DAVANGERE UNIVERSITY

Shivagangothri-577 007, Davangere

NATIONAL EDUCATION POLICY 2020 INITIATIVES

SYLLABUS
FOR
BACHELOR OF SCIENCE (B. SC.)
SEMESTER SCHEME - CBCS
UNDER
NEW EDUCATION POLICY-2020

MATHEMATICS
(MAJOR)

With effect from The Academic Year
2021-22 & Onwards

Registrar
Davangere University

BoS-Chairman,
Department of Mathematics
Davangere University

PREAMBLE

The subject wise expert committee to draft model curriculum contents in Mathematics constituted by the Department of Higher Education, Government of Karnataka, Bangalore vide GO No. ED 260 UNE 2019 (PART-1) DATED 13.08.2021 is pleased to submit its partial report on the syllabus for the First Year (First & Second Semesters) B.A./B.Sc.(Basic/Honors) Mathematics and detailed Course Structure for B.A./B.Sc.(Honors) Mathematics and M.Sc. (One Year)Mathematics.

The committee discussed various models suggested by the Karnataka State Higher Education Council in its joint meetings with the Chairpersons of Board of Studies of all state universities in Karnataka and resolved to adopt Model IIA (*Model Program Structure for the Bachelor of Arts (Basic/Hons.)/ Bachelor of Science (Basic/Hons.*) for the subjects with practical's with Mathematics as Major/Minor.

To achieve the core objectives of the National Education Policy 2020 it is unanimously resolved to introduce computer based practical's for the Discipline Core (DSC) courses by using Free and Open Source Software's (FOSS) tools for implementation of theory based on DSC courses as it is also suggested by the LOCF committee that the papers may be taught using various Computer Algebra System (CAS) software's such as Mathematica, MATLAB, Maxima and R to strengthen the conceptual understanding and widen up the horizon of students' self-experience. In view of these observations the subject expert committee suggested the software's Phython /R / Msxima/ Scilab/ Maple/MatLab/Mathematica for hands on experience of implementation of mathematical concepts in computer based lab.

The expert committee suggests the implementation this curriculum structure in all the Departments of Mathematics in Universities/Colleges in Karnataka.

The subject expert committee designed the Course Learning Outcome (CO) to help the learners to understand the main objectives of studying the courses by

keeping in mind of the Programme outcomes (PO) of the graduate degree with honors in Mathematics or a graduate degree with Mathematics as a major subject.

As the Mathematics subject is a vast with several branches of specializations, it is difficult for every student to learn each branch of Mathematics, even thougheach paper has its own importance. Hence the subject expert committee suggests number of elective papers (for both Discipline electives and Open Electives) along with Discipline Core Courses. The BoS in Mathematics of universities may include additional electives based on the expertise of their staff and needs of the students'.A student can select elective paper as per her/his needs and interest.

The subject expert committee in Mathematics suggests that the concerned Department/Autonomous Colleges/Universities to encourage their faculty members to include necessary topics in addition to courses suggested by the expert committee.

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Definitions of Key Words:

a. **Academic Year**: Two consecutive (one odd + one even) semesters constitute one academic year.

b. **Choice Based Credit System (CBCS):** The CBCS provides choice for students to select courses from the prescribed courses (core, open elective, discipline elective, ability and skill enhancement language, soft skill etc. courses).

c. **Course**: Usually referred to, as 'papers' is a component of a programme. All courses need not carry the same weight. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/ tutorials/laboratory work/ field work/ project work/ vocational training/viva/ seminars/term papers / assignments / presentations/ self-study etc. or a combination of some of these.

d. **Credit Based Semester System (CBSS)**: Under the CBSS, the requirement for awarding a degree /diploma /certificate is prescribed in terms of number of credits to be earned.

e. **Credit**: A unit by which the course work is measured. It determines the number of hours of instructions required per week in a semester. One credit is equivalent to one hour of lecture or tutorial or two hours of practical work/field work per week in a semester. It will be generally equivalent to 13-15 hours of instructions

f. **Grade Point**: It is a numerical weight allotted to each letter grade on a 10-point scale.

g. **Credit Point**: It is the product of grade point and number of credits for a course.

h. **Letter Grade:** It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, P and F.

i. **Programme**: A programme leading to award of a Degree, diploma or certificate.

j. **Semester**: Each semester will consist of over 16 weeks of academic work equivalent to 90 actual teaching days. The odd semester may be generally scheduled from June to November and even semester from January to May.

k. **Semester Grade Point Average (SGPA)**: It is a measure of performance of work done in a semester. It is the ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.

l. **Cumulative Grade Point Average (CGPA)**: It is a measure of overall cumulative performance of a student over all the semesters of a programme. The CGPA is the ratio of total credit points secured by a student in various courses in all the semesters and sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

m. **Transcript or Grade Card or Certificate:** Based on the grades earned, a Grade Card shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, number of credits, grade secured etc.).

The candidates shall complete the courses equivalent to minimum credit requirements

Exit with	Minm Credits Requirement*	NSQF Level
Certificate at the Successful Completion of First Year (Two Semesters) of Four Years Multidisciplinary UG Degree Programme	48	5
A Diploma at the Successful Completion of the Second Year (Four Semesters) of Four Years Multidisciplinary UG Degree Programme	96	6
Basic Bachelor Degree at the Successful Completion of the Third Year (Six Semesters) of Four Years Multidisciplinary Undergraduate Degree Programme	140	7
Bachelor Degree with Honours in a **Discipline** at the Successful Completion of the Four Years (Eight Semesters) Multidisciplinary Undergraduate Degree Programme	180	8

*Details of courses to be successfully completed equal to minimum credits requirement are described later

The students shall be required to earn at least fifty per cent of the credits from the Higher Education Institution (HEI) awarding the degree or diploma or certificate: Provided further that, the student shall be required to earn the required number of credits in the core subject area necessary for the award of the degree or Diploma or Certificate, as specified by the degree awarding HEI, in which the student is enrolled.
A candidate who successfully completes a threeyear Bachelor's degree, with a minimum CGPA of 7.5 and wishes to pursue the fourth year of the undergraduate programme by research, shall be allowed to continue the programme with Research to obtain the Bachelor's degree with honours by research, while other candidates may continue their studies in the fourth year of the undergraduate programme with or without a research project along with other courses as prescribed for the programme to complete their Bachelor's degree with honours.

Candidates who successfully complete their four years Bachelor's degree with honours, either by research or course work with research component and a suitable grade are eligible to enter the 'Doctoral (Ph.D.) Programme' in a relevant discipline or to enter the 'Two Semester Master's Degree programme". Candidates who wish to complete the undergraduate and the postgraduate programmes faster, may do so by completing the different courses equal to the required number of credits and fulfilling all other requirements in N-1 semesters (where N is the number of semesters of an undergraduate/ postgraduate programme). This facility is available for the programmes with a minimum duration of three years or six semesters. For example, a candidate may obtain his/her Six Semesters Bachelor's degree, after successfully completing five semesters of the programme, provided he/she has completed courses equal to the required/ prescribed number of credits and fulfills all other requirements for awarding the degree. Likewise, a candidate may obtain his/her Eight Semesters Bachelor's degree with honours, after successfully completing seven semesters of the programme, provided he/she has completed courses equal to the required number of credits and fulfills all other requirements for awarding the Bachelor's degree with honours.

Similarly, candidates may complete both the undergraduate and the postgraduate programmes in slow track. They may pursue the three years or six semester programmes in 4 to 5 years (8 to 10 semesters) and four years or eight semester programmes in 5 to 6 years (10 to 12 semesters). As a result, the higher education institutions have to admit candidates not only for programmes, but also for subjects or courses. But the new admissions are generally made in the beginning of an academic year or the beginning of odd semesters.

MISSION AND VISION OF THE NEW SYLLABUS IN MATHEMATICS

Mission

Improve retention of mathematical concepts in the student.

- To develop a spirit of inquiry in the student.
- To improve the perspective of students on mathematics as per modern requirement.
- 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 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 make the learning process student-friendly by having a shift in focus in mathematical teaching, especially in the mathematical learning environment.
- Exploit techno-savvy nature in the student to overcome math-phobia.
- Propagate FOSS (Free and open source software) tools amongst students and teachers as per vision document of National Mission for Education.
- To set up a mathematics laboratory in every college in order to help students in the exploration of mathematical concepts through activities and experimentation.
- To orient students towards relating Mathematics to applications.

Vision

- To remedy Math phobia through authentic learning based on hands-on experience with computers.
- To foster experimental, problem-oriented and discovery learning of mathematics.
- To show that ICT can be a panacea for quality and efficient education when properly integrated and accepted.
- To prove that the activity-centered mathematics laboratory places the student in a problem solving situation and then through self-exploration and discovery habituates the student into providing a solution to the problem based on his or her experience, needs, and interests.
- To provide greater scope for individual participation in the process of learning and becoming autonomous learners.
- To provide scope for greater involvement of both the mind and the hand which facilitates cognition?
- To ultimately see that the learning of mathematics becomes more alive, vibrant, relevant and meaningful; a program that paves the way to seek and understand the world around them. A possible by-product of such an exercise is that mathphobia can be gradually reduced amongst students.
- To help the student build interest and confidence in learning the subject.

Name of the Degree Program : **B.Sc. (Honours)**

Discipline Course : **Mathematics**
Starting Year of Implementation : **2021-22**

Programme Outcomes (PO): By the end of the program the students will be able to:

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 softwares 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.)	--	--

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Contents of Courses for/B.Sc. with Mathematics as Major Subject & B.Sc. (Hons) Mathematics
Model IIA

Semester	Course No.	Theory/ Practical	Credits	Paper Title	Marks	
					S.A.	I.A.
I	MATDSCT1.1	Theory	4	Algebra - I and Calculus - I	60	40
	MATDSCP1.1	Practical	2	Theory based Practical's on Algebra - I and Calculus - I	25	25
	MATOET1.1	Theory	3	(A) Mathematics – I (B) Business Mathematics – I	60	40
II	MATDSCT2.1	Theory	4	Algebra - II and Calculus - II	60	40
	MATDSCP2.1	Practical	2	Theory based Practical's on Algebra - II and Calculus - II	25	25
	MATOET2.1	Theory	3	(A) Mathematics – II (B) Business Mathematics-II	60	40
Exit Option with Certificate						
III	MATDSCT3.1	Theory	4	Ordinary Differential Equations and Real Analysis-I	60	40
	MATDSCP3.1	Practical	2	Theory based Practical's on Ordinary Differential Equations and Real Analysis-I	25	25
	MATOET3.1	Theory	3	(A) Ordinary Differential Equations (B) Quantitative Mathematics	60	40
IV	MATDSCT4.1	Theory	4	Partial Differential Equations and Integral Transforms	60	40
	MATDSCP4.1	Practical	2	Theory based Practical's on Partial Differential Equations and Integral Transforms	25	25
	MATOET4.1	Theory	3	(A) Partial Differential Equations (B) Mathematical Finance	60	40
Exit Option with Diploma						
V	MATDSCT5.1	Theory	3	Real Analysis and Complex Analysis	60	40
	MATDSCP5.1	Practical	2	Theory based Practical's on Real Analysis and Complex Analysis	25	25
	MATDSCT5.2	Theory	3	Ring Theory	60	40
	MATDSCP5.2	Practical	2	Theory based Practical's on Ring Theory	25	25
	MATDSET5.1	Theory	3	(A) Vector Calculus (B) Mechanics (C) Mathematical Logic	60	40
VI	MATDSCT6.1	Theory	3	Linear Algebra	60	40
	MATDSCP6.1	Practical	2	Theory based Practical's on Linear Algebra	25	25
	MATDSCT6.2	Theory	3	Numerical Analysis	60	40

	MATDSCP6.2	Practical	2	Theory based Practical's on Numerical Analysis	25	25
	MATDSET6.1	Theory	3	(A) Analytical Geometry in 3D (B) Number Theory (C) Special Functions (D) History of Bhârtîya Gaṇita	60	40
Exit Option with Bachelor of Science, B.Sc. Degree						
VII	MATDSCT7.1	Theory	3	Discrete Mathematics	60	40
	MATDSCP7.1	Practical	2	Theory based Practical's on Discrete Mathematics	25	25
	MATDSCT7.2	Theory	3	Advanced Ordinary Differential Equations	60	40
	MATDSCP7.2	Practical	2	Theory based Practical's on Advanced Ordinary Differential Equations	25	25
	MATDSCT7.3	Theory	4	Advanced Analysis	60	40
	MATDSET 7.1	Theory	3	(A) Graph Theory (B) Entire and Meromorphic Functions (C) General Topology (D) Bhâratîya Trikoṇmiti Śâstra	60	40
	MATDSET 7.2	Theory	3	Research Methodology in Mathematics	60	40
VIII	MATDSCT8.1	Theory	4	Advanced Complex Analysis	60	40
	MATDSCT8.2	Theory	4	Advanced Partial Differential Equations	60	40
	MATDSCT8.3	Theory	3	Fuzzy Sets and Fuzzy Systems	60	40
	MATDSET 8.1	Theory	3	(A) Operations Research (B) Lattice theory and Boolean Algebra (C) Mathematical Modelling *(D) Aṅkapâśa* (Combinatorics)	60	40
	MATDSET 8.2	Research Project	6 (3 + 3)	Research Project* OR Any Two of the following electives (A) Finite Element Methods (B) Cryptography (C) Information Theory and Coding (D) Graph Theory and Networking	120 OR 60 60	80 OR 40 40

Award of Bachelor of Science (B.Sc.,) Honors Degree in Mathematics

DAVANGERE UNIVERSITY

Bachelor of Science (B. Sc.) Semester Scheme – CBCS
(National Education Policy 2020)
Subject: MATHEMATICS
Course Structure, Scheme of Teaching and Evaluation

Semester	Theory/ Practical	Paper Code & Title of the Paper	Teaching Hours/ week	Semester End Exam.	Internal Assessment	Total Marks	Credits	Examination Duration
I	Semester-I (Theory)	BS-MAT-T1.1 ALGEBRA - I AND CALCULUS - I	04	60	40	100	4	3
	Semester-I (Practical)	BS-MAT-P1.1 Mathematics Lab-I	04	25	25	50	2	3
II	Semester-II (Theory)	BS-MAT-T1.2 ALGEBRA – II AND CALCULUS – II	04	60	40	100	4	3
	Semester-II (Practical)	BS-MAT-P1.2 Mathematics Lab-II	04	25	25	50	2	3
	Total		**16**	**170**	**130**	**300**	**12**	---

1. Scheme of Admission: As per the University rules.
2. Eligibility: As prescribed by the University.
3. Scheme of Examination: Continuous assessment.

Abbreviation for BS-MAT-T1.1 / BS-MAT-P1.1

MAT – Mathematics: **DSC** – Discipline Core; **BS** – Bachelor of Science; **T** – Theory /**P** – Practical; **DSC** – Discipline Elective

CURRICULUM STRUCTURE FOR UNDERGRADUATE DEGREE PROGRAM

Name of the Degree Program : 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	MATDSCT1.1	PO 1, PO 2, PO 3	----	MOOC	CLASS TESTS
II	MATDSCT2.1	PO 1, PO 2, PO 3, PO 8	MATDSCT1.1	PROBLEM SOLVING	SEMINAR
III	MATDSCT3.1	PO 1, PO 4, PO7, PO 8	-----	SEMINAR	QUIZ
IV	MATDSCT4.1	PO 1, PO 4, PO7, PO 8	MATDSCT3.1	PROJECT BASED LEARNING	ASSIGNMENT
V	MATDSCT5.1	PO 1, PO 2, PO 3, PO 5	----	ASSIGNMENTS	TERM END EXAM
V	MATDSCT5.2	PO 3, PO 4, PO 7, PO10	MATDSCT2.1	GROUP DISCUSSION	
VI	MATDSCT6.1	PO 6, PO 7, PO 10.	MATDSCT5.2		
VI	MATDSCT6.2	PO 5, PO 8, PO 9, PO 10.	MATDSCT1.1 & MATDSCT2.1		
VII	MATDSCT7.1	PO 3, PO 4, PO5, PO 7, PO 9.	MATDSCT1.1 & MATDSCT2.1		
VII	MATDSCT7.2	PO 2, PO 4, PO 5, PO 10	MATDSCT3.1		
VII	MATDSCT7.3	PO 2, PO 4, PO 5, PO 10	MATDSCT3.1		
VIII	MATDSCT8.1	PO 2, PO 4, PO 5, PO 10	MATDSCT5.1		
VIII	MATDSCT8.2	PO 2, PO 4, PO 5, PO 10	MATDSCT4.1		VIVA-VOCE
VIII	MATDSCT8.3	PO 2, PO 4, PO 5, PO 10	MATDSCT7.3		

** 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).

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

(For Model IIA)

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)*4=24	4 Courses 3 * 4 = 12	---	(4+4=8) Courses 8*(3+1) =32	2 Courses 2*(1+1)= 4	72
Other Subject		Minor	24	--	--	--	--	24
								96
Mathematics	V & VI	Major	4 Courses 4*(3+2)=20	-----	2 Courses 2 * 3 = 06	---	2 Courses 2 * 2 = 4	30
Other Subject		Minor	10	--	--	--	--	10
				(96+40)=136				
Mathematics	VII & VIII	Major	2 Courses 2*(3+2)=10 3 Courses 3 * 4 = 12 1 Course 1 * 3 = 3 Total=25	-----	2 Courses 2 * 3 = 6 Res.Methl * 3 = 3 2 Courses 2 * 3 = 6 Total= 15	----	-----	40
Total No. of Courses			14	04	07	08	04	
								136+40=176

Syllabus for B.Sc. (Honors) Mathematics w.e.f. 2021-22
I SEMESTER

MATDSCT 1.1: Algebra - I and Calculus - I	
Teaching Hours : 4 Hours/Week	**Credits: 4**
Total Teaching Hours: 56 Hours	**Max. Marks: 100** **(60 Sem End Exam + 40 IA)**

Course Objectives:

- To solve system of linear equations.
- To find eigenvalues and eigenvectors.
- To find curvature of curves.
- To learn techniques of successive differentiation.
- To apply the intermediate value theorems and L'Hospital rule.
- To trace the curves.

Course Learning Outcomes: This course will enable the students to

- Learn to solve the system of homogeneous and non homogeneous linear equations in m variables by using concept of rank of matrix, finding eigenvalues and eigenvectors.
- Sketch curves in Cartesian, polar and pedal equations.
- Geometrical representation and problem solving on MVT and Rolls theorems.
- Students will be familiar with the techniques of integration and differentiation of function with real variables.
- Identify and apply the intermediate value theorems and L'Hospital rule.
- Trace the curves.

(D. Ashok Reddy)

BoS-Chairman,
Department of Mathematics
Davangere University
Shivagangotri, Davangere-577007.

Syllabus for B.Sc. (Honors) Mathematics w.e.f. 2021-22

I SEMESTER

ALGEBRA - I AND CALCULUS - I

(4 lecture hours/ week: 14 x 4 = 56 HOURS)

UNIT – I: Matrices **(14 Hours)**

Cayley- Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof). Algebra of Matrices; Row and column reduction, 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. Eigen values and Eigen vectors of square matrices, real symmetric matrices and their properties.

Unit-II: Polar Co-ordinates **(14 Hours)**

Polar coordinates, angle between the radius vector and tangent. Angle of Intersection of curves, 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,

Unit-III: Differential Calculus-I **(14 Hours)**

Limits (definition only), Continuity problems using LHL and RHL Concept, Differentiability, Rolle's Theorem only statement and problems, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Maclaurin's series, Indeterminate forms and examples.

Unit-IV: Successive Differentiation **(14 Hours)**

Derivative of a function - Derivatives of higher order – n^{th} derivatives of the functions: e^{ax}, $(ax + b)^n$, $\log(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$, $e^{ax}\sin(bx+ c)$, $e^{ax}\cos(bx + c)$ – Problems, Leibnitz theorem and its applications.

Books for References

1. Lipman Bers – Calculus, Volumes 1 and 2
2. B S Vatssa, Theory of Matrices, New Delhi: New Age International Publishers, 2005.
3. G B Thomas and R L Finney, Calculus and analytical geometry, Addison Wesley, 1995.
4. J Edwards, An elementary treatise on the differential calculus: with Applications and numerous example, Reprint. Charleston, USA BiblioBazaar, 2010.
5. N P Bali, Differential Calculus, India: Laxmi Publications (P) Ltd.., 2010.
6. S Narayanan & T. K. Manicavachogam Pillay, Calculus.:S. Viswanathan Pvt. Ltd., vol. I & II 1996.
7. Frank Ayres and Elliott Mendelson, Schaum's Outline of Calculus, 5th ed.USA: Mc. Graw Hill., 2008.
8. Shanthi Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: S Chand and Co. Pvt. Ltd., 2014.

PRACTICALS
Mathematics Lab-I
(Based on ALGEBRA – I and CALCULUS – I)
(4 hours/ week per batch of not more than 15 students)
Mathematics practical with Free and open Source Software (FOSS)
Tools for computer programs

MATDSCP 1.1: Practicals on Algebra - I and Calculus – I	
Practical Hours : 4 Hours/Week	Credits: 2
Total Practical Hours: 56 Hours	Max. Marks: 50 (25 Sem End Exam + 25 IA)

Course Objectives:

- To learn Free and Open Source Software (FOSS) tools for computer programming
- Acquire knowledge of applications of algebra and calculus through FOSS

Course Learning Outcomes: This course will enable the students to

- Learn Free and Open Source Software (FOSS) tools for computer programming
- Solve problem on algebra and calculus theory 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/Maple/MatLab/Mathematica/Phython/R.

Programs using Scilab/Maxima/Python:

1. Introduction to Scilab and commands connected with matrices.
2. Computation of addition and subtraction of matrices,
3. Computation of Multiplication of matrices.
4. Computation of Trace and Transpose of Matrix
5. Computation of Rank of matrix and Row reduced Echelon form.
6. Computation of Inverse of a Matrix using Cayley-Hamilton theorem.
7. Solving the system of homogeneous and non-homogeneous linear algebraic equations.
8. Finding the continuity of a function
9. Finding the differentiability of a function
10. Verification Cauchy's mean value theorem
11. Verification of Lagrange's mean value theorem
12. Evaluation of limits by L-Hospital rule.

(Question Paper pattern for Major Mathematics)

I Semester B.Sc. Examination

(2021-22 CBCS Scheme)

MATHEMATICS

BSM 1T: ALGEBRA - I AND CALCULUS – I (Theory)

Time: 3 Hours **Max. Marks: 60**

Note: *All the sections are compulsory is compulsory.*

SECTION – A

1. Answer **any FIVE questions** of the following: **(5x2 = 10)**

a)
b)
c)
d)
e)
f)
g)
h)

SECTION – B

Answer **any FIVE questions** of the following: **(5x4 = 20)**

2.
3.
4.
5.
6.
7.
8.
9.

SECTION – C

(3x10 = 30)

Answer **any THREE full questions** of the following:

10. a)
    b)
11. a)
    b)
12. a)
    b)
13. a)
    b)
14. a)
    b)
15. a)
    b)

Department of Mathematics
Davangere University
Shivagangotri, Davangere-577007.

I Semester B.Sc.,(Honors) Practical Examination
(2021-22 CBCS Scheme)
MATHEMATICS
BSM 1P: Mathematics Lab – I (Practical)

Time: 3 Hours **Max. Marks: 25**

1. Answer **any two** questions: (10x2 =20)

a. Program- 1 writing & Execution

b. Program – II writing & Execution

c. Program – III writing & Execution

(Note: Writing a Program & Execution carries 05 & 05 marks, respectively.)

2. Viva-Voce & Project Record (5)

Note: 1) Credit means the unit by which the course work is measured. One hour session of Lecture per week for 16 weeks amounts to 1 credit. Two hours session of Tutorial/Practical per week for 16 weeks amounts to 1 credit.

2) Internal Assessment (IA) marks of Theory (for 40 marks) & practical (for 25 marks) should be conducted by the course teacher.

IA Pattern (Theory)		
Sl. No.	IA Component	Marks to be Awarded
1	Assignment	05
2	Attendance for Theory >75%	05
3	1st IA test for 30 marks of 90 minutes duration after 8 weeks & 2nd IA Test for 30 marks of 90 minutes duration after 15 weeks. Average of two IA tests should be considered.	30
IA Pattern (Practical)		
1	Journal/Practical record	05
2	Attendance for Practical Labs >75%	05
3	1st IA test for 15 marks of 90 minutes duration after 8 weeks & 2nd IA Test for 15 marks of 90 minutes duration after 15 weeks. Average of two IA tests should be considered.	15

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Open Elective Course

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

MATOET 1.1: Mathematics - I	
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

- Learn to solve system of linear equations.
- Solve the system of homogeneous and non-homogeneous m-linear equations by using the concept of rank of matrix, finding eigen values and eigen vectors.
- Students will be familiar with the techniques of differentiation of function with real variables.
- Identify and apply the intermediate value theorems and L'Hospital rule.
- Learn to trace some standard curves.

UNIT – I: Matrices **(14 Hours)**

Cayley- Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof). Algebra of Matrices; Row and column reduction, 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. Eigen values and Eigen vectors of square matrices, real symmetric matrices and their properties.

Unit-II: Differential Calculus-I **(14 Hours)**

Limits (definition only), Continuity problems using LHL and RHL Concept, Differentiability, Rolle's Theorem only statement and problems, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Maclaurin's series, Indeterminate forms and examples.

Unit-III: Successive Differentiation **(14 Hours)**

Derivative of a function - Derivatives of higher order – n^{th} derivatives of the functions: e^{ax}, $(ax + b)^n$, $\log(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$, $e^{ax}\sin(bx+ c)$, $e^{ax}\cos(bx + c)$ – Problems, Leibnitz theorem and its applications.

Books for References

1. Lipman Bers – Calculus, Volumes 1 and 2
2. B S Vatssa, Theory of Matrices, New Delhi: New Age International Publishers, 2005.
3. G B Thomas and R L Finney, Calculus and analytical geometry, Addison Wesley, 1995.
4. J Edwards, An elementary treatise on the differential calculus: with Applications and numerous example, Reprint. Charleston, USA BiblioBazaar, 2010.
5. N P Bali, Differential Calculus, India: Laxmi Publications (P) Ltd.., 2010.
6. S Narayanan & T. K. Manicavachogam Pillay, Calculus.:S. Viswanathan Pvt. Ltd., vol. I & II 1996.
7. Frank Ayres and Elliott Mendelson, Schaum's Outline of Calculus, 5th ed.USA: Mc. Graw Hill., 2008.
8. Shanthi Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: S Chand and Co. Pvt. Ltd., 2014.

Open Elective
(For Students of other than Science Stream)

MATOET 1.1: Business Mathematics-I	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(60 Sem End Exam + 40 IA)**

Course Objectives:

- To learn sets, relations, functions
- To learn permutations and combinations.
- To understand the use of matrices.
- To apply the trigonometric functions in economics and business.

Course Learning Outcomes: This course will enable the students to

- Apply sets, relations, functions in business.
- Use permutations and combinations.
- Use matrices in commercial field.
- Apply trigonometric function in real world.

Unit-I Algebra **14 Hours**

Sets, relations, functions, indices, logarithms, permutations and combinations, Examples on commercial mathematics.

Unit-II: Matrices **14 Hours**

Definition of a matrix; types of matrices; Algebra of matrices, Determinants, 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 involving not more than three variables. Examples on commercial mathematics

Unit-III: Trigonometric Functions **14 Hours**

Recapitulation of basic Definitions of trigonometric functions. Signs of trigonometric functions and sketch of their graphs. Trigonometric functions of sum and difference of two angles. Trigonometric ratios of multiple angles (Simple problems).

Books for References:

1. Allel R.G.A: Basic Mathematics: Macmilan, New Delhi.
2. Dowling, E.T. Mathematics for Economics: Schaum Series, McGraw Hill, London.
3. Soni R.S.: Business Mathematics: Pitamber Publishing House, Delhi
4. N. Rudraiah and Others: College Mathematics for B.Sc Series I and II SBS Publication Co. Bangalore.

(Question Paper pattern for Open Elective Mathematics)

I Semester B.Sc. Examination

(2021-22 CBCS Scheme)

MATHEMATICS

BSM 1T: ALGEBRA - I AND CALCULUS – I (Theory)

Time: 3 Hours **Max. Marks: 60**

Note: *All the sections are compulsory is compulsory.*

SECTION – A

1. Answer **any FIVE questions** of the following: **(5x2 = 10)**

a)

b)

c)

d)

e)

f)

g)

h)

SECTION – B

Answer **any FIVE questions** of the following: **(5x4 = 20)**

2.

3.

4.

5.

6.

7.

8.

9.

SECTION – C

(3x10 = 30)

Answer **any THREE full questions** of the following:

10. a)
    b)
11. a)
    b)
12. a)
    b)
13. a)
    b)
14. a)
    b)
15. a)
    b)

II SEMESTER

Syllabus for B.Sc. (Honors) Mathematics w.e.f. 2021-22

ALGEBRA - II AND CALCULUS - II

(4 lecture hours/ week: 14 x 4 = 56 HOURS)

MATDSCT 2.1: Algebra - II and Calculus - II	
Teaching Hours : 4 Hours/Week	**Credits: 4**
Total Teaching Hours: 56 Hours	**Max. Marks: 100** **(60 Sem End Exam + 40 IA)**

Course Objectives:

- To understand countable, uncountable sets and groups.
- To identify the link the fundamental concepts of groups and symmetries of geometrical objects.
- To understand the significance of the notions of Cosets and factor groups.
- To analyze the extreme values of functions.
- To learn multiple integration.

Course Learning Outcomes: This course will enable the students to

- Recognize the countable set and 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.
- Finding the extreme values of functions.
- Evaluate multiple integration.

Unit-I: Number Theory: **14 Hours**

Divisibility and its properties, Euclidean algorithm, GCD (greatest common divisor) of two numbers and problems, LCM (least common multiple) of any two integers, Fundamental theorem of arithmetic (finding GCD and LCM of two positive integers), congruences and properties, solution of linear congruences, simultaneous linear congruences.

Unit-II: Groups **14 Hours**

Definition of a group with examples and properties, problems. Subgroups, center of groups, order of an element of a group and its related theorems, cyclic groups, Coset decomposition, Factor groups, Lagrange's theorem, and its consequences. Fermat's theorem and Euler's function.

Unit-III: Partial Derivatives **14 Hours**

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. Maxima-Minima of functions of two variables.

Unit-IV: Integral Calculus **14 Hours**

Recapitulation of definite integrals and its properties. Reduction formula $\sin^n x$, $\cos^n x$, $\tan^n x$, $\sec^n x$, $\operatorname{cosec}^n x$, $\cot^n x$, and $\sin^m x \cos^n x$. area of plane curves, volume of solids of revolutions, surfaces of revolutions.

Reference Books:

1. I N Herstain, Topics in Algebra, Wiley Eastern Ltd., New Delhi.
2. Bernard & Child, Higher algebra, Arihant, ISBN: 9350943199/ 9789350943199.
3. Sharma and Vasishta, Modern Algebra, Krishna Prakashan Mandir, Meerut, U.P.
4. Shanti Narayan, Differential Calculus, S. Chand & Company, New Delhi.
5. Shanti Narayan and P K Mittal, Integral Calculus, S. Chand and Co. Pvt. Ltd.,
6. Schaum's Outline Series, Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw Hill., 2008.
7. S C Malik, Mathematical Analysis, Wiley Eastern.
8. Vijay K Khanna and S K Bhambri, A Course in Abstract Algebra, Vikas Publications.
9. G K Ranganath, Text Book of B.Sc. Mathematics, S Chand & Company.

PRACTICALS
Mathematics Lab-II
ALGEBRA – II and CALCULUS – II
(4 hours/ week per batch of not more than 15 students)
Mathematics practical with Free and Open Source Software (FOSS)
tools for computer programs

MATDSCP 2.1: Practicals on Algebra -II and Calculus - II	
Practical Hours: 4 Hours/Week	**Credits: 2**
Total Practical Hours: 56 Hours	**Max. Marks: 50** **(25 Sem End Exam + 25 IA)**

Course Objectives:

- To learn Free and Open-Source Software (FOSS) tools for computer programming
- Acquire knowledge of applications of algebra and calculus through FOSS

Course Learning Outcomes: This course will enable the students to

- Learn Free and Open Source Software (FOSS) tools for computer programming
- Solve problem on 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.

Programs using Scilab/Maxima/Python:

1. Program for verification of binary operations.
2. Programs to verification of Lagrange's theorem with suitable examples.
3. Finding all possible subgroups of a finite group.
4. Program to find first and second order partial derivatives
5. Program to verify the Euler's theorem and its extension.
6. Finding the Jacobians
7. Plotting of standard cartesian curves
8. Plotting of polar curves
9. Plotting of parametric curves
10. Program to find area of curves
11. Program to find surface area of a curve
12. Program to find volume of a curve

Open Elective

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

MATOET 2.1(A): 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 Outcomes: This course will enable the students to

- 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.
- Understand the concept of differentiation and fundamental theorems in differentiation and various rules.
- Find the extreme values of functions of two variables.
- To understand the concepts of multiple integrals and their applications.

Unit-I: Groups **14 Hours**

Definition of a group with examples and properties, problems. Subgroups, center of groups, order of an element of a group and its related theorems, cyclic groups, Coset decomposition, Factor groups, Lagrange's theorem and its consequences. Fermat's theorem and Euler's function.

Unit-II: Partial Derivatives **14 Hours**

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. Maxima-Minima of functions of two variables.

Unit-III: Integral Calculus **14 Hours**

Recapitulation of definite integrals and its properties. Reduction formula $\sin^n x$, $\cos^n x$, $\tan^n x$, $\sec^n x$, $\operatorname{cosec}^n x$, $\cot^n x$, and $\sin^m x \cos^n x$ and its applications, Area of plane curves, Length of plane curves, Volume of solids of revolutions, Surfaces area of revolutions.

Reference Books:

1. Topics in Algebra, I N Herstain, Wiley Eastern Ltd., New Delhi.
2. Higher algebra, Bernard & Child, Arihant, ISBN: 9350943199/ 9789350943199.

3. Modern Algebra, Sharma and Vasishta, Krishna Prakashan Mandir, Meerut, U.P.
4. Differential Calculus, Shanti Narayan, S. Chand & Company, New Delhi.
5. Integral Calculus, Shanti Narayan and P K Mittal, S. Chand and Co. Pvt. Ltd.,
6. Schaum's Outline Series, Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw Hill., 2008.
7. Mathematical Analysis, S C Malik, Wiley Eastern.
8. A Course in Abstract Algebra, Vijay K Khanna and S K Bhambri, Vikas Publications.
9. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.

Open Elective

(For Students of other than science stream)

MATOET 2.1(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 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.
- Apply decision-support tools to business decision making.
- Will be able to apply knowledge of business concepts and functions in an integrated manner.

Unit - I: Commercial Arithmetic **14 Hours**

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.

Unit - II: Measures of central Tendency and Dispersion **14 Hours**

Frequency distribution: Raw data, attributes and variables, Classification of data, frequency distribution, cumulative frequency distribution, Histogram and give curves. Requisites of ideal measures of central tendency, Arithmetic Mean, Median and Mode for ungrouped and grouped data. Combined mean, Merits and demerits of measures of central tendency, Geometric mean: definition, merits and demerits, Harmonic mean: definition, merits and demerits, Choice of A.M., G.M. and H.M. Concept of dispersion, Measures of dispersion: Range, Variance, Standard deviation (SD) for grouped and ungrouped data, combined SD, Measures of relative dispersion: Coefficient of range, coefficient of variation. Examples and problems.

Unit - III: Correlation and regression **14 Hours**

Concept and types of correlation, Scatter diagram, Interpretation with respect to magnitude and direction of relationship. Karl Pearson's coefficient of correlation for ungrouped data. Spearman's rank correlation coefficient. (with tie and without tie) Concept of regression, Lines of regression for ungrouped data, predictions using lines of regression. Regression coefficients and their properties (without proof). Examples and problems.

Reference Books:

1. Practical Business Mathematics, S. A. Bari New Literature Publishing Company New Delhi
2. Mathematics for Commerce, K. Selvakumar Notion Press Chennai
3. Business Mathematics with Applications, Dinesh Khattar & S. R. Arora S. Chand Publishing New Delhi
4. Business Mathematics and Statistics, N.G. Das &Dr. J.K. Das McGraw Hill New Delhi
5. Fundamentals of Business Mathematics, M. K. Bhowal, Asian Books Pvt. Ltd New Delhi
6. Mathematics for Economics and Finance: Methods and Modelling, Martin Anthony and Norman, Biggs Cambridge University Press Cambridge
7. Financial Mathematics and its Applications, Ahmad Nazri Wahidudin Ventus Publishing APS Denmark
8. Fundamentals of Mathematical Statistics, Gupta S. C. and Kapoor V. K.:, Sultan Chand and Sons, New Delhi.
9. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi.
10. Applied Statistics, Mukhopadhya Parimal New Central Book Agency Pvt. Ltd. Calcutta.
11. Fundamentals of Statistics, Goon A. M., Gupta, M. K. and Dasgupta, B. World Press Calcutta.
12. Fundamentals of Applied Statistics, Gupta S. C. and Kapoor V. K.:, Sultan Chand and Sons,

Registrar
Davangere University
Shivagangotri, Davangere.