		
MAM-2004 Group Theory (Major –Theory)		
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (CO's) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Define basic concepts of Group theory with focus on axiomatic theory and key concepts associated with groups.	1
CO2	Articulate the fundamental concepts of abstract algebra such as groups and their role in modern Mathematics and applied contexts.	2
CO3	Demonstrate capacity for mathematical reasoning through analyzing, proving, and explaining concepts from abstract algebra.	3
CO4	Compare different types of groups and subgroups. Explain various notions of abstract structures.	4
CO5	Justify theorems based on group theory and articulate problem-solving techniques based on them.	5
CO6	Construct the ability to think about solving abstract problems.	6

MAM-2004 Group Theory
(Major- Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Groups, Subgroups and Cyclic Groups:** Definition and Examples of Groups; Properties of Groups; Order of a group; Order of an element in a group; Subgroups; Subgroup Tests. Cyclic Groups; Properties of Cyclic Groups; Classification of Subgroups of Cyclic Groups.	**10**
2	**Permutation Groups:** Definition and notation; Cycles; Properties of Permutations; Even and odd permutations; Alternating Group.	**5**
3	**Normal subgroups and Factor groups:** Cosets, Lagrange's Theorem and Normal subgroups, Homomorphisms: Definition and properties of Cosets; Lagrange's Theorem and consequences; Normal Subgroups; Factor Groups; Application of Factor Groups	**10**
4	**Homomorphism and isomorphism of groups:** Examples, properties of group homomorphism and group isomorphism, first fundamental theorem of Isomorphism	**5**

Learning Resources: References

Sr. No.	References
1	Joseph Gallian, Contemporary Algebra, 9th Edition, Narosa Publishing House.
2	J.B. Fraleigh, Abstract Algebra, 7th edition
3	David S. Dummit, Richard M. Foote, Abstract Algebra, 2 nd Edition, John Wiley and Sons (Indian Edition)
4	I.S. Luthar and I.B.S. Passi, Algebra (Volume 1) Groups (Narosa Publishing House)
5	I.N. Herstein, Topics in Algebra (Wiley-Eastern Ltd)
6	M. Artin, Algebra (Prentice Hall)

MAM-2014 Numerical Analysis (Major-Theory)		
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (CO's) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	State and apply different methods of Numerical methods and analysis.	1
CO2	Explain the basic principles and theory of interpolation	2
CO3	Implement all the standard linear and non-linear system solving techniques	3
CO4	Identify the role of Linear Numerical analysis in various applications like optimization.	4
CO5	Determine various numerical methods to solve real life problems	5
CO6	Develop the knowledge to compute the errors in all the techniques mentioned in the course	6

MAM-2014 – Numerical Analysis
(Major – Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Solution to Non-Linear Equations** Introduction to Big O notation, Types of Errors, Fixed point iterative method, bracketing method for roots, initial approximation and convergence criteria, Newton Raphson and Secant method, Error Analysis, rate of convergence, Accelerated Newton Raphson Method, Mullers Method	10
2	**Solutions to Linear and Non-Linear Systems** Upper triangular linear systems, Gaussian Elimination and Pivoting, Triangular Factorization, Iterative methods to solve Linear Systems and their convergence, Newton's method to solve nonlinear systems, Computing Eigenvalues numerically using Power Method, computing Eigenvalues of Symmetric matrix using House holders' method.	10
3	**Interpolation and Polynomial Approximation** Introduction to the concept of Interpolation, Lagrange Interpolation, Newton's Interpolation and its various forms (divided difference, forward and backward), Error Analysis with these approximations, Pade Approximations	10

Learning Resources- References

Sr. No.	References
1	John Mathews & Kurtis Fink, Numerical Analysis using MATLAB, Prentice Hall.
2	Kendall Atkinson, Numerical Analysis, Wiley Publications.
3	S.S.Sastry, Numerical Analysis, Prentice Hall India Publication
4	A.G. Hamilton, Linear Algebra, Cambridge University Press

	MAM-2024 Applied Mathematics Practical 9 Practical Based on MAM-2004 and MAM-2014 (Major- Practical)	
	Number of Credits: 02 No. of Hours: 60	
CO1	Recall fundamental concepts of group theory (groups, subgroups, operations) and numerical analysis methods, including interpolation, error analysis, and solution techniques for equations**.**	1
CO2	Explain the underlying principles of abstract algebraic structures and numerical methods, including interpolation, iterative techniques, and their computational significance.	2
CO3	Solve computational problems involving group operations and properties, as well as numerical methods for solving linear and non-linear equations and interpolation problems.	3
CO4	Analyze algebraic structures such as groups and subgroups, and examine the performance and accuracy of numerical methods through error estimation and convergence analysis.	4
CO5	Evaluate the effectiveness and limitations of various group-theoretic approaches and numerical techniques in solving mathematical and real-world problems.	5
CO6	Formulate and implement algorithms combining concepts of group theory and numerical analysis to model and solve problems in mathematics, science, and engineering.	6

MAM-2024 Applied Mathematics Practical 9
Practical Based on MAM-2004 and MAM-2014
(Major- Practical)

Unit No.	**Contents**
1	**Practical 1**
2	Practical 2
3	Practical 3
4	Practical 4
5	Practical 5
6	Practical 6
7	Practical 7
8	Practical 8
9	Practical 9
10	Practical 10

MAM-2114 Design and Analysis of Algorithms I Minor-Theory		
	Number of Credits: 02 **No. of Hours:30**	
	Course Outcomes (CO's) **On completion of the course, the students will be able to:**	**Bloom's Cognitive level**
CO1	Understand the core paradigms and mathematical foundations of algorithms	1
CO2	Apply algorithmic techniques to solve computational problems	2
CO3	Analyze the computational efficiency of diverse algorithms	3
CO4	Evaluate algorithmic choices for correctness and optimality	4
CO5	Design algorithmic solutions using advanced paradigms	5
CO6	Assess computational limitations and approximation approaches	6

MAM-2114 Design and Analysis of Algorithms II
(Minor - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Graph Algorithms: Graph** Representations-BFS, DFS, Topological Sorting: Connected Components, Strongly Connected Components (Kosaraju's Algorithm), Shortest Path Algorithms: Bellman–Ford, Floyd–Warshall, Maximum Flow Algorithms: Ford–Fulkerson, Edmonds–Karp	**7**
2	**Backtracking and Branch & Bound: State** space tree-Backtracking design, N-Queens problem, Branch and bound approach, Traveling salesman problem	**7**
3	**Number Theory & String Algorithms: Modular** Arithmetic, GCD, Extended, Euclid, Sieve of Eratosthenes, Fast Exponentiation, Pattern Matching, Naïve, KMP, Rabin-Karp, Z-Algorithm, Suffix Arrays (basics)	**8**
4	**Advanced Data Structures Introduction:** Disjoint Set Union (Union–Find) + Path, Compression, AVL Trees / Red-Black Trees (conceptual), Binomial Heaps, Fibonacci Heaps, Segment Trees, Fenwick Trees (Binary Indexed Tree),Tries & Suffix Trees (beyond basics)	**8**

Learning Resources- References

Sr. No.	References
1.	Fundamentals of Algorithms, Horowiitz, Sahani and Rajasekeran An Introduction to Analysis of Algorithms, Micheal Soltys
2.	Introduction to Algorithms, H Coremen, Rivest, Stein and Leiserson
3.	Mathematics for Analysis of Algorithms, Donald Knuth and H.Green
4.	Algorithm Design, Eva Tardos , Jon Klienberg
5.	The Algorithm Design Manual, Steven Skiena

MAM-2124 Applied Mathematics Practical 10 Introduction to Machine Learning Minor- Practical		
	Number of Credits: 02 **No. of Hours:60**	
	Course Outcomes (CO's) **On completion of the course, the students will be able to:**	**Bloom's Cognitive level**
CO1	Use Python libraries such as NumPy and Pandas to perform basic numerical operations, probability calculations, and data preprocessing for machine learning tasks.	1
CO2	Visualize and analyze datasets using Matplotlib and Pandas to understand data patterns through graphs such as bar charts, histograms, and scatter plots.	2
CO3	Implement and evaluate regression models (simple, multiple, ridge, and Lasso) using scikit-learn to perform prediction and compare model performance using appropriate metrics.	3
CO4	Develop and test classification models such as Logistic Regression, Decision Trees, Random Forest, and basic Neural Networks, and interpret results using accuracy and confusion matrix.	4
CO5	Apply unsupervised learning techniques like k-means clustering and frequent pattern mining (Apriori) to discover hidden patterns in datasets	5
CO6	Analyze real-world case studies and select appropriate machine learning techniques for solving practical problems using Python-based tools.	6

MAM-2124 Applied Mathematics Practical 10
Introduction to Machine Learning
(Minor- Practical)

Unit No.	Title of Unit and Contents
1	Basic Python for ML (NumPy & Probability), simple programs using NumPy to create arrays, perform matrix operations, and calculate mean, variance, and probability of events.
2	Data Handling and Visualization, Load a CSV dataset using Pandas, handle missing values, and draw simple graphs (bar chart, histogram, scatter plot) using Matplotlib.
3	Simple Linear Regression (Using Library), Implement simple linear regression using scikit-learn to predict values (e.g., marks vs study hours). Display regression line.
4	Multiple Linear Regression, Use more than one input feature to predict an output using linear regression. Evaluate using Mean Squared Error.
5	Ridge and Lasso Regression (Basic Use), Apply ridge and Lasso regression using scikit-learn and compare results with simple linear regression.
6	Logistic Regression (Binary Classification), Build a logistic regression model to classify data (e.g., pass/fail, spam/not spam). Display accuracy and confusion matrix.
7	K-Means Clustering, apply k-means clustering on a dataset and plot clusters using a scatter plot.

8	Decision Tree Classifier, implement a decision tree for classification using a dataset (e.g., iris dataset). Visualize the tree structure.
9	Random Forest Classifier, apply random forest on the same dataset and compare accuracy with decision tree.
10	Simple Neural Network (MLP), Use scikit-learn MLP classifier for a basic classification problem. Observe how accuracy changes with hidden layers.
11	Introduction NLP – Tokenization, Preprocessing Pipeline- Tokenization, stop word removal, stemming
12	Case Studies

	Learning Resources:References
1.	Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Jonathan Taylor, An Introduction to Statistical Learning with Applications in Python, 2023, Springer
2.	Data Mining: Tools and Techniques, 3rd Edition. Jiawei Han and Michelline Kamber.
3.	Elements of Statistical Learning. Hastie, Tibshirani, and Friedman. Springer
4.	Pattern Recognition and Machine Learning. Christopher Bishop.
5.	Kevin R Murphy, Machine Learning - A Probabilistic Perspective, The MIT Press, 2012.

MAM-2204: Web Designing OE-Theory		
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (CO's) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Understand the structure of the World Wide Web and client-server architecture.	1
CO2	Develop static websites using modern HTML5 and CSS3.	2
CO3	Implement responsive, mobile-first layouts (Flexbox/Grid).	3
CO4	Add client-side interactivity using JavaScript.	4
CO5	*Applied Math Integration:* Visualize mathematical data using JavaScript libraries (e.g., Plotly, Canvas API).	5

MAM-2204 Web Designing
(OE-Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Fundamentals & HTML5 : Web Basics:** HTTP/HTTPS, URLs, Domains, DNS, Client vs. Server, **HTML5 Structure:** DOCTYPE, <head>, <body>, Semantic elements (<header>, <nav>, <section>, <footer>), **Content Creation:** Text formatting, Lists, Tables, Hyperlinks, Images, Audio/Video tags. **Forms:** Input types, Labels, Buttons, POST vs. GET methods, Data validation basics.	**7**
2	**Cascading Style Sheets: Introduction to CSS:** Inline, Internal, and External style sheets. **Selectors & Specificity:** Class, ID, Universal, Descendant, Pseudo-classes, **CSS Properties:** Colors, Typography (Google Fonts), Backgrounds, Borders, **Box Model:** Margin, Padding, Border, Height/Width, **Layout Techniques:** Positioning (Static, Relative, Absolute, Fixed), Flexbox (Modern 1D layout), CSS Grid (Modern 2D layout),**Responsive Web Design:** Media Queries, Fluid layouts, Mobile-first approach.	**7**
3	**Introduction to Bootstrap: Introduction to Bootstrap :**What is Bootstrap?, Advantages of Bootstrap in web development, Difference between CSS and Bootstrap, Installing Bootstrap, Using CDN, Using downloaded files, Basic HTML template with Bootstrap, Bootstrap container classes, Typography classes, Colors and background utilities**, Bootstrap Grid System: R**esponsive design concept, Bootstrap breakpoints， Grid structure, column sizing and auto-layout, Offset classes, Nesting columns, **Bootstrap Components, Forms and Tables:** Bootstrap form classes,Form layout,Input groups,Validation styles,Tables ,**Utilities and Advanced Components:** Spacing utilities (margin, padding): Display utilities,Flex utilities,Modal,Carousel,Collapse,Toast	**5**
4	**Introduction to User Experience & Tools: UI/UX Principles:** Color Theory, Typography, User-centric design.**Tools:** Using VS Code, Browser Developer Tools (Debugging).**Version Control:** Introduction to Git and GitHub.	**4**

5	**JavaScript Fundamentals :Introduction to Scripting:** JavaScript vs. Java, Client-side programming,**JS Basics:** Variables, Data types, Operators, Type Conversion,**Control Flow:** If-else, Switch, Loops (For, While),**Functions:** Arrow functions, Events (onclick, onmouseover), Alert, Prompt.**Document Object Model (DOM):** Selecting elements, Modifying HTML/CSS with JavaScript.	**4**
6	**Javascript libraries:HTML Canvas API:** Drawing basic shapes, graphs, and fractals,**Data Visualization:** Introduction to Math-friendly libraries (e.g., Chart.js or Plotly.js)	**3**

Learning Resources- References

Sr. No.	References
1	**Official Free Resources (Not PDFs but great)** ● **Mozilla Developer Network (MDN)** – Extensive HTML, CSS, JavaScript docs and tutorials https://developer.mozilla.org ● **Eloquent JavaScript official site** – Full online interactive reading https://eloquentjavascript.net/ ● **freeCodeCamp** – Full free course covering HTML, CSS, JavaScript (with projects and exercises) ● **Chart.js Official Documentation** – Free guides and examples https://www.chartjs.org/
2	Jon Duckett – *HTML and CSS: Design and Build Websites*
3	Elizabeth Castro & Bruce Hyslop – *HTML, XHTML, and CSS (Visual QuickStart Guide)*
4	David Flanagan – *JavaScript: The Definitive Guide*
5	Marijn Haverbeke – *Eloquent JavaScript*
6	Adam Janes – *Interactive Data Visualization for the Web*
7	Linda Nguyen & Robert Fernandez – *Practical D3.js*
8	Nick Downie – *Getting Started with Chart.js*

MAM-2304 Introduction to Computer Networks VSC - Theory		
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (CO's) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Explain basic networking concepts and types of networks used in real life.	1
CO2	Describe OSI and TCP/IP models and how data travels on the internet.	2
CO3	Identify IP addresses, ports, and basic routing concepts.	3
CO4	Understand how web, email, and file transfer applications work.	4
CO5	Apply basic subnetting and network configuration concepts.	5
CO6	Recognize modern networking trends like cloud, Wi-Fi, and network security.	6

MAM-2304 Introduction to Computer Networks
(VSC – Theory)

Unit No.	Title of Unit and Contents	No. of hours
1.	**Foundations of Computer Networks:** Importance of Networks in modern industry(cloud, internet, mobile apps, IOT),LAN vs. WAN, Network Topologies (Star, Mesh, Bus),Data Communication - (Sender/Receiver/Protocol), topologies dictate network efficiency, The Models- OSI (7 Layers) vs. TCP/IP (4 Layers), Focus on the function of each layer	5
2.	**Physical Layer**: Importance of Physical Layer, Digital Transmission, Media & Transmission: Fiber optics vs. Wireless, Switching: Packet Switching basics, and Bandwidth, understanding of hardware, Multiplexing	3
3.	**The Data Link Layer :** Addressing - Difference between a MAC Address (Physical) and an IP Address (Logical), Error Control-Framing, Parity bits, and CRC, Flow Control: The "Stop and Wait" mechanism for data integrity	5
4.	**Network Layer & Addressing:** IPv4 vs. IPv6, why we transitioned to 128-bit addresses? Subnetting -Calculating simple subnet masks, Routing: How routers use tables to move packets across the internet, NAT (Network Address Translation): How home routers manage multiple devices,	6
5.	**Transport Layer Mechanics:** TCP (Transmission Control Protocol): Connection-oriented, reliable, used for Email/Web, UDP (User Datagram Protocol), Connectionless, fast, used for Gaming/Streaming, Ports & Sockets: How a computer knows which app should receive the incoming data.	6
6.	**Applications & Modern Trends:** Services - DNS (Domain Name System), HTTP/HTTPS, and Email protocols (SMTP/IMAP), Modern Tech:4G/5G basics, IoT Networking, and Cloud APIs, Security-Firewalls, Encryption basics, and Cybersecurity Awareness	5

Learning Resources: References

Sr. No.	References
1	Data Communications and Networking, Behrouz A. Forouzan, Fifth Edition - McGraw-Hill Forouzan Networking Series
2	Computer Networks, Andrew S. Tanenbaum, David Wetherall, Fourth Edition,5th Edition Pearson

MAM-2404 Fundamentals of Go Language SEC-Theory		
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (CO's) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recall the importance, history, features, and application areas of the Go programming language, including its compilation model, concurrency support, and use in modern computing domains.	1
CO2	Apply fundamental Go program structure concepts—names, variables, constants, type declarations, packages, scope, and file organization—to develop well-structured and readable Go programs.	2
CO3	Differentiate and utilize basic and composite data types along with operators in Go to design and implement programs that perform data manipulation and problem solving.	3
CO4	Implement control structures and functions in Go, including conditional statements, loops, recursion, multiple return values, error handling, variadic and anonymous functions, and deferred calls to solve computational problems.	4
CO5	Design modular programs using methods, structs, pointer receivers, and encapsulation concepts, demonstrating composition and reuse through struct embedding and method expressions.	5
CO6	Develop interface-based solutions by defining and implementing Go interfaces as contracts, enabling abstraction, polymorphism, and flexible program design in real-world applications.	6

MAM-2404 Fundamentals of Go Language
(SEC- Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	Introduction to Go Language: Importance, History, what is Go? Why Go (Compile Time, String Processing, Concurrency), Application areas of Go language, Go– Compilation in Go, Set Up & First Program, Go Comments	2
2	Program Structure- Names, Declarations, Variables, Constants, Assignments, Type Declarations, Packages and Files, Scope	2
3	Basic Data Types and Composite Types- Introduction, comparison between Basic and Composite data types, Practice Programs based on both data types, Go Operators	6
4	Go Conditions and Functions: Conditional Statements, Function Declarations, Recursion, Multiple Return Values, Errors, Function Values, Anonymous Functions , Variadic Functions, Deferred Function Calls, Switch Case- Single Case	7

	and Multi Case, Loops	
5	Methods: Method Declarations, Methods with a Pointer, Receiver, Composing Types by Struct Embedding, Met hod Values and Expressions, Example: Bit Vec tor Type, Encapsulation	7
6	Interfaces: Interfaces as Contracts, Interface Types, Interface, Satisfaction, Parsing Flags with flag, Value, Int reface Values, Introduction to Routines	6

Learning Resources: References

Sr. No.	References
1.	The Go Programming Language, Alan A. A. Donovan Google Inc. Brian W. Kernighan Princeton University,
2.	Introducing Go, by Caleb Doxsey, O'Reilly
3.	Headfirst Go: A Brain-Friendly Guide, Jay McGavren, O'Reilly
Web References:	
1.	https://go.dev/
2.	https://gobyexample.com/

	MTS-2454 Field Project **FP-Practical**	
	Number of Credits: 02 **No. of Hours: 30**	

MTS-2454 Field Project

Here's a set of guidelines for undergraduate field projects in science subjects like Botany, Chemistry, Geology, Electronics, Mathematics, Physics, Statistics, and Zoology. These guidelines align with the requirement that each teacher supervises a batch of 15 students.

Field Project Guidelines for Undergraduate Students

1. Objective

The field project aims to:

- Provide hands-on experience in the application of theoretical knowledge.
- Enhance skills in data collection, analysis, and scientific inquiry.
- Promote teamwork and independent research capabilities.

---

2. Structure and Framework

Batch Size

- Each batch will consist of a maximum of **15 students**, supervised by one teacher.
- Students will work collaboratively but must submit individual reports.
- Each group may comprise of 3/ 4 students.

Duration

- Projects should be spread over a semester or at least a period of 12 weeks. (total of 60 hours minimum)
- Weekly progress reviews should be conducted by the supervisor.

3. Suggested Topics

- Topics should align with the subject's curriculum and include practical, real-world applications.
  Illustrative Examples:
  - **Botany**: Biodiversity surveys, plant taxonomy studies, or ecological assessments.
  - **Chemistry**: Analysis of soil or water samples, chemical synthesis, or environmental chemistry studies.
  - **Geology**: Rock/mineral surveys, geomorphological mapping, or field-based stratigraphy.
  - **Electronics**: Circuit design, sensor applications, or IoT device development.
  - **Mathematics**: Data modelling, statistical analysis, or optimization problems.
  - **Physics**: Experimental studies in optics, mechanics, or energy systems.
  - **Statistics**: Surveys, bio-statistical analysis, or statistical modelling.
  - **Zoology**: Wildlife surveys, behaviour studies, or habitat analysis.

---

4. Roles and Responsibilities

Students

- Actively participate in all phases of the project.
- Collect, analyse, and interpret data using appropriate methodologies.
- Maintain proper records and submit a detailed report at the end of the project.

Supervisors

- Guide students in topic selection, planning, and execution.
- Ensure ethical and safety standards are met during fieldwork.

- Review weekly progress and provide constructive feedback.
- Evaluate reports and presentations.

---

5. Illustrative Evaluation Criteria

- **Topic Understanding (20%)**: Clarity on the purpose and scope of the project.
- **Methodology (20%)**: Appropriateness and rigor in data collection and analysis.
- **Execution (20%)**: Timeliness, teamwork, and innovation.
- **Report (20%)**: Presentation, accuracy, and depth of analysis.
- **Presentation (20%)**: Clarity, confidence, and ability to answer questions.

---

6. Safety and Ethical Considerations

- Adhere to all safety protocols for field and laboratory work.
- Obtain necessary permissions for field studies (e.g., working in protected areas).
- Ensure ethical treatment of living organisms, if applicable.
- Avoid plagiarism in reporting.

---

7. Logistics and Support

- Departments should provide guidance for requirements of tools, equipment.

---

8. Expected Deliverables

- **Proposal**: Outline of project goals, methodology, and expected outcomes.
- **Weekly Progress Reports**: Brief updates shared during supervisory meetings.
- **Final Report**: Comprehensive documentation of the project.
- **Presentation**: Oral presentation supported by slides, videos, or demonstrations.
