ESTD : 1880

St Aloysius College (Autonomous)
Mangaluru

Re-accredited by NAAC "A" Grade

Course structure and syllabus of
B.Sc.
MATHEMATICS

Under NEP Regulations, 2021

Date: 17-08-2022

NOTIFICATION

Sub: Syllabus of **B.Sc. MATHEMATICS** under NEP Regulations, 2021.
(As per Mangalore University guidelines)

Ref: 1. Decision of the Academic Council meeting held on 18-12-2021 vide
Agenda No: 6.21(2021-22)
2. Decision of the Academic Council meeting held on 09-07-2022 vide
Agenda No:14
3. Office Notification dated 21-02-2022.
4. Office Notification dated 17-08-2022

Pursuant to the above, the Syllabus of **B.Sc. MATHEMATICS** under NEP Regulations, 2021 which was approved by the Academic Council at its meeting held on 18-12-2021& 09-07-2022 is hereby notified for implementation with effect from the academic year **2021-22**.

PRINCIPAL

REGISTRAR

To:

1. The Chairman/Dean/HOD.
2. The Registrar Office
3. Library

Board of Studies meeting held on 20th November 2021 chaired by Ms Priya Monteiro, Head of the Department.

Members present:

1. Dr Adelaide Saldanha, HOD, Department of Mathematics, St Agnes College (Autonomous), Mangaluru.
2. Mr Udaya K, HOD of Mathematics, St Philomena College, Puttur.
3. Dr John Edward Dsilva
4. Ms Melvita Leema Baretto
5. Ms Rollin Preetha Vaz
6. Ms Shaila Priya Rodrigues

Board of Studies meeting was held on 25th June 2022 chaired by Ms Priya Monteiro, Head of the Department.

Members present:

1. Dr Chandru Hegde, Assistant Professor, Department of Mathematics, Mangalore University, Mangalagangothri. (University nominee)
2. Dr Adelaide Saldanha, HOD, Department of Mathematics, St Agnes College (Autonomous), Mangaluru. (subject expert)
3. Mr Udaya K, HOD of Mathematics, St Philomena College, Puttur. (subject expert)
4. Mr G K Baliga, (Industry nominee).
5. Dr John Edward Dsilva, Director, Xavier Block.
6. Ms Melvita Leema Baretto
7. Ms Rollin Preetha Vaz
8. Ms Shaila Priya Rodrigues
9. Ms Chethana U V
10. Ms Michelle Ann Abhijit (student representative).

Board of Studies meeting was held on February 22, 2023 chaired by Ms Priya Monteiro, Head of the Department.

Members present:

1. Dr Chandru Hegde, Assistant Professor, Department of Mathematics, Mangalore University, Mangalagangothri(University Nominee).
2. Dr Adelaide Saldanha, Former HOD, Department of Mathematics, St Agnes College(Autonomous),Mangaluru(Subject Expert).
3. Mr Udaya K, Former HOD of Mathematics, St Philomena College, Puttur (Subject Expert).
4. Ms Melvita Leema Baretto
5. Ms Rollin Preetha Vaz
6. Ms Tinu John
7. Ms Anisha Jean Mathias

Programme Outcomes (PO):

By the end of the program it is expected that the students will be benefited by the following:

PO 1	**Disciplinary Knowledge**: Bachelor degree in Mathematics is the culmination of in-depth knowledge of Algebra, Calculus, Geometry, differential equations and several other branches of pure and applied mathematics. This also leads to study the related areas such as computer science and other allied subjects
PO 2	**Communication Skills**: Ability to communicate various mathematical concepts effectively using examples and their geometrical visualization. The skills and knowledge gained in this program will lead to the proficiency in analytical reasoning which can be used for modeling and solving of real life problems.
PO 3	**Critical thinking and analytical reasoning:** The students undergoing the programme acquire ability of critical thinking and logical reasoning and capability of recognizing and distinguishing the various aspects of real life problems.
PO 4	**Problem Solving**: The Mathematical knowledge gained by the students through the programme develop an ability to analyze the problems, identify and define appropriate computing requirements for its solutions. This programme enhances students overall development and also equip them with mathematical modelling ability, problem solving skills.
PO 5	**Research related skills:** Student completing the program will develop the capability of inquiring about appropriate questions relating to the Mathematical concepts in different areas of Mathematics.
PO 6	**Information/digital Literacy**: The completion of the programme will enable the learner to use appropriate softwares to solve system of algebraic equation and differential equations.
PO 7	**Self – directed learning**: Student completing the program will develop an ability of working independently and to make an in-depth study of various notions of Mathematics.

PO 8	**Moral and ethical awareness/reasoning:** The student completing the program will develop an ability to identify unethical behavior such as fabrication, falsification or misinterpretation of data and adopting objectives, unbiased and truthful actions in all aspects of life, in general and Mathematical studies, in particular.
PO 9	**Lifelong learning**: The programme provides self-directed learning and lifelong learning skills. The programme helps the learner to think independently and develop algorithms and computational skills for solving real word problems.
PO 10	Ability to peruse advanced studies and research in pure and applied Mathematical sciences.

Assessment

Weightage for the Assessments (in percentage)

Type of Course	Formative Assessment/ I.A.	Summative Assessment (S.A.)
Theory	40%	60 %
Practical	50%	50 %
Projects	40%	60 %
Experiential Learning (Internship etc.)	--	--

Structure under NEP 2021 Batch Onwards

Course Code	Title of course	Category of course	Teaching hours per week	SEE	CIE	Total Marks	Credits
SEMESTER I							
G 503 DC1.1	Number Theory - I, Algebra - I and Calculus - I	DSC	4	60	40	100	4
G 503 DC2.1P	Theory based practicals on Number Theory – I, Algebra - I and Calculus - I	DSC	4	25	25	50	2
G 503 OE1.1	Mathematics – I	OEC	3	60	40	100	3
Total credit							9
SEMESTER II							
G 503 DC1.2	Number Theory - II, Algebra - II and Calculus - II	DSC	4	60	40	100	4
G 503 DC2.2P	Theory based practicals on Number Theory – II, Algebra - II and Calculus - II	DSC	4	25	25	50	2
G 503 OE1.2	Mathematics – II	OEC	3	60	40	100	3
Total credit							9
SEMESTER III							
G 503 DC1.3	Ordinary Differential Equations and Real Analysis – I	DSC	4	60	40	100	4
G 503 DC2.3P	Theory based practicals on Ordinary Differential Equations and Real Analysis – I	DSC	4	25	25	50	2
G 503 OE1.3	(A) Ordinary Differential Equations (B) Quantitative Mathematics	OEC	3	60	40	100	3
Total credit							9
SEMESTER IV							
G 503 DC1.4	Partial Differential Equations and Integral Transforms	DSC	4	60	40	100	4
G 503 DC2.4P	Theory based practicals on Partial Differential Equations and Integral Transforms	DSC	4	25	25	50	2
G 503 OE1.4	(A) Partial Differential Equations (B) Mathematical Finance	OEC	3	60	40	100	3
Total credit							9

Course Code	Title of course	Category of course	Teaching hours per week	SEE	CIE	Total Marks	Credits
	SEMESTER V						
	Real and Complex Analysis	DSC	3	60	40	100	3
	Theory based practicals on Real and Complex Analysis	DSC	2	25	25	50	2
	Modern Algebra-I	DSC	3	60	40	100	3
	Theory based practicals on Modern Algebra-I	DSC	2	25	25	50	2
	Elementary Graph Theory	DSE	3	60	40	100	3
Total credit							
	SEMESTER VI						
	Linear Algebra -I	DSC	3	60	40	100	3
	Theory based practicals on Linear Algebra -I	DSC	2	25	25	50	2
	Numerical Analysis	DSC	3	60	40	100	3
	Theory based practicals on Numerical Analysis	DSC	2	25	25	50	2
	Linear Programming	DSE	3	60	40	100	3
Total credit							

	programme enhances students overall development and also equip them with mathematical modelling ability, problem solving skills.
PO 5	**Research related skills:** Student completing the program will develop the capability of inquiring about appropriate questions relating to the Mathematical concepts in different areas of Mathematics.
PO 6	**Information/digital Literacy**: The completion of the programme will enable the learner to use appropriate softwares to solve system of algebraic equation and differential equations.
PO 7	**Self – directed learning**: Student completing the program will develop an ability of working independently and to make an in-depth study of various notions of Mathematics.
PO 8	**Moral and ethical awareness/reasoning:** The student completing the program will develop an ability to identify unethical behavior such as fabrication, falsification or misinterpretation of data and adopting objectives, unbiased and truthful actions in all aspects of life, in general and Mathematical studies, in particular.
PO 9	**Lifelong learning**: The programme provides self-directed learning and lifelong learning skills. The programme helps the learner to think independently and develop algorithms and computational skills for solving real word problems.
PO 10	Ability to peruse advanced studies and research in pure and applied Mathematical sciences.

Assessment

Weightage for the Assessments (in percentage)

Type of Course	Formative Assessment/ I.A.	Summative Assessment (S.A.)
Theory	40%	60 %
Practical	50%	50 %
Projects	40%	60 %
Experiential Learning (Internship etc.)	--	--

Structure under NEP

Course Code	Title of course	Category of course	Teaching hours per week	SEE	CIE	Total Marks	Credits
SEMESTER I							
G 503 DC1.1	Number Theory - I, Algebra - I and Calculus - I	DSC	4	60	40	100	4
G 503 DC2.1P	Theory based practicals on Number Theory – I, Algebra - I and Calculus - I	DSC	4	25	25	50	2
G 503 OE1.1	Mathematics - I	OEC	3	60	40	100	3
Total credit							9
SEMESTER II							
G 503 DC1.2	Number Theory - II, Algebra - II and Calculus - II	DSC	4	60	40	100	4
G 503 DC2.2P	Theory based practicals on Number Theory – II, Algebra - II and Calculus - II	DSC	4	25	25	50	2
G 503 OE1.2	Mathematics - II	OEC	3	60	40	100	3
Total credit							9

Syllabus for B.A./B.Sc. with Mathematics as Major Subject &

B.A./B.Sc. (Hons.) Mathematics

SEMESTER – I

G 503 DC1.1: Number Theory – I, Algebra-I and Calculus-I	
Teaching Hours : 4 Hours/Week	Credits: 4
Total Teaching Hours: 56 Hours	Max. Marks: 100
	(S.A.– 60 + I.A.– 40)

Course Learning Outcomes: This course will enable the students to

- Understand the elementary concepts of Number Theory.
- Solve the system of homogeneous and non-homogeneous *m* linear equations in *n* variables.
- Sketch curves in Cartesian and polar co-ordinates.
- Identify and apply intermediate value theorem, mean value theorems and L'Hospital rule.

Unit-I: Number Theory: Division Algorithm, The Greatest Common Divisor (g.c.d), Euclidean Algorithm, Diophantine Equations, Fundamental Theorem of Arithmetic. The Theory of Congruences, Basic Properties of Congruences, Binary and Decimal Representation of Integers. Linear Congruences and The Chinese Remainder Theorem.

14 Hours

Unit-II: Matrices: Recapitulation of Symmetric and Skew Symmetric matrices, Cayley-Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof). Algebra of Matrices, Row and column reduction to Echelon form. Rank of a matrix, Inverse of a matrix by elementary operations, Solution of system of linear equations, Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations.

14 Hours

Unit-III: Polar Co-ordinates: Polar coordinates, angle between the radius vector and tangent. Angle of intersection of two curves (polar forms), length of perpendicular from

pole to the tangent, pedal equations. Derivative of an arc in Cartesian, parametric and polar forms, curvature of plane curve-radius of curvature formula in Cartesian, parametric and polar and pedal forms- center of curvature, asymptotes, Tracing of curves (standard curves).

14 Hours

Unit-IV: Differential Calculus: Intermediate value theorem, Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Maclaurin's series, Indeterminate forms and evaluation of limits using L' Hospital rule. **14 Hours**

Reference Books:

[1] David M. Burton., Elementary Number Theory, 7th Ed., McGraw Hill, 2011.

[2] Gareth A. Jones and J. Marry Jones, Elementary Number Theory, Springer, 1998.

[3] N. S Gopalakrishnan, University Algebra, 3rd Ed., New Age International Publications, 2015.

[4] B. S. Vatssa, Theory of Matrices, New Age International Publishers, New Delhi, 2005.

[5] A. R. Vasishtha and A. K. Vasishtha, Matrices, Krishna Prakashana Media (P) Ltd., 2008.

[6] Shanti Narayan and P.K. Mittal, Text book of Matrices, 5th Ed., S Chand and Co. Pvt. Ltd., New Delhi, 2013.

[7] Shanthi Narayan and P.K. Mittal, Differential Calculus, Reprint. S Chand and Co. Pvt. Ltd., New Delhi, 2014.

[8] Debasish Sengupta, Applications of Calculus, Books and Allied (P) Ltd., 2019.

[9] George B. Thomas and Ross L. Finney, Calculus and Analytic Geometry, Addison-Wesley, 1992.

[10] Louis Leithold, Calculus with Analytic Geometry, 5th Ed., Harper and Row International, 1986.

[11] Maurice D. Weir, George B. Thomas, Jr., Joel Hass and Frank R. Giordano, Thomas' Calculus, 11th Ed., Pearson, 2008.

[12] S. Narayanan and T. K. Manicavachogam Pillay, Calculus, Vol. I & II, S. Viswanathan Pvt. Ltd., 1996.

G 503 DC1.1P: Practicals on Number Theory – I, Algebra-I and Calculus-I	
Practical Hours : 4 Hours/Week	**Credits: 2**
Total Practical Hours: 56 Hours	**Max. Marks: 50** **(S.A.– 25 + I.A. – 25)**

Course Learning Outcomes: This course will enable the students to

- Learn *Free and Open Source Software (FOSS)* tools for computer programming.
- Solve problems on Algebra and Calculus studied in **MATDSCT 1.1** by using FOSS softwares.
- Acquire knowledge of applications of algebra and calculus through FOSS.

Practical/Lab Work to be performed in Computer Lab   (FOSS)

Suggested Softwares: Maxima/Scilab/Python.

1. Introduction to the software and commands related to the topic.
2. Program for Euclidean Algorithm.
3. Program for Divisibility tests.
4. Programs for Binary and Decimal Representation of Integers.
5. Program to solve Simultaneous Congruences involving Chinese Remainder Theorem.
6. Computation of addition and subtraction of matrices.
7. Computation of Multiplication of matrices.
8. Computation of Trace and Transpose of Matrix.
9. Computation of Rank and Row reduced Echelon form of a matrix.
10. Computation of Inverse of an invertible Matrix using Cayley-Hamilton theorem.
11. Solving systems of homogeneous and non-homogeneous linear algebraic equations.
12. Tracing of standard curves (Cartesian form).
13. Tracing of standard curves (Polar form).
14. Taylor's and Maclaurin's expansions of the given functions.

G 503 DC1.2: Number Theory – II, Algebra-II and Calculus-II	
Teaching Hours : 4 Hours/Week	Credits: 4
Total Teaching Hours: 56 Hours	Max. Marks: 100
	(S.A.– 60 + I.A. – 40)

Course Learning Outcomes: This course will enable the students to

• Understand the Euler's ϕ-function and finite continued fractions.

• Recognize the mathematical objects called Groups.

• Identify cyclic and non-cyclic groups

• Link the fundamental concepts of groups and symmetries of geometrical objects.

• Understand the concept of partial derivatives of functions of several variables.

• Find the Taylor's and Maclaurin's series of functions of two variables.

• Find the extreme values of functions of two variables.

• Understand the concepts of line integrals, multiple integrals and their applications.

Unit-I: Number Theory: Fermat's Theorem, Wilson's Theorem, Quadratic Congruence. Euler's ϕ-function, definition and properties, Euler's theorem and corollaries, finite continued fractions. **14 hours**

Unit-II: Groups: Binary Operations, Associativity, Commutativity, Examples for Binary Operations, Definition of a Group, Examples, Right inverse, Left inverse, Some properties, Abelian and Non-abelian groups, Laws of exponents, Subgroups, Intersection of subgroups, Centralizer of an element, Normalizer of a subgroup, Product of subgroups, Order of products of subgroups, Cyclic groups, Properties, Number of generators. **14 hours**

Unit-III: Partial Derivatives: Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples. Taylor's and Maclaurin's series for functions of two variables, Maxima-Minima of functions of two variables.

14 hours

Syllabus for B.A./B.Sc. with Mathematics as Major Subject &

B.A./B.Sc. (Hons.) Mathematics

SEMESTER III

G 503 DC1.3: Ordinary Differential Equations and Real Analysis - I	
Teaching Hours : 4 Hours/Week	Credits: 4
Total Teaching Hours: 56 Hours	Max. Marks: 100 (S.A.– 60 + I.A.– 40)

Course Learning Outcomes: This course will enable the students to

- Understand the concept of differential equation.
- Classifies the differential equations with respect to their order and linearity.
- Demonstrate skills in constructing rigorous mathematical arguments.
- Demonstrate skills in communicating mathematics.
- Understand and be able to apply basic definitions and concepts of convergence.
- To prove simple statements involving convergent arguments.
- Learn to solve differential equation using Scilab/Maxima

UNIT – I: Differential Equations– I   (14 Hours)

Definition, examples of differential equations (Recapitulation). Differential equations of first order- separation of variables (Recapitulation) reducible to variable separable, homogeneous differential equations (Recapitulation) reducible to homogeneous differential equations. Exact Differential Equations (Recapitulation). Equations reducible to exact form. The general solution of a linear equation – Integrating factors found by inspection. The determination of integrating factors, Linear differential equations, Bernoulli's equation. Illustrative Examples.

UNIT – II: Linear Differential Equations- I   (14 Hours)

Ordinary Linear differential equations with constant coefficients – Complementary function – Particular integral with $f(x) = e^{ax}$, $sinax$, $cosax$, x^n, $e^{ax}v(x)$ – Inverse differential operators. Cauchy – Euler differential equations – Simultaneous differential equations (two variables with constant coefficients)

UNIT –III: Sequences and Series   (14 Hours)

Sequences, monotonic and bounded Sequences, least upper bound and greatest lower bound, the axiom of completeness, infinite series of constant terms, partial sums, infinite series of positive terms, Comparison test, Limit Comparison Test, Hyper harmonic series, Integral test.

UNIT – IV: Infinite Series   (14 Hours)

Alternating series, Leibniz's test, absolute convergence and conditional convergence, ratio test and root test for absolute convergence of an infinite series of nonzero terms.

Books for References

1. Daniel A Murray – Introductory Course to Differential equations.
2. Earl David Rainville and Philip Edward Bedient–A short course in Differential equations,Prentice Hall College Div; 6th edition.
3. M D Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt. Ltd.,2013.
4. F Ayres, Schaum's outline of theory and problems of Differential Equations, 1sted. USA McGraw-Hill, 2010.
5. S Narayanan and T K Manicavachogam Pillay, Differential Equations: S V Publishers Private Ltd., 1981.
6. The calculus with analytical geometry – Louis Leithold – 6th edition, Harper & Row, Publishers, New York.
7. S.C.Malik and Savita Arora, Mathematical Analysis, 2nd ed. New Delhi, India: New Ageinternational (P) Ltd.,1992
8. Richard R Goldberg, Methods of Real Analysis, Indian ed.
9. Asha Rani Singhal and M .K Singhal, A first course in Real Analysis
10. Robert G Bartle and Donald R Sherbert, Introduction to Real Analysis, John Wiley andSons Inc., Fourth Ed.
11. B. S. Grewal – Higher Engineering Mathematics.
12. E Kreyszig- Advanced Engineering Mathematics, Wiley India Pvt. Ltd.

G 503 DC2.3P: Practicals on Ordinary Differential Equations and Real Analysis - I	
Practical Hours : 4 Hours/Week	**Credits: 2**
Total Practical Hours: 56 Hours	**Max. Marks: 50** **(S.A.– 25 + I.A. – 25)**

Mathematics practical with Free and open Source Software (FOSS)tools for computer programs (Topics to be covered)

1) General and particular solutions of ordinary differential equations.

2) Solutions of first order differential equations and plotting direction fields.

3) Sketching orthogonal trajectories of a family of curves.

4) Simultaneous differential equations.

5) Finding limits of sequences.

6) Convergence tests for series with non-negative terms

7) Absolute and conditional convergence of series.

(For students of Science stream who have not chosen Mathematics as one of Core subjects)

G 503 OE1.3: Ordinary Differential Equations	
Teaching Hours : 3 Hours/Week	Credits: 3
Total Teaching Hours: 42 Hours	Max. Marks: 100 (S.A.– 60 + I.A. – 40)

Course Learning Outcomes: This course will enable the students to

- Understand the concept of differential equation.

- Classifies the differential equations with respect to their order and linearity.

- Demonstrate skills in constructing rigorous mathematical arguments.

- Demonstrate skills in communicating mathematics.

UNIT – I:(14 Hours)

Definition, examples of differential equations (Recapitulation). Differential equations of first order- separation of variables (Recapitulation) reducible to variable separable, homogeneous differential equations (Recapitulation) reducible to homogeneous differential equations. Exact Differential Equations (Recapitulation).

UNIT – II:(14 Hours)

The general solution of a linear equation – Integrating factors found by inspection. The determination of integrating factors, linear differential equations, Bernoulli's equation. Illustrative Examples.

UNIT– III:(14 Hours)

Ordinary Linear differential equations with constant coefficients – Complementary function – particular integral with $f(x) = e^{ax}$, $sinax$, $cosax$, x^n, $e^{ax}v(x)$ – Inverse differential operators. Cauchy – Euler differential equations.

Books for References
1. Daniel A Murray – Introductory Course to Differential equations.
2. Earl David Rainville and Philip Edward Bedient–A short course in Differential equations,Prentice Hall College Div; 6th edition.
3. F Ayres, Schaum's outline of theory and problems of Differential Equations, 1st ed. USAMcGraw-Hill,2010.
4. S Narayanan and T K Manicavachogam Pillay, Differential Equations .: S V Publishers Private Ltd., 1981.
5. M D Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt. Ltd.,2013.
6. B. S. Grewal – Higher Engineering Mathematics
7. E Kreyszig- Advanced Engineering Mathematics, Wiley India Pvt.Ltd.

Open Elective

(For Students of other than Science Stream)

G 503 OE1.3: Quantitative Mathematics	
Teaching Hours : 3 Hours/Week	Credits: 3
Total Teaching Hours: 42 Hours	Max. Marks: 100 (S.A.– 60 + I.A. – 40)

Course Learning Outcomes: This course will enable the students to

- To enable student to answer competitive examinations
- Solve Speed and Distance related problems.
- Solve Present & Past age calculations.

Quantitative Mathematics

Unit-I: (14 Hours)

Percentage, Ratio and proportion, partnership, averages, alligation and mixtures, problems on age.

Unit-II: (14 Hours)

Time and work, pipes and cisterns, time and distance, problems on trains, boats and streams, race and games of skill.

Unit-III: (14 Hours)

Clocks, Calendar, Heights and Distances, Data interpretation – Tabulation, Bar Graphs, Pie Charts, Line Graphs.

Books for References:
1. Business Mathematics by Dr. S.K. Sharma and Dr. Gurmeet Kaur (Published by Sultan Chand & Sons).
2. Quantitative Aptitude by Dr. R.S. Aggarwal; Revised Edition (Published by S. Chand & Company Ltd.).
3. A Text book of Business mathematics for B.Com and BBA
   Course by HazarikaPadmalochan, Chand Publication.
4. Business Mathematics by J K Thukrol published by abcibook:2020 first edition.
5. Business Mathematics and Statics by N G Das and J K Daspublisher
   Mc Graw Hill Education, 2017.

G 503 DC1.4: Partial Differential Equations and Integral Transforms	
Teaching Hours : 4 Hours/Week	Credits: 4
Total Teaching Hours: 56 Hours	Max. Marks: 100
	(S.A.– 60 + I.A. – 40)

Course Learning Outcomes: This course will enable the students to

- Understand the concept of Partial differential equation.
- Classifies the Partial differential equations with respect to their order and linearity.
- Understand and be able to apply various methods to solve Partial Differential Equations.
- Learn to solve Integral Equations and differential equations using Laplace Transforms.

UNIT–I: First Order Partial Differential Equations (14 Hours)

Basic concepts–Formation of a partial differential equations by elimination of arbitrary constants and functions – Solution of partial differential equations – Solution by Direct integration, Lagrange's linear equations of the form $+ Qq = R$, Standard types of first order non-linear partial differential equations.

UNIT–II: Second Order Partial Differential Equations (14 Hours)

Second Order Partial Differential Equations - Introduction, origin of second order equations. Linear partial differential equations with constants coefficients and equations having operator of the form $(\alpha_r D + \beta_r D' + \gamma_r)^n$. Solution of one dimensional heat, wave and Laplace equation using separation of variable methods.

UNIT –III: Laplace Transform (14 Hours)

Definition and basic properties–laplace transforms of e^{kt} , $\cos kt$, $\sin kt$, a^t , t^n, $\cosh kt$ and $\sinh kt$ – Laplace transform of $e^{at} F(t)$, t^n F(t), F(t)/t – problems – Laplace transform of derivatives of functions–Laplace transforms of integrals of functions–Laplace transforms of periodic functions.

Inverse Laplace transforms – problems. Convolution theorem with proof – Simple initial value problems – Solution of first and second order differential equations with constant coefficients byLaplace transforms method and solutions of integral equations.

Books for References

1. Daniel A Murray – Introductory Course to Differential equations.

2. Earl David Rainville and Philip Edward Bedient – A short course in Differential equations, Prentice Hall College Div; 6th edition.

3. G. Stephonson – An introduction to Partial Differential Equations.

4. B. S. Grewal – Higher Engineering Mathematics

5. M D Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt. Ltd., 2013.

6. S Narayanan and T K Manicavachogam Pillay, Differential Equations: S V Publishers Private Ltd., 1981.

G 503 DC2.4P: Practicals on Partial Differential Equations and Integral Transforms	
Practical Hours : 4 Hours/Week	**Credits: 2**
Total Practical Hours: 56 Hours	**Max. Marks: 50** **(S.A.– 25 + I.A.– 25)**

Mathematics practical with Free and open Source Software (FOSS) tools for computer programs (Topics to be covered)

1) Solution of Laplace Equation
2) Solution of Poisson Equation
3) Solution of Heat Equation
4) Solution of Wave Equation
5) Finding the Laplace transforms of some standard functions.
6) Finding the inverse Laplace transform of simple functions.
7) Solution of ODE using Laplace transforms
8) Verification of Convolution Theorem.

Open Elective Course

(For students of Science stream who have not chosen Mathematics as one of Core subjects)

G 503 OE1.4: Partial Differential Equations	
Teaching Hours : 3 Hours/Week	Credits: 3
Total Teaching Hours: 42 Hours	Max. Marks: 100 (S.A.– 60 + I.A. – 40)

Course Learning Outcomes: This course will enable the students to

- Understand the concept of Partial differential equation.
- Classifies the Partial differential equations with respect to their order and linearity.
- Understand and be able to apply various methods to solve Partial Differential Equations.

UNIT–I: (14 Hours)

Basicconcepts– Formationofapartialdifferentialequationsbyeliminationofarbitraryconstants and functions – Solution of partial differential equations – Solution by Direct integration, Lagrange's linear equations of the form $Pp + Qq = R$, Standard types of first order non-linear partial differential equations.

UNIT – II: (14 Hours)

Solution of ordinary second order linear differential equations with variable coefficient by various methods such as: (i) By finding part of a complementary function, (ii) Changing the independent variable, (iii) Changing the dependent variable, (iv) By method of variation of parameters, (v) Exact equations.

Total differential equations - Necessary and sufficient condition for the equation $Pdx + Qdy + Rdz = 0$ to be exact (Problems only), Simultaneous equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$.

Books of reference:

1. Daniel A Murray – Introductory Course to Differential equations.

2. EarlDavidRainvilleandPhilipEdwardBedient–AshortcourseinDifferentialequations, Prentice Hall College Div; 6thedition.

3. Murray R Speigel – Laplace Transforms

4. E Kreyszig- Advanced Engineering Mathematics, Wiley India Pvt.Ltd.

5. B. S. Grewal – Higher Engineering Mathematics

6. E Kreyszig- Advanced Engineering Mathematics, Wiley India Pvt.Ltd.

7. G. Stephonson – An introduction to Partial Differential Equations.

8. B. S. Grewal – Higher Engineering Mathematics

9. M D Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt. Ltd., 2013.

10. S Narayanan and T K Manicavachogam Pillay, Differential Equations: S V Publishers Private Ltd., 1981.

Open Elective

(For Students of other than Science Stream)

G 503 OE1.4: Mathematical Finance	
Teaching Hours : 3 Hours/Week	Credits: 3
Total Teaching Hours: 42 Hours	Max. Marks: 100 (S.A.– 60 + I.A. – 40)

Course Learning Outcomes: This course will enable the students to

- develop problem solving skills with a particular emphasis on financial and business applications
- Find solution to the problems related percentage, true discount and profit and loss.
- Employ methods related to these concepts in a variety of financial applications.

Unit-I: (14 Hours)

Shares: Concept of share, face value, market value, dividend, brokerage, equity shares, preferential shares, bonus shares. Examples and Problems Mutual Funds: Concept of Mutual Funds, Problems on calculation of Net Income after considering entry load, Dividend, Change in Net Asset Value (NAV) and exit load. Averaging of price under the Systematic Investment Plan (S.I.P.), Examples and Problems.

Unit-II: (14 Hours)

Buying & Selling Prices Calculations, Discounts in transaction calculations, Profit ratio calculations.

Unit-III: (14 Hours)

Bill discounting, true discount, bankers discount, bankers gain, equated due date, problems. Mathematics of finance: Annuity: Ordinary Annuity, Sinking Fund, Annuity due, Present Value and Future Value of Annuity, Equated Monthly Instalments (EMI) by Interest of Reducing Balance and Flat Interest methods, Examples and Problems, perpetuity, differed annuity and differed perpetuity.

Books for References:
1. Business Mathematics by Dr. S.K. Sharma and Dr. Gurmeet Kaur (Published by Sultan Chand & Sons).
2. Quantitative Aptitude by Dr. R.S. Aggarwal; Revised Edition (Published by S. Chand & Company Ltd.).
3. A Text book of Business mathematics for B.Com and BBA Course by Hazarika Padmalochan, Chand Publication.
4. Business Mathematics by J K Thukrol published by abcibook:2020 first edition.
5. Business Mathematics and Statics by N G Das and J K Daspublisher Mc Graw Hill Education, 2017