Gondwana University, Gadchiroli
NEP 2020 U.G. PROGRAMME SESSION 2025-26
Faculty of Science and Technology
Programme Name - B.Sc. Sem III (MATHEMATICS)

Sr. No.	Course Category	Subject name	Total Credit	Teaching Scheme (Hrs)			Examination Scheme									Tot Mar
							Theory					Practical				
				Theory	Practical	Total Hrs.	UA	CA	Total Mark	Min. Passing	Duration of Exam (Hrs.)	UA	CA	Total Mark	Min. Passing	
1	Major	Paper I- Advanced Calculus & Its Application	04	04	--	04	80	20	100	40	03	--	--	--	--	10
		Paper II- Ordinary Differential Equation	04	04	--	04	80	20	100	40	03					10
2	Minor	Calculus And Matrices	04	04	--	04	80	20	100	40	03					10
3	OE	Basic Maths And Reasoning	02	02	--	02	40	10	50	20	02	--	--	--	--	5(
4	VSC	Sage Math software system	02	--	04	04	--	--	--	--	--	30	20	50	25	5(
5	AEC	English/Marathi	02	02	--	02	40	10	50	20	02	--	--	--	--	5(
6	FP	Based on Major (30hrs/credit)	02	--	04	04	--	--	--	--	--	--	50	50	25	5(
7	CC	NSS/SPORTS/YOGA	02	--	04	04	--	--	--	--	--	30	20	50	25	5(
Total			22	16	12	28	320	80	400	160	13	60	90	150	75	55

MAJOR

SYLLABUS MMMJ301 SEMESTER III

ADVANCED CALCULUS AND ITS APPLICATION **4 Credits 80 Marks**

UNIT-I: Sequence & Series-Real Sequence, Bounded Sequence, Cauchy Convergence Criterion For Sequences, Cauchy's Theorem On Limits, Monotone Sequences And Their Convergence, Monotone Convergence Theorem, Infinite Series, Positive Term Series, Geometric Series, Comparison Test, Convergence Of P-Series, Root Test, Ratio Test, Alternating Series, Leibnitz's Test, Test for Convergence.

UNIT-II: De Moivre's Theorem & Its Application, Square Root of Complex Number, Inverse Circular & Hyperbolic Functions, Logarithm Of Complex Quantity, Summation Of Series. C+iS Method

UNIT-III: Double Integration: Properties of Double Integration, Iterated Integral, Change Of Order Integration, Transformation Of Double Integral In Polar Form, Area By Double Integration.

UNIT-IV: Triple Integral: Definition of Triple Integrals And Evaluation-Change Of Variables, Volume As Triple Integral, Differentiation Under The Integral Sign By Leibnitz Rule

References-

1. H. Anton, I. Birens and Davis, Calculus, John Wiley and Sons, Inc.,2002.
2. G.B. Thomas and R. L. Finney, Calculus, Pearson Education,2007.
3. Text Book of Differential Calculus – Gorakh Prasad .
4. Integration for Degree Student – Dr. P. K. Mittal, S. Chand & Co. New Delhi.
5. Text Book of Differential Calculus – Musheer Ahmad, Macmillan India Ltd. Delhi - 2006.
6. Wilfred Kaplan & D. J. Lewis, Calculus & linear algebra combined edition.
7. S. L. Loney, Plane trigonometry part-II, Macmillan & company, London.
8. Differential Calculus and Trigonometry, T. M. Karde, SonuNilu Publication
9. Real Analysis, T. M. Karde, SonuNilu Publication
10. Vector Analysis, Geometry and Difference Equations, T. M. Karde, SonuNilu Publication

SYLLABUS MMMJ302 SEMESTER III

ORDINARY DIFFERENTIAL EQUATION **4 Credits 80 Marks**

UNIT-I: First order exact differential equation, Integrating factor, Rules to find an integrating factors, Linear differential equation, Bernoulli's equation, First order higher degree equations solvable for x, y, p, Orthogonal Trajectory.

UNIT-II: Simultaneous differential equations, Linear equation with constant coefficients, Complementary function operator to find the Particular integral, The homogeneous linear equations.

UNIT-III: Linear equation with Variable coefficients, Cauchy's Euler's homogeneous linear differential equation, Wronskian & its properties, Method of variation of parameter.

UNIT-IV: Formation of Difference equation . Order of difference equation, Linear difference equation. Homogeneous linear equation with constant coefficients, Non-homogeneous linear equation, Particular integrals.

References-

1. Differential equations N. Ch. S. N. Iyengar, Anmol Publication Pvt. Ltd.
2. D. A. Murry, Introductory Course in Differential Equations , orient Longman (India) 1967.
3. G. F. Simmons, Differential Equation Tata McGraw Hill 1972.
4. Shepley L.Ross, Differential Equations, 3rd. Ed., John Wiley and Sons, 1984.
5. H. C. Saxena, Calculus of Finite Differences & Numerical Analysis, S.Chand & Co.Ltd,New Delhi,1976. Scope: chapter 8
6. H. K. DASS University of Hull (England) Dr. RAMA VERMA Professor S. CHAND & COMPANY PLT. - Introduction To Engineering Mathematics Volume – II
7. E. A. Coddington, An Introduction to Ordinary Differential Equations (Prentice-Hall).
8. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.
9. Ordinary Differential Equations, T. M. Karde, SonuNilu Publication

MINOR.

SYLLABUS MMMN303 SEMESTER III

CALCULAS AND MATRICES **4 Credits 80 Marks**

UNIT-I: Sequences in R

Convergent sequence, Limit of a sequence, Bounded sequence, Limit theorems, Monotone sequences, Monotone convergence theorem, Sub-sequences, Bolzano -Weierstrass theorem for sequences, Limit superior and limit inferior for bounded sequence, Cauchy sequence, Cauchy's convergence criterion.

UNIT-II: Infinite Series

Convergence and divergence of infinite series of real numbers, Necessary condition for convergence, Cauchy criterion for convergence; Tests for convergence of positive term series: Integral test, Basic comparison test, Limit comparison test, D'Alembert's ratio test, Cauchy's nth root test, Alternating series, Leibniz test, Absolute and conditional convergence.

UNIT-III: Matrices

Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

UNIT-IV: Eigen values and Eigen vectors

Linear Transformation and Orthogonal Transformation: Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

References-

1. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R. G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
3. K. A. Ross, Elementary Analysis - The Theory of Calculus Series- Undergraduate Text in Mathematics, Springer Verlag, 2003.
4. Text Book of Differential Calculus - Gorakh Prasad .
5. Text Book of Differential Calculus - Musheer Ahmad, Macmillan India Ltd. Delhi - 2006.
6. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
7. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016
8. Real Analysis, T. M. Karde, SonuNilu Publication
9. Algebra and Trigonometry, T. M. Karde, SonuNilu Publication

OE

SYLLABUS MMOE304 SEMESTER III

BASIC MATHS AND REASONING **2 Credits 40 Marks**

Total Marks: 50 (Theory: 40, Internal Assessment: 10) Workload: 2 Lectures (per week), Duration: 15 Weeks (30 Hrs.) Examination: 2Hrs.

Course Objectives: The main aim of this course is to gain knowledge of elementary ideas about arithmetic abilities which one finds in daily life. It will help the students from any background to get acquainted with this knowledge and get prepared for any competitive examinations.

Course Learning Outcomes: This course will enable the students to: i) gain sufficient ideas of mental and arithmetic abilities. ii) handle mental/quantitative aptitude test questions with great ease. iii) acquire the skill of solving problems of daily life/business quickly.

UNIT-I: Set, Empty set, Finite and infinite sets, Cardinality of sets, Set operations, Union, Intersection, Difference of sets, Compliment of sets

UNIT-II: Arithmetic operations, Factorial, Permutation and Combination, Basic Probability

UNIT-III: Syllogism, Analogy, Blood relations, Statement and Conclusions, Direction sense.

UNIT-IV: Classification, Counting of figures, Arrangments, Series Pattern, Order and ranking.

References-

1. N. K. Singh Text book of probability and statistics, 1st edition, Pragati Publication, Meerut.
2. Arithmetic by Lalji Prasad published by Students friends.
3. Mathematics, Maharashtra State Board Book of Class X, XI.
4. Analytical and Logical reasoning for CAT and other management entrance test by Sijwali B. S.
5. Analytical and Logical reasoning By Sijwali B. S.
6. https://prepinsta.com/
7. https://www.indiabix.com

SYLLABUS MMVSC305 SEMESTER III

SAGE MATH SOFTWARE SYSTEM **2 Credits 30 Marks**

List of Practical to be performed at the Laboratory:

1. Introductory Tutorial
2. Evaluating Sage Commands
3. Functions in Sage
4. Annotating with Sage
5. Basic Symbolics and Plotting
6. Basic 2D Plotting
7. Basic 3D Plotting
8. Calculus 1- Differentiation
9. Calculus 2- Integration
10. Advanced 2D Plotting
11. Graphing Functions and Plotting Curves
12. Plotting Data

Reference books / materials:

1. Computational Mathematics with Sage Math, By Paul Zimmermann, Alexandre Casamayou, Nathann Cohen, Guillaume Connan, Thierry Dumont, Laurent Fousse, François Maltey, Matthias Meulien, Marc Mezzarobba, Clément Pernet, Nicolas M. Thiéry, Erik Bray, John Cremona, Marcelo Forets, Alexandru Ghitza, Hugh Thomas.
2. https://doc.sagemath.org/html/en/prep/index.html
3. https://www.ictmumbai.edu.in/Mathematics/SageMathLecure, Ajit Kumar, ICT Mumbai.pdf
4. http://lamastex.org/preprints/compSageMathZimmerman120517.pdf
5. ajitmathsoft.wordpress.com/sage math

SYLLABUS MMFP307 SEMESTER III

FIELD PROJECT — 2 Credits 50 Marks

Course Objectives: The main aim of this project course is to bridge theoretical knowledge with real-world applications. This project work will help students develop problem-solving skills, analytical thinking and the ability to communicate mathematical ideas effectively.

Course Learning Outcomes: Upon completing the field project, students should be able to-

i) Apply mathematical concepts to real-world problems.
ii) Develop research skills and data analysis techniques.
iii) Enhance critical thinking and problem-solving abilities.
iv) Improve written and oral communication of mathematical findings.
v) Work collaboratively on mathematical investigations.

Guidelines:

1. The project work is to be done individually or in groups (Maximum 5 students)
2. The project work should relevant to Mathematics subject.
3. The project work will carry 50 Marks.
4. The internal presentation and viva-voice examination would be held before the university theory exams.

Report Format:

1. **Cover Page**: Title, student details, institution, and date.
2. **Introduction**: Background, objectives, and methodology.
3. **Methodology**: Explanation of techniques and data analysis.
4. **Results and Discussion**: Findings with interpretations.
5. **Conclusion**: Summary
6. **References**: Cited books, papers, and online sources.

Distribution of Marks: Total Marks: 50 (College assessment)

Sr No.		Marks
1	Participation & Attendance	10
2	Data Collection & Analysis	10
3	Results/Interpretation	10
4	Report Writing	10
5	Presentation & viva	10

Gondwana University, Gadchiroli
NEP 2020 U.G. PROGRAMME SESSION 2025-26
Faculty of Science and Technology
Programme Name - B.Sc. Sem IV (MATHEMATICS)

Sr. No.	Course Category	Subject name	Total Credit	Teaching Scheme (Hrs)			Examination Scheme									Tot Mar
							Theory					Practical				
				Theory	Practical	Total Hrs.	UA	CA	Total Mark	Min. Passing	Duration of Exam (Hrs.)	UA	CA	Total Mark	Min. Passing	
1	Major	Paper I - Partial Differential Equation	04	04	--	04	80	20	100	40	03	--	--	--	--	10
		Paper II- Advanced Differential Equation And Its Application	04	04	--	04	80	20	100	40	03					10
2	Minor	Differential Equation	04	04	--	04	80	20	100	40	03					10
3	OE	Business Mathematics-II	02	02	--	02	40	10	50	20	02	--	---	---	---	5(
4	SEC	Business Statistics	02	02	--	02	40	10	50	20	02	---	---	---	---	5(
5	AEC	Eng/Marathi	02	02	--	02	40	10	50	20	02	--	--	--	-	5(
6	CEP	Based on Major (30hrs/credit)	02	--	04	04	--	--	--	--	--	--	50	50	25	5(
7	CC	NSS/SPORTS/YOGA	02	--	04	04	--	--	--	--	--	30	20	50	25	5(
Total			22	18	08	26	360	90	450	180	15	30	70	100	50	55

MAJOR

SYLLABUS MMMJ401 SEMESTER IV

PARTIAL DIFFERENTIAL EQUATION **4 Credits 80 Marks**

UNIT-I: Linear partial differential equation of first order, Formation partial differential equation by eliminating the arbitrary constant and arbitrary function, Homogeneous partial differential equation with constant coefficient, Solution of partial differential equation complementary function and particular integral, Jacobi's method.

UNIT-II: Compatible Differential Equations, Condition of Compatibility, Non-linear partial differential equations.

UNIT-III: Non- Homogeneous linear partial differential equation with constant coefficient, finding complementary function and particular integral, Equation reducible to linear partial differential equation with constant coefficients.

UNIT-IV: Partial Differential equations of order two with variable coefficients with variable constants Type I, II, III and IV, Solutions of equations under given geometrical conditions, Monges' method of integration of $Rr+Ss+Tt = V$.

References-

1. Differential equations N. Ch. S. N. Iyengar, Anmol Publication Pvt. Ltd.
2. D. A. Murry, Introductory Course in Differential Equations , orient Longman (India) 1967.
3. G. F. Simmons, Differential Equation Tata Mc Graw2 Hill 1972.
4. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
5. H. C. Saxena, Calculus of Finite Differences & Numerical Analysis, S.Chand & Co.Ltd,New Delhi,1976. Scope: chapter
6. I. Sneddon, Elements Of partial Differential Equations, Mc Graw-Hill, International Edition ,1967.
7. Ordinary and partial differential equation, M.D. Raisinghania, S.Chand and Company limited, 2006.
8. Partial Differential Equations, T. M. Karde, SonuNilu Publication

MAJOR

SYLLABUS MMMJ402 SEMESTER IV

ADVANCED DIFFERENTIAL EQUATION AND ITS APPLICATION **4 Credits 80 Marks**

UNIT-I: One-Dimensional Wave Equation, One Dimensional of Heat Equation, Derivation Of Fourier Equation Of Heat Conduction, Boundary Value Problem.

UNIT-II: Method of separation of variable, Solution of boundary value problems, Heat, Wave and Laplace equation in cartesian coordinates, Solution of one dimensional and two dimensional heat equation, Solution one dimensional and two dimensional wave equation.

UNIT-III: Legendre's Equation And Its Solution, Legendre's Polynomial of degree n, Generating Function For Legendre Polynomials, Orthogonal Properties of Legendre's polynomials, Recurrence relations, Rodrigue's formula.

UNIT-IV: Bessel's equation and its solution, Bessel's function of order n, generating function, Bessel's function of second kind of order recurrence Relations, example involving integration and recurrence relations.

References-

1. Differential equations N.Ch.S.N.Iyengar , Anmol Publication Pvt. Ltd.
2. D.A.Murry, Introductory Course in Differential Equations , orient Longman (India) 1967.
3. G.F.Simmons, Differential Equation Tata Mc Graw Hill 1972.
4. Shepley L.Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
5. H.C.Saxena, Calculus of Finite Differences & Numerical Analysis, S.Chand & Co.Ltd, New Delhi,1976. Scope: chapter

6 Sneddon Elements Of partial Differential Equations, Mc Graw-Hill, International Edition ,1967.

7. Ordinary and partial differential equations, M. D. Raisinghania, S. Chand and Company limited, 2006.

MINOR

SYLLABUS MMMN403 SEMESTER IV

DIFFERENTIAL EQUATION **4 Credits 80 Marks**

UNIT-I: First order exact differential equation, integrating factor, rules to find an integrating factors, Linear differential equation , Bernoulli's equation, First order higher degree equations solvable for x, y, p, Orthogonal Trajectory.

UNIT-II: Linear differential equations of second and third order with constant coefficients of the type F(D)y = Q(x), where Q(x) = 0, eax, $cosax$, $sinax$, xn their sum and product in pairs. Solving a non-homogeneous linear differential equation with constant coefficients by the method of undetermined coefficients. Examples and exercises based on these topics.

UNIT-III: Solution of homogeneous linear differential equations with variable coefficients and non--homogeneous linear differential equations with constant coefficients by reduction of order method, Non-homogeneous linear differential equations with variable coefficients: the method of variation of parameters, the Cauchy-Euler equation. Examples, problems and exercises based on these topics.

UNIT-IV: Linear partial differential equation of first order, Formation partial differential equation by eliminating the arbitrary constant and arbitrary function, Homogeneous partial differential equation with constant coefficient, Solution of partial differential equation complementary function and particular integral, Jacobi's method.

References-

1. Differential equations, N. Ch. S. N. Iyengar, Anmol Publication Pvt. Ltd.

2. D. A. Murry, Introductory Course in Differential Equations, Orient Longman (India), 1967.

3. G. F. Simmons, Differential Equation Tata McGraw-Hill 1972.

4.Shepley L.Ross, Differential Equations, 3rd. Ed., John Wiley and Sons, 1984.

5. H.C.Saxena, Calculus of Finite Differences & Numerical Analysis, S.Chand & Co.Ltd,New Delhi,1976. Scope: chapter 8

6. H.K. DASS University of Hull (England) Dr. RAMA VERMA Professor S. CHAND & COMPANY PLT. - Introduction To Engineering Mathematics , Volume – II.

7 E. A. Coddington, An Introduction to Ordinary Differential Equations (Prentice-Hall).

8. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.

9. Ordinary Differential Equations, T. M. Karde, SonuNilu Publication

10. Partial Differential Equations, T. M. Karde, SonuNilu Publication

OE

SYLLABUS MMOE404 SEMESTER IV

BUSINESS MATHEMATICS-II **2 Credits 40 Marks**

Total Marks: 50 (Theory: 40, Internal Assessment: 10) Workload: 2 Lectures (per week), Duration: 15 Weeks (30 Hrs.) Examination: 2Hrs.

Course Objectives: The main aim of this course is to gain knowledge of elementary ideas about arithmetic abilities which one finds in daily life. It will help the students from any background to get acquainted with this knowledge and get prepared for any competitive examinations.

Course Learning Outcomes: This course will enable the students to: i) gain sufficient ideas of mental and arithmetic abilities.
ii) handle mental/quantitative aptitude test questions with great ease. iii) acquire the skill of solving problems of daily life/business quickly.

UNIT-I: Tax system, Taxable value, GST, CGST

UNIT-II: Shares, Face value, Market value, Dividend, Brokerage, Stock exchange, Rate of return

UNIT-III: Markups and Markdowns, Margins, Discount, Banker's discount, True discount

UNIT-IV: Investments, Return on investment, Insurance, Fixed deposits(FD), Recurring deposits(RD), Commissions.

References-

1. Chapter: Financial Mathematics, Maharashtra state board book of class IX and X.

2. Quantitative aptitude for Competitive examination By R. S. Agarwal.

3. https://www.geeksforgeeks.org/business-mathematics/

4. https://www.indiabix.com

SYLLABUS MMSEC405 SEMESTER IV

BUSINESS STATISTICS

2 Credits 40 Marks

UNIT-I: Introduction: Concept, features, Significance & limitations of statistics, Types of data, Classification & Tabulation, Frequency distribution & graphical representation.

UNIT-II: Measures of Central Tendency (Mean, Median, Mode), Measures of Variation (Range, Quartile Deviation, Mean, Deviation and Standard Deviation, Significance & properties of a good measure of variation, Measures of Skewness & Kurtosis.

UNIT-III: Correlation and Regression: Meaning and types of correlation, Simple correlation, Scatter diagram method, Karl Pearson's Coefficient of correlation, Significance of correlation,

UNIT-IV: Regression concept, Regression Analysis: Principle of least squares and regression lines, Regression equations and estimation; Properties of regression coefficients; Relationship between Correlation and Regression coefficients; Standard Error of Estimate and its use in interpreting the results.

References-

1. Levin, Richard, David S. Rubin, Sanjay Rastogi, and H. M. Siddiqui, Statistics for Management, 7th ed., Pearson Education.
2. David M. Levine, Mark L. Berenson, Timothy C. Krehbiel, P. K. Viswanathan, Business Statistics: A First Course, Pearson Education.
3. Siegel Andrew F. Practical Business Statistics, McGraw Hill Education.
4. Gupta S. P., and Archana Agarwal. Business Statistics, Sultan Chand and Sons, New Delhi.
5. Vohra N. D., Business Statistics, McGraw Hill Education.
6. Murray R. Spiegel, Larry J. Stephens, Narinder Kumar. Statistics (Schaum's Outline Series), Mc-Graw Hill Education.
7. Gupta, S.C. Fundamentals of Statistics, Himalaya Publishing House.
8. Anderson, Sweeney, and Williams, Statistics for Students of Economics and Business, Cengage Learning.

SYLLABUS MMCEP407 SEMESTER III

COMMUNITY ENGAGEMENT PROGRAM **2 Credits 50 Marks**

Course Objectives: The primary aim of the Community Engagement Program is to utilize mathematical knowledge and skills to address real-world problems within the community. The program seeks to-

i) Bridge the gap between theoretical mathematics and practical applications.

ii) Enhance students' problem - solving and analytical skills in a social context.

iii) Promote mathematical awareness and literacy in the community.

iv) Encourage collaborative learning and service-oriented projects.

Course Learning Outcomes: By the end of the program, students should be able to-

i) Apply mathematical concepts to solve local community problems.

ii) Develop communication and teamwork skills while working with diverse groups.

iii) Enhance critical thinking and problem-solving abilities in a real-world context.

iv) Produce a structured report documenting their findings, contributions, and experiences.

v) Develop a sense of social responsibility through mathematics-driven community engagement.

Guidelines for conducting program:

1. Identify community needs, where mathematics can be applied. (e.g., financial literacy, statistical data collection, optimization of resources).
2. Form student groups, assign mentors and design activities.
3. Conduct workshops, tutoring sessions or data analysis projects to engage with community members to apply mathematical concepts.
4. Assess impact through feedback and surveys.
5. Reflect on experiences, challenges, and learning outcomes.
6. Prepare and present a final report.

Suggested Topics: Financial literacy, Tutoring school students in rural area, Management of energy consumption in household purposes, Applications of probability and statistics in public health and Safety, Various educational/health surveys, Cryptography and cybersecurity awareness, etc.

Report Format:

1. **Cover Page** (Title, Student details, Institution and Date)
2. **Acknowledgment** (Gratitude towards mentors, community members)
3. **Introduction** (Background, objectives, and importance of mathematics in the topic)
4. **Planning & Preparation** (Selection of topic and rationale behind it, resources and materials to be used)
5. **Implementation & Execution** (Date, location of the program, description of activities conducted)
6. **Community Interaction & Impact** (through feedback and survey)
7. **Conclusion**

Distribution of Marks: Total Marks: 50 (College assessment)

Sr No.		Marks
1	Participation & Attendance	10
2	Engagement with the Community	10
3	Ethics	10
4	Report Writing	10
5	Presentation & viva	10