SRI DHARMASTHALA MANJUNATHESHWARA COLLEGE (AUTONOMOUS)

UJIRE – 574 240

DAKSHINA KANNADA, KARNATAKA STATE

(Re-Accredited by NAAC at 'A' Grade with CGPA 3.61 out of 4)

Ph: 08256-236221, 236101(O), Fax: 236220

e-Mail:sdmcollege@rediffmail.com, sdmcollege@sdmcujire.in, Website: www.sdmcujire.in

DEPARTMENT OF MATHEMATICS

Syllabus of

Bachelor's Degree in Mathematics

CHOICE BASED CREDIT SYSTEM

SEMESTER SCHEME

UNDER NEW EDUCATION POLICY 2020

2021-22 ONWARDS

Approved by the BOS meeting held on 13th November 2021
Approved by the Academic Council meeting, held on 10-12-2021

Preamble

The NEP-2020 envisages a student centric educational system with an opportunity to learn multiple courses and programmes. It also provides a comparable and globally competitive educational system. It transforms the existing Higher Educational System into creative, innovative and research oriented system. In addition to the traditional and time-tested system of continuing with the 3-year educational programme, the NEP provides an opportunity to the young minds to move up the ladder of knowledge stream by entering into the Honors and Research qualifications. The under-graduate four-year programme create a better avenue for higher-degree study at Master's / Ph.D. level and also demonstrate to prospective employers a higher capacity for independent learning and research, along with enhanced problem-solving, critical thinking, independent learning and communication.

The present syllabus in Mathematics under NEP-2020 is drafted keeping in view of the wide applications of Mathematics in science, engineering, social science, business and a most of other areas too. The study of the syllabi will enable the students to equipped with the state of the art of the subject and will empower them to get employed in technical and engineering fields as well as in business, education and healthcare sectors.

The current syllabus is at par with Mangalore University syllabus which offers ample choice of elective papers along with compulsory papers. A student can select elective papers as per her/his needs and interests. To strengthen the conceptual understanding of the topic and to widen the horizon of knowledge a Learn *Free and Open Source Software (FOSS)* tools for computer programming such as SCILAB and MAXIMA are also incorporated. This syllabus is meant to be introduced from the academic year 2021-22.

PROGRAMME OBJECTIVES

- To give greater exposure to the syllabus through open electives
- To improve the perspective of students on mathematics as per modern requirement
- To develop a spirit of inquiry and scientific temper in the student
- To initiate students to enjoy mathematics, pose and solve meaningful problems, to use abstraction to perceive relationships and structure and to understand the basic structure of mathematics
- To make learning process student-friendly

- To foster experimental, problem-oriented and discovery learning of mathematics
- To orient students towards relating mathematics applications
- To improve retention of mathematical concepts in the student
- To enable the teacher to demonstrate, explain and reinforce abstract mathematical ideas by using concrete objects, models, charts, graphs, pictures, posters with the help of FOSS tools on a computer
- To provide scope for greater involvement of both the mind and the hand
- To help the student build interest and confidence in learning the subject

PROGRAMME SPECIFIC OUT COME

PSO1: After the completion of three years B.Sc, students with the intension of higher studies, are expected to expose to topics like differential calculus, integral calculus, modern algebra, complex numbers and number theory.

PSO2: They develop problem solving skills.

PSO3: Students who are joining software companies develop a very good reasoning power.

PSO4: They develop life skills and also the confidence of facing real life problems.

PSO5: Course Pattern and Scheme of Examinations).

PSO6: The practical's introduced in the curriculum help the students to understand the concepts in a concrete way.

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 this 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 this 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:** The completing this programme 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 this programme will enable the learner to use appropriate software to solve system of algebraic equation and differential equations.
PO 7	**Self – directed learning**: The student completing this 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 this 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**: This programme provides self-directed learning and lifelong learning skills. This 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.)	--	--

Contents of Courses for B.Sc. with Mathematics as Major Subject &

B.Sc. (Hons) Mathematics

(Model IIA suggested by the Karnataka State Higher Education Council)

Semester	Course No.	Theory/ Practical	Credits	Paper Title	Marks	
					S.A.	I.A.
I	MATDSCT101	Theory	4	Number Theory-I, Algebra-I and Calculus-I	60	40
	MATDSCP102	Practical	2	Theory based Practicals on Number Theory-I, Algebra-I and Calculus-I	25	25
	MATOET103	Theory	3	(A) Mathematics I (B) Business Mathematics –I (C) Mathematics for Business and Economics-I	60	40
II	MATDSCT201	Theory	4	Number Theory-II, Algebra - II and Calculus - II	60	40
	MATDSCP202	Practical	2	Theory based Practicals on Number Theory-II, Algebra - II and Calculus - II	25	25

	MATOET203	Theory	3	(A) Mathematics II (B) Business Mathematics -II (C) Quantitative Tecniques-II	60	40
Exit Option with Certificate						
III	MATDSCT301	Theory	4	Ordinary Differential Equations and Algebra - III	60	40
	MATDSCP302	Practical	2	Theory based Practical's on Ordinary Differential Equations and Algebra - III	25	25
	MATOET303	Theory	3	(A) Ordinary Differential Equations (B) Mathematical Logic	60	40
IV	MATDSCT401	Theory	4	Partial Differential Equations and Integral Transforms	60	40
	MATDSCP402	Practical	2	Theory based Practical's on Partial Differential Equations and Integral Transforms	25	25
	MATOET403	Theory	3	(A) Partial Differential Equations (B) Mathematical Finance	60	40

Exit Option with Diploma						
V	MATDSCT501	Theory	3	Real and Complex Analysis	60	40
	MATDSCP502	Practical	2	Theory based Practicals on Real and Complex Analysis	25	25
	MATDSCT503	Theory	3	Modern Algebra - I	60	40
	MATDSCP504	Practical	2	Theory based Practicals Modern Algebra - I	25	25
	MATDSET505	Theory	3	(A) Vector Calculus (B) Elementary Graph Theory (C) Discrete Mathematics	60	40
VI	MATDSCT601	Theory	3	Linear Algebra -I	60	40
	MATDSCP602	Practical	2	Theory based Practicals on Linear Algebra	25	25
	MATDSCT603	Theory	3	Numerical Analysis	60	40
	MATDSCP604	Practical	2	Theory based Practicals on Numerical Analysis	25	25
	MATDSET605	Theory	3	(A) Analytical Geometry in 3D (B) Linear Programming (C) Special Functions (D) Fourier Series and Fourier Transforms	60	40
Exit Option with Bachelor of Science(B.Sc.) Degree						
VII	MATDSCT701	Theory	3	Linear Algebra -II	60	40
	MATDSCP702	Practical	2	Theory based Practicals on Linear Algebra -II	25	25
	MATDSCT703	Theory	3	Advanced Ordinary Differential Equations	60	40
	MATDSCP704	Practical	2	Theory based Practicals on Advanced Ordinary Differential Equations	25	25

	MATDSCT705	Theory	4	Advanced Real Analysis	60	40
	MATDSET 706	Theory	3	(A) Graph Theory (B) Advanced Number Theory (C) Mathematical Statistics (D) Advanced Numerical Analysis	60	40
	MATDSET 707	Theory	3	Research Methodology in Mathematics	60	40
VIII	MATDSCT801	Theory	4	Advanced Complex Analysis	60	40
	MATDSCT802	Theory	4	Abstract Algebra	60	40
	MATDSCT803	Theory	3	General Topology	60	40
	MATDSET 804	Theory	3	(A) Operations Research (B) Lattice theory (C) Mathematical Modelling (D) Discrete Mathematics	60	40
	MATDSET 805	Research Project	6 (3+3)	Research Project* OR Any Two of the following electives (A) Theory of Modules (B) Theory of Partitions (C) Cryptography (D) Finite Element Methods	120 OR 60 60	80 OR 40 40
Award of Bachelor of Science Honours (B.Sc. Hons) Degree in Mathematics						

Abbreviation for MATDSCTx.y/MATDSCPx.y/MATDSETx.y/MATOETx.y

MAT-Mathematics;

DSC- Discipline Core;DSE- Discipline Elective;OE—Discipline Elective

T- Theory, P- Practical; X,Y-Xth semester, Course-y

MATOET x,y (A)- For students of Science stream who have not chosen mathematics has one of the core subject

MATOET x.y(B)- For students other than Science stream.

CURRICULUM STRUCTURE FOR UNDERGRADUATE DEGREE PROGRAM

Name of the Degree Program : B.A. / B.Sc. (Honors)

Discipline/Subject : Mathematics

Starting Year of Implementation: 2021-22

PROGRAM ARTICULATION MATRIX

Semester	Course No.	Programme Outcomes that the Course Addresses	Pre-Requisite Course(s)	Pedagogy *	Assessment**
I	MATDSCT101	PO 1, PO 2, PO 3	----	MOOC PROBLEM SOLVING SEMINAR PROJECT BASED LEARNING ASSIGNMENTS	CLASS TESTS SEMINAR QUIZ ASSIGNMENT
II	MATDSCT201	PO 1, PO 2, PO 3, PO 8	MATDSCT 1.1		
III	MATDSCT301	PO 1, PO 4, PO7, PO 8	-----		
IV	MATDSCT401	PO 1, PO 4, PO7, PO 8	MATDSCT 3.1		
V	MATDSCT501	PO 1, PO 2, PO 3, PO 5	----		
V	MATDSCT502	PO 3, PO 4, PO 7, PO10	MATDSCT 2.1		
VI	MATDSCT601	PO 6, PO 7, PO 10.	MATDSCT 5.2		

VI	MATDSCT602	PO 5, PO 8, PO 9, PO 10.	MATDSCT 1.1& MATDSCT 2.1	GROUP DISCUSSION	TERM END EXAM
VII	MATDSCT701	PO 3, PO 4, PO5, PO 7, PO 9.	MATDSCT 1.1& MATDSCT 2.1		
VII	MATDSCT702	PO 2, PO 4, PO 5, PO 10	MATDSCT 3.1		
VII	MATDSCT703	PO 2, PO 4, PO 5, PO 10	MATDSCT 3.1		
VIII	MATDSCT801	PO 2, PO 4, PO 5, PO 10	MATDSCT 5.1		VIVA-VOCE
VIII	MATDSCT802	PO 2, PO 4, PO 5, PO 10	MATDSCT 4.1		
VIII	MATDSCT803	PO 2, PO 4, PO 5, PO 10	MATDSCT 7.3		

** Pedagogy for student engagement is predominantly Lecture. However, other pedagogies enhancing better student engagement to be recommended for each course. This list includes active learning/ course projects / Problem based or Project based Learning / Case Studies / Self Study like Seminar, Term Paper or MOOC.

Every Course needs to include assessment for higher order thinking skills (Applying/ Evaluating/ Creating). However, this column may contain alternate assessment methods that help formative assessment (i.e. assessment for Learning).

B.Sc. with Mathematics as a Minor in the 3rd Year

Semester	Course No.	Theory/ Practical	Credits	Paper Title	Marks	
					S.A.	I.A.
V	MATDSCMT501	Theory	3	Complex Analysis	60	40
	MATDSCMP502	Practical	2	Theory based Practicals on Complex Analysis	25	25
VI	MATDSCMT601	Theory	3	Numerical Analysis	60	40
	MATDSCMP602	Practical	2	Theory based Practicals on Numerical Analysis	25	25

Abbreviation for MATDSCMT501 / MATDSCMP501

MAT – Mathematics; **DSC** – Discipline Core; **M** – Minor; **T** – Theory /**P** – Practical; **5** – Fifth Semester; **01** – Course 1

Credit Distribution for B.A./B.Sc.(Honors) with Mathematics as Major in the 3rd Year

(Model IIA suggested by the Karnataka State Higher Education Council)

Subject	Semester	Major/ Minor in the 3rd Year	Credits					
			Discipline Specific Core (DSC)	**Open Elective (OE)**	**Discipline Specific Elective (DSE)**	**AECC & Languages**	**Skill Enhancement Courses (SEC)**	**Total Credits**
Mathematics	I - IV	Major	4 Courses (4+2)x 4=24	4 Courses 3 x 4 = 12	---	(4+4=8) Courses 8x(3+1)=32	2 Courses 2x(1+1)= 4	72
Other Subject		Minor	24	--	--	--	--	24
								96
Mathematics	V & VI	Major	4 Courses 4x(3+2)=20	-----	2 Courses 2 x 3 = 06	---	2 Courses 2 x 2 = 4	30
Other Subject		Minor	10	--	--	--	--	10
								(96+40)**=136**

Mathematics	VII & VIII	Major	2 Courses 2x(3+2)=10 3 Courses 3 x 4 = 12 1 Course 1 x 3 = 3 Total=25	-----	2 Courses 2 x 3 = 6 Res.Meth 1 x 3 = 3 2 Courses 2 x 3 = 6 Total= 15	----	-----	40
Total No. of Courses			14	04	07	08	04	
							136+40=**176**	

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

B.Sc. (Hons.) Mathematics

SEMESTER – I

MATDSCT 101: 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)**

Learning Objectives:

- Learning Number Theory helps improving one's ability of mathematical thinking
- A study of basic structure and properties of Integers such as divisibility, congruence's
- To find the GCD of integers by Euclid's method, to solve linear equations by using Diophantine equations.
- How to solve system of equations by matrix method; Knowledge about caley-Hamilton theorem
- L' Hospitals rule for solving indeterminant forms of function, Taylor's series expansions of various functions
- The basic knowledge to sketch the curves in Cartesian and Parametric coordinates
- To develop the skills of solving problems through Practical

Course Learning Outcomes: This course will enable the students to

- Understand the elementary concepts of Number Theory.
- Learn to solve system of linear equations.
- Solve the system of homogeneous and non-homogeneous linear of *m* equations in *n* variables by using concept of rank of matrix.
- Sketch curves in Cartesian, polar and co-ordinates.

- Identify and apply intermediate value theorem, the 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, Fermat's Theorem, Wilson's Theorem, Quadratic Congruence. **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. Leibnitz theorem and its applications. **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. Vashista, Matrices, Krishna Prakashana Mandir, 2003.

[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.

MATDSCP 101: 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 problem on Number theory, Algebra and Calculus studied in **MATDSCT 101** by using FOSS software's.
- Acquire knowledge of applications of algebra and calculus through FOSS

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

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

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 of matrix and Row reduced Echelon form.
10. Computation of Inverse of a Matrix using Cayley-Hamilton theorem.
11. Solving the system 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.

Open Elective Course

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

MATOET 101: Mathematics - I	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Totatl Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 60 + I.A. – 40)**

Learning Objectives:

- Learning Number Theory helps improving one's ability of mathematical thinking
- A study of basic structure and properties of Integers such as divisibility, congruence's
- To find the GCD of integers by Euclid's method, to solve linear equations by using Diophantine equations.
- How to solve system of equations by matrix method; Knowledge about caley- Hamilton Theorem
- L' Hospitals rule for solving indeterminant forms of function, Taylor's series expansions of various functions

Course Learning Outcomes: This course will enable the students to

- Understand the elementary concepts of Number Theory.
- Learn to solve system of linear equations.
- Solve the system of homogeneous and non-homogeneous linear of *m* equations in *n* variables by using concept of rank of matrix.
- Identify and apply intermediate value theorem, the 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, Fermat's Theorem, Wilson's Theorem, Quadratic Congruence. **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: 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. Leibnitz theorem and its applications. **14 Hours**

Reference Books:

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

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

[3] A. R. Vashista, Matrices, Krishna Prakashana Mandir, 2003.

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

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

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

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

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

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

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

Open Elective

(For Students of other than Science Stream)

MATOE 101(B): Business Mathematics-I	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Totat Teaching Hours: 42 Hours	**Max. Marks: 100 (S.A.- 60 + I.A. – 40)**

Learning Objective:

- To study economic problems with the formal tools of mathematics like Matrices and its properties
- Analyze And Interpret numerical data, of economic model into matrix form students and able to Solve systems of linear equations by various methods
- To solve the problems optimization such as those of profit maximization, cost minimization, output and revenue maximization.
- The partial derivative is extensively used in economics and managerial decision making

Learning Outcomes: This course will enable the students to

- Translate the real word problems through appropriate mathematical modelling.
- Explain the concepts and use equations, formulae and mathematical expression and relationship in a variety of context.
- Finding the extreme values of functions.
- Analyze and demonstrate the mathematical skill require in mathematically intensive areas in economics and business.

Unit-I: Matrices: Definition of a matrix; types of matrices; algebra of matrices. Properties of determinants; calculations of values of determinants up to third order; Adjoint of a matrix, elementary row and column operations; solution of a system of linear equations having unique solution and involving not more than three variables. Examples on commercial mathematics. **14 Hours**

Unit-II: Straight line: Straight line in economics, Break-Even point, System of straight lines, Effect of a Tax or Subsidy. Parabola: Parabola in in economics, The non-linear model. Rectangular hyperbola: Rectangular hyperbola in economics. Circle: Circle in economics.

Inequalities and absolute values: Properties of inequalities, Linear inequality in one variable, Absolute values. Applications in economics. **14 Hours**

Unit-III: Derivatives of functions: Economic applications, Demand function, Price demand, income demand, Cross demand, Law of supply, Revenue functions, Short-run production function, Short-run cost function, Relation between marginal product and marginal cost. The maxima and minima of functions: Applications of maxima and minima of functions in economics and business. **14 Hours**

Reference Books:

[1] N. S. Gopalakrishnan, University Algebra, 3rd Ed., New Age International Publications, 2015.
[2] B. S. Vatssa, Theory of Matrices, New Age International Publishers, New Delhi, 2005.
[3] A. R. Vashista, Matrices, Krishna Prakashana Mandir, 2003.
[4] Shanti Narayan and P.K. Mittal, Text book of Matrices, 5th Ed., S Chand and Co. Pvt. Ltd., New Delhi, 2013.
[5] Shanthi Narayan and P.K. Mittal, Differential Calculus, Reprint. S Chand and Co. Pvt. Ltd., New Delhi, 2014.
[6] Debasish Sengupta, Applications of Calculus, Books and Allied (P) Ltd., 2019.
[7] George B. Thomas and Ross L. Finney, Calculus and Analytic Geometry, Addison-Wesley, 1992.
[8] Louis Leithold, Calculus with Analytic Geometry, 5th Ed., Harper and Row International, 1986.
[9] Maurice D. Weir, George B. Thomas, Jr., Joel Hass and Frank R. Giordano, Thomas' Calculus, 11th Ed., Pearson, 2008.
[10] S. Narayanan and T. K. Manicavachogam Pillay, Calculus, Vol. I & II, S. Viswanathan Pvt. Ltd., 1996.
[11] E.T. Dowling, , Mathematics for Economics, Schaum's Outline, 3rd Ed., McGraw Hill, London, 2011.
[12] R.G.D. Allen, Basic Mathematics, Macmillan, UK, 1968.
[13] N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill, New Delhi, 2007.
[14] R. S. Soni, Business Mathematics with Applications in Business and Economics, Pitambar Publishing, India 1996.

MATOE 101(C): Mathematics for Business and Economics-I	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Totat Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 60 + I.A. – 40)**

Course Objective:

Students will be able to know about

- To study economic problems with the formal tools of mathematics like Matrices and its properties
- Mathematical models that can be used to know about financial structures
- Take appropriate decisions about Capital investment and understand the concept of bonds and Annuities.
- Mathematical formulation of some real life problems and their solutions using graphical methods.
- To construct mathematical model by using LPP in solving economic interpretation problems

Learning Outcomes:

Upon successful completion of this course, students will able to

- Analyze And Interpret numerical data, of economic model into matrix form students and able to Solve systems of linear equations by Gaussian Jordan Method , Cramer's rule matrix inversion method.
- Find compound interest, effective rate of interest by using mathematical model
- Find annuity and various types of annuity problems
- Sketching a graphical representation of 2 dimensional LPP model given in general, standard or canonical forms
- Formulation of given simplified description of a suitable real world problem as a linear programming model and to solve optimization problems by using simplex algorithm.

14 hrs

Unit I: Mathematics finance: Compound Interest, rates of growth/decay, nominal and effective rates of interest, Applications of present values**:** Capital investment decisions, bonds, bond price. Annuities: Types of Annuities, Amount of Annuities, Sinking funds, Present value of an Annuity-Problem.

14 hrs

Unit II: Applications of Linear Programming model in Economics: General form of a LPP, Formulation of the problem, Graphical method of solution, Simplex method for maximization of LPP. Minimization of LPP: Standard forms, Economic Interpretation of the dual form –related problems. **14 hrs**

Unit III: (Recapitulations) Matrices, Algebra of matrices, Transpose of a matrix, determinants and non singularity, Inverse of a matrix.Rank of a matrix, matrix representation of a system of linear equations, , solution of equations by
Crammers rule, Matrix Inversion Method, Gauss Jordan Method.
Economic applications; Two- Commodity Market equilibrium, National Income Model.

Reference Books:

1. Mathematics for Economics and Business by Prof. R S Bharadwaj.
2. Linear Programming and it's Applications by James K Strayer.
3. https://www.youtube.com/watch?v=RU-osjAs6hE - How To Calculate The Present Value of an Annuity
4. https://www.youtube.com/watch?v=RO5477EKlXE - Simplex Algorithm Explanation (How to Solve

SEMESTER – II

MATDSCT 201: 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)**

Learning Objectives:

- Learning Number Theory helps improving one's ability of mathematical thinking
- Student will able to understand Fermat's theorem, Wilson's theorem, Euler Phi-function, Finite continued product.
- Group theory will enable the students how to find the solutions to polynomial equations and has its full significance, as a mathematical formulation of symmetry, been understood.
- Students will able to know properties of groups such as subgroups, cyclicness.
- Compute partial derivatives of functions of several variables, totoal derivatives, mixed derivatives, Jacobinans, Maxima & Minima of functions
- Use iterated integrals to evaluate integrals over planar regions, and to calculate volume.Build on elementary integration techniques to evaluate multiple integrals efficiently.
- Set up and evaluate double integrals in polar coordinates.Set up and evaluate integrals to compute surface area.
- Set up and evaluate triple integrals in Cartesian coordinates.Set up and evaluate triple integrals in cylindrical and spherical coordinates

Course Learning Outcomes: This course will enable the students to

- Understand the Euler's Phi-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.
- Explain the significance of the notions of Cosets, normal subgroups and factor groups.
- 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 concept of line integrals, multiple integrals and their applications.

Unit-I: Number Theory: Fermat's Theorem, Wilson's Theorem, and Quadratic Congruences.

Euler's Phi 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**

Unit-IV: Integral Calculus: Recapitulation of definite integrals and its properties. *Line integral*: Definition of line integral and basic properties, examples on evaluation of line integrals. *Double integral*: Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Computation of plane surface areas, volume underneath a surface of revolution using double integral. *Triple integral*: Definition of triple integrals and evaluation-change of variables, volume as triple integral. Differentiation under the integral sign by Leibnitz 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] I. N. Herstein, Topics in Algebra, 2nd Ed., Wiley Publishers, 1975.

[5] A. R. Vasishtha and A. K. Vasishtha, Modern Algebra, Krishna Prakashan Mandir, Meerut, U.P., 2008.

[6] Bernald and Child, Higher Algebra, Arihant Publication India Limited, India, 2016.

[7] Vijay K Khanna and S K Bhambri, A Course in Abstract Algebra, 5th Ed., Vikas Publishing House, India, 2016.

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

[9] Shanti Narayan and P. K. Mittal, Integral Calculus. S. Chand Ltd., India, 2005.

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

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

[12] S. Arora and S .C. Malik, Mathematical analysis, Wiley, India, 1992.

MATDSCP 201: Practicals on Number Theory-II, Algebra-II and Calculus-II	
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 Number Theory, Algebra and Calculus by using FOSS softwares.
- Acquire knowledge of applications of algebra and calculus through FOSS

Practical/Lab Work to be performed in Computer Lab

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

1. Program to compute Euler's □-function values for positive integers.
2. Program to write a rational numbers as finite continued fractions.
3. Program to find the rational numbers corresponding to the given finite continued fractions.
4. Program for verification of binary operations.
5. Program to construct Cayley's table and test abelian for given finite set.
6. Program to find all possible cosets of the given finite group.
7. Program to find generators and corresponding possible subgroups of a cyclic group.
8. Programs to verification of Lagrange's theorem with suitable examples.
9. Program to verify the Euler's □-function for a given finite group.
10. Program to verify the Euler's theorem and its extension.
11. Programs to construct series using Maclaurin's expansion for functions of two variables.
12. Program to evaluate the line integrals with constant and variable limits.
13. Program to evaluate the Double integrals with constant and variable limits.
14. Program to evaluate the Triple integrals with constant and variable limits.

Open Elective

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

MATOET 201(A): Mathematics – II	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 60 + I.A. – 40)**

Learning Objectives:

- Learning Number Theory helps improving one's ability of mathematical thinking
- Student will able to understand Fermat's theorem, Wilson's theorem, Euler Phi- function, Finite continued product.
- Group theory will enable the students how to find the solutions to polynomial equations and has its full significance, as a mathematical formulation of symmetry, been understood.
- Students will able to know properties of groups such as subgroups, cyclicness.
- Compute partial derivatives of functions of several variables, totoal derivatives, mixed derivatives, Jacobinans, Maxima & Minima of functions
- Use iterated integrals to evaluate integrals over planar regions, and to calculate volume.Build on elementary integration techniques to evaluate multiple integrals efficiently.
- Set up and evaluate double integrals in polar coordinates.Set up and evaluate integrals to compute surface area.
- Set up and evaluate triple integrals in Cartesian coordinates.Set up and evaluate triple integrals in cylindrical and spherical coordinates.

Course Learning Outcomes: This course will enable the students to

- Identify cyclic and non-cyclic groups
- Recognize the mathematical objects called Groups.
- Link the fundamental concepts of groups and symmetries of geometrical objects.

- Explain the significance of the notions of Cosets, normal subgroups and factor groups.
- Find the extreme values of functions of two variables.
- Understand the concept of line integrals, multiple integrals and their applications.

Unit-I: 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-II: 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**

Unit-III: Integral Calculus: Recapitulation of definite integrals and its properties. *Line integral*: Definition of line integral and basic properties, examples on evaluation of line integrals. *Double integral*: Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Computation of plane surface areas, volume underneath a surface of revolution using double integral. *Triple integral*: Definition of triple integrals and evaluation-change of variables, volume as triple integral. Differentiation under the integral sign by Leibnitz rule.

14 Hours

Reference Books:

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

[2] I. N. Herstein, Topics in Algebra, 2nd Ed., Wiley Publishers, 1975.

[3] A. R. Vasishtha and A. K. Vasishtha, Modern Algebra, Krishna Prakashan Mandir, Meerut, U.P., 2008.

[4] Bernald and Child, Higher Algebra, Arihant Publication India Limited, India, 2016.

[5] Vijay K Khanna and S K Bhambri, A Course in Abstract Algebra, 5th Ed., Vikas Publishing House, India, 2016.

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

[7] Shanti Narayan and P. K. Mittal, Integral Calculus. S. Chand Ltd., India, 2005.

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

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

[10] S. Arora and S .C. Malik, Mathematical analysis, Wiley, India, 1992.

Open Elective

(For Students of other than science stream)

MATOET 201(B): Business Mathematics-II	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 60 + I.A. – 40)**

Course Learning Objectives :

- To provide college students with reinforcement of mathematical computations.
- Challenge the student to understand how to process and interpret information to arrive at logical conclusions to common business math applications.
- Develop proficiency in the application to solve business math problems.
- Understand the important role math plays in all facets of the business world
- Student will able to understand Interst Rate calculations, Annuity,Shares and profit, cost and expenditures
- To calculate age problems,Percentage, ratio , parternships, calander problems etc.
- This paper will give the confidence in facing various competitive examinations.

Course Learning Outcomes: This course will enable the students to

- Integrate concept in international business concept with functioning of global trade.
- Evaluate the legal, social and economic environment of business.
- To learn deferent techniques of simplification
- To enable to student answer competitive examinations
- Will be able to apply knowledge of business concepts and functions in an integrated manner.

Unit-I: Commercial Arithmetic: Interest**:** Concept of Present value and Future value, Simple interest, Compound interest, Nominal and Effective rate of interest, Examples and Problems Annuity: Ordinary Annuity, Sinking Fund, Annuity due, Present Value and Future Value of Annuity, Equated Monthly Installments (EMI) by Interest of Reducing Balance and Flat Interest methods, Examples and Problems. **14 Hours**

Unit-II: Techniques of Solving Problems involving number system and decimal Fractions, to calculate share and profit, and Simplifications of equations involving cost and expenditures, Average, Problems on numbers, Problems on ages. **14 Hours**

Unit-III: Percentage, Ratio and proportion, partnerships, Concepts of Time and distance, Related problems, technique for problems related to Time and Work, Situations in Boats and Streams, velocity related problems, Simple problems on trains and other moving objects, different types of problems in Calendar, number of days, dates etc., Positions of hour hand and minute hand in Clocks, related problems. **14 Hours**

Reference Books:

[1] R. S. Agarwal, Quantitative Aptitude, S. Chand & company Pvt. Ltd., 2014.
[2] S. A. Bari, Practical Business Mathematics, New Literature Publishing Company, Bombay, 1971.
[3] K. Selvakumar, Mathematics for Commerce, Notion Press, Chennai, 2014.
[4] Dinesh Khattar and S. R. Arora, Business Mathematics with Applications, S. Chand Publishing, New Delhi, 2001.
[5] N. G. Das and J. K. Das, Business Mathematics and Statistics, McGraw Hill, New Delhi, 2011.
[6] M. K. Bhowal, Fundamentals of Business Mathematics, Asian Books Pvt. Ltd., New Delhi, 2009
[7] Martin Anthony and Norman Biggs, Mathematics for Economics and Finance: Methods and Modelling, Cambridge University Press, Cambridge, 1996.
[8] Ahmad Nazri and Wahidudin, Financial Mathematics and its Applications, Ventus Publishing, APS, Denmark, 2011.
[9] S. C. Gupta and V. K Kapoor, Fundamentals of Mathematical Statistics, 12th Ed., Sultan Chand and Sons, New Delhi, 2020.
[10] S. P. Gupta, Statistical Methods, Sultan Chand and Sons, New Delhi, 2000.
[11] Parimal Mukhopadhya, Applied Statistics, New Central Book Agency Pvt. Ltd., Calcutta, 1999.
[12] A. M. Gun, M. K. Gupta, and B. Dasgupta, Fundamentals of Statistics, World Press Calcutta, 2008.
[13] S. C. Gupta and V. K Kapoor, Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi, 2007.

MATOET 201(C): Quantative Techniques	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 60 + I.A. – 40)**

Learning Objective:

- This course enables students to develop their ability to reason by introducing them to elements of
  Formal reasoning.
- The course will help to prepare students for success in future courses, gain skills for the
  Workplace, and participate as productive citizens in our society
- Defining the type and quantity of data need to be collected. Organizing and summarizing the data. Analyzing the data and drawing conclusions from it.

Course Outcome: The Students will be able

- to distinguish the basic elements of arguments and recognize different types of arguments.
- Symbolize natural language statements in the language of propositional and predicate logic.
  Identify logical relations among statements; and analyze logically complex statements into their
  Truth- functional or quantificational components.
- To Use statistics to make decisions in financial planning and budgeting, while are guided by statistics in financial policy decisions. Banks use statistics to lower risk in lending operations, analyze activity in the financial market, and predict the impact of economic crises

Unit I : (14 hrs)

Reasoning Ability: Alphabet Test, Analogy, Arithmetical Reasoning, Blood Relations, Calendar and

Clock test, Classification, Coding and Decoding, Cubes and Dices Test.

Unit II : (14hrs)

Logical Reasoning: Alpha Numeric Series, Reasoning analogies, Decision Making, Deductive

Reasoning / statement Analysis, Pattern of sequences and series, Shape construction.

Unit III :

Probability and distribution, Tabulations, data interpretation, data sufficiency, and quantitative analysis,Bar Graphs, Pie charts, Line Graphs. True Discount & Banker's Discount. (14hrs)

Books For Refernces:

1. Quantative Aptitude by R.S. Aggrwal
2. Quantative Aptitude by Vikas Experts, S. Chand Publishers
3. The Pearson Guide to Quatative Aptitude by Dinesh Kattar
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3045202/
https://www.careerbless.com/aptitude/qa/home.php
https://www .indiabix.com/

SCHEME OF QUESTION PAPERS

Question paper Pattern for I, II Semester end examinations

CODE NO: Reg. No:

SRI DHARMASTHALA MANJUNATHESHWARA COLLEGE (AUTONOMOUS), UJIRE

CORE SUBJECT-SEMESTER END EXAMINATIONS - CBCS

B.Sc.-MATHEMATICS

PAPER-SEMESTER I/II

TOPIC-

TIME: 2HRS **Max Marks 60**

Note: Answer all Parts

PART- A

I). Answer any SIX of the following 2X6=12

1)

2)

3)

4)

5)

6)

7)

8)

PART B

II) Answer any TWO Question from each unit and each unit carries 12 marks

UNIT-I

a) (6x2=12)

b)

c)

d)

UNIT-II

2) a) (6x2=12)

b)

c)

d)

UNIT-III

3) a) (6x2=12)

b)

c)

d)

UNIT-IV

4) a) (6x2=12)

b)

c)

d)

Question paper Pattern for I, II Semester end examinations

CODE NO:Reg No:

SRI DHARMASTHALA MANJUNATHESHWARA COLLEGE (AUTONOMOUS), UJIRE

OPEN ELECTIVE - SEMESTER END EXAMINATIONS - CBCS

B.Sc.-MATHEMATICS

PAPER-SEMESTER I/II

TOPIC-

TIME: 2HRS Max Marks: 60

Note: Answer all Parts

PART- A

I. **Answer any FIVE of the following**

(3X5=15)

1)

2)

3)

4)

5)

6)

PART B

II) Answer any one Three Question from each and each unit carries 15 marks

UNIT-1

1) a)

(5x3=15)

b)

c)

d)

UNIT-II

2) a)

(5x3=15)

b)

c)

d)

UNIT-III

3) a) (5x3=15)

b)

c)

d)

xxxxxxxxxx

SRI DHARMASTHALA MANJUNATHESHWARA COLLEGE (AUTONOMOUS), UJIRE

CORE/OPEN ELECTIVES - INTERNAL EXAMINATIONS

MATHEMATICS

CODE NUMBER **PAPER -** **SEMESTER- I/II**

TOPIC-

Time: 1 hr **Max marks: 30**

I Answer any FIVE of the following **2X5=10**

1.

2.

3.

4.

5.

6.

II Answer any two questions

1 a) 4 Marks

b) 6 Marks

2)a) 4Marks

b) 6Marks

3 a) 4Marks

b) 6 Marks

Self Learning Topics:

Sl. No.	Semester	Unit	Topic
1	I	I	Division Algorithm, The Greatest Common Divisor (g.c.d)
2	I	II	Recapitulation of Symmetric and Skew Symmetric matrices
3	I	III	Polar coordinates, angle between the radius vector and tangent. Angle of intersection of two curves (polar forms),
4	I (OE)	I	Definition of a matrix; types of matrices; algebra of matrices
5	II	II	Binary Operations, Associativity, Commutativity, Examples for Binary Operations
6	II	IV	Recapitulation of definite integrals and its properties.
7	II (OE)	II	Techniques of Solving Problems involving number system and decimal Fractions