RANI CHANNAMMA UNIVERSITY, BELAGAVI

PROGRAM /COURSE STRUCTURE AND SYLLABUS

as per the Choice Based Credit System (CBCS) designed in accordance with Learning Outcomes-Based Curriculum Framework (LOCF) of National Education Policy (NEP) 2020 for

Bachelor of Science (Mathematics)

w.e.f.

Academic Year 2021-22 and onwards

Board of studies (UG) committee

S.No.	Name	Designation
1.	Dr. Vijayalaxmi S. Shigehalli	Chairperson
2.	Dr. D. Radhakrishna	Member
3.	Dr. Vithal Yashavant Patil	Member
4.	Shri. S.K. Girigol	Co-opted Member
5.	Shri. Nagasuresh	Co-opted Member

Dr. Vijayalaxmi S. Shigehalli   Dr. Vijayalaxmi S. Shigehalli
Dean of Science Faculty   Chairperson BoS(UG)
Rani Channamma University, Belagavi   Dearment of Mathematics,
                                                          RCU Belagavi

PREAMBLE

The subject wise expert committee to draft model curriculum contents in Mathematics constituted by the Department of Higher Education, Government of Karnataka, Bengaluru 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 /Maxima/ 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 though each 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.

PROGRAM OUTCOMES:

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.

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 modelling and solving of real-life problems.

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.

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.

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.

6. **Information/digital Literacy:** The completion of this programme will enable the learner to use appropriate software's to solve system of algebraic equation and differential equations.

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.

8. **Moral and ethical awareness/reasoning:** The student completing this program will develop an ability to identify unethical behaviour 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.

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.

10. Ability to peruse advanced studies and research in pure and applied Mathematical sciences.

RANI CHANNAMMA UNIVERSITY
Vidyasangama, NH-4, Belagavi. -591156

Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Mathematics Major& One Minor Discipline Scheme for the Four Years Mathematics B.Sc. Undergraduate Honors Programme with effect from 2021-22.

SEMESTER-I										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L1	21BSC1L1LK1	Kannada	40	60	100	4	-	-	3	2
	21BSC1L1LFK1	Functional Kannada								
L2	21BSC1L2LEN2	English	40	60	100	4	-	-	3	2
	21BSC1L2LHI2	Hindi								
	21BSC1L2LSN2	Sanskrit								
	21BSC1L2LTE2	Telugu								
	21BSC1L2LUR2	Urdu								
DSC1	21BSC1C1MAT1L	Algebra - I and Calculus - I	40	60	100	4	-	-	4	2
	21BSC1C1MAT1P	Theory based Practical's on Algebra -I and Calculus – I	25	25	50	-	-	4	2	3
DSC1	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
SEC1	21BSC1SE1CS1	Digital Fluency	25	25	50	1	-	2	2	2
VBC1	21BSC1V1PE1	Physical Education- Yoga	25	-	25	-	-	2	1	-
VBC2	21BSC1V2HW1	Health & Wellness	25	-	25	-	-	2	1	-
OEC1	21BSC1O1MAT1-A	Mathematics – I	40	60	100	3	-	-	3	2
	21BSC1O1MAT1-B	Business Mathematics – I								
			Total Marks		**700**	**Semester Credits**			**25**	

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L3	21BSC2L3LK2	Kannada	40	60	100	4	-	-	3	2
	21BSC2L3FKL2	Functional Kannada								
L4	21BSC2L4EN2	English	40	60	100	4	-	-	3	2
	21BSC2L4HI2	Hindi								
	21BSC2L4SN2	Sanskrit								
	21BSC2L4TE2	Telugu								
	21BSC2L4UR2	Urdu								
DSC2	21BSC2C2MAT2L	Algebra - II and Calculus - II	40	60	100	4	-	-	4	2
	21BSC2C2MAT2P	Theory based Practical's on Algebra- II and Calculus – II	25	25	50	-	-	4	2	3
DSC2	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
AECC1	21BSC2AE1ES2	Environmental Studies	20	30	50	3	-	-	2	2
VBC3	21BSC2V3PE2	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC4	21BSC2V4NC1	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC2	21BSC2O2MAT2-A	Mathematics – II	40	60	100	3	-	-	3	2
	21BSC2O2MAT2-B	Business Mathematics-II								
		Total Marks		700		Semester Credits			25	

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
SECOND YEAR; SEMESTER-III										
			IA	SEE	Total	L	T	P		
L5	21BSC3L5LK3	Kannada	40	60	100	4	-	-	3	2
	21BSC3L5LFK3	Functional Kannada								
L6	21BSC3L6EN3	English	40	60	100	4	-	-	3	2
	21BSC3L6HI3	Hindi								
	21BSC3L6SN3	Sanskrit								
	21BSC3L6TE3	Telugu								
	21BSC3L6UR3	Urdu								
DSC3	21BSC3C3MAT1L	Ordinary Differential Equations and Real Analysis-I	40	60	100	4	-	-	4	2
	21BSC3C3MAT1P	Theory based Practical's on Ordinary Differential Equations and Real Analysis-I	25	25	50	-	-	4	2	3
DSC3	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
SEC2	21BSC3SE2ES2	Artificial Intelligence	25	25	50	1	-	2	2	2
VBC5	21BSC3V5PE3	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC6	21BSC3V6NC2	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC3	21BSC3O3MAT3-A	Ordinary Differential Equations	40	60	100	3	-	-	3	2
	21BSC3O3MAT3-B	Quantitative Mathematics								
Total Marks				**700**		**Semester Credits**			**25**	

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L7	21BSC4L7LK4	Kannada	40	60	100	4	-	-	3	2
	21BSC4L7LFK4	Functional Kannada								
L8	21BSC4L8EN4	English	40	60	100	4	-	-	3	2
	21BSC4L8HI4	Hindi								
	21BSC4L8SN4	Sanskrit								
	21BSC4L8TE4	Telugu								
	21BSC4L8UR4	Urdu								
DSC4	21BSC4C4MAT2L	Partial Differential Equations and Integral Transforms	40	60	100	4	-	-	4	2
	21BSC4C4MAT2P	Theory based Practical's on Partial Differential Equations and Integral Transforms	25	25	50	-	-	4	2	3
DSC4	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
AECC2	21BSC4AE1ES2	Constitution of India	20	30	50	3	-	-	2	2
VBC7	21BSC4V5PE4	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC8	21BSC4V6NC3	NCC/NSS/R&R(S&G)/Cultural	25	-	25	-	-	2	1	-
OEC4	21BSC4O4MAT4-A	Partial Differential Equations	40	60	100	3	-	-	3	2
	21BSC4O4MAT4-B	Mathematical Finance								
		Total Marks	700			Semester Credits			25	

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
SEMESTER-V										
Mathematics as Major Discipline										
DSC5	21BSC5C5MATMJ1L	Real Analysis and Complex Analysis	40	60	100	3	-	-	3	2
	21BSC5C5MATMJ1P	Theory based Practical's on Real Analysis and Complex Analysis	25	25	50	-	-	4	2	3
DSC6	21BSC5C5MATMJ2L	Ring Theory	40	60	100	3	-	-	3	2
	21BSC5C5MATMJ2P	Theory based Practical's on Ring Theory	25	25	50	-	-	4	2	3
DSC5	Another Department Code as a Minor Subject	Another Department Course Title	40	60	100	3	-	-	3	2
			25	25	50	-	-	4	2	3
DSE	21BSC5DSEMAT-A	Vector Calculus	40	60	100	3	-	-	3	2
	21BSC5DSEMAT-B	Mechanics								
	21BSC5DSEMAT-C	Mathematical Logic								
VBC9	21BSC5V5PE5	Physical Education- Sports	25	25	50	-	-	2	1	-
VBC10	21BSC5V6NC4	NCC/NSS/R&R(S&G)/Cultural	25	25	50	-	-	2	1	-
SEC3	21BSC5SE3MAT3	Cyber Security	25	25	50	1	-	2	2	2
		Total Marks			**650**	**Semester Credits**			**22**	

SEMESTER-VI

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
Mathematics as Major Discipline										
DSC7	21BSC6C6MATMJ1L	Linear Algebra	40	60	100	3	-	-	3	2
	21BSC6C6MATMJ1P	Theory based Practical's on Linear Algebra	25	25	50	-	-	4	2	3
DSC8	21BSC6C6MATMJ2L	Numerical Analysis	40	60	100	3	-	-	3	2
	21BSC6C6MATMJ2P	Theory based Practical's on Numerical Analysis	25	25	50	-	-	4	2	3
DSC6	Another Department Code as a Minor Subject	Another Department Course Title	40	60	100	3	-	-	3	2
			25	25	50	-	-	4	2	3
DSE	21BSC6DSEMAT-A	Analytical Geometry in 3D	40	60	100	3	-	-	3	2
	21BSC6DSEMAT-B	Number Theory								
	21BSC6DSEMAT-C	Special Functions								
	21BSC6DSEMAT-C	History of Bhârtîya Gaṇita								
INT1	21BSC6 INT1L	Internship	25	50	75	-	-	-	2	2
VBC1	21BSC6V5PE5	Physical Education-Sports	25	-	25	-	-	2	1	-
VBC2	21BSC6V6NC4	NCC/NSS/R&R(S&G) / Cultural	25	-	100	-	-	2	1	-
SEC4	21BSC6SE4MAT4	Professional Communication	25	25	50	1	-	2	2	2
		Total Marks			**700**	**Semester Credits**			**24**	
		Total Marks for BSC Program			**4175**	**Total Credits for BSC Program**			**146**	

Mathematics Subject as a Minor Discipline

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
SEMESTER-V										
			IA	SEE	Total	L	T	P		
DSC5 As a Minor Subject	21BSC5C5MATMN1L	Complex Analysis	40	60	100	3	-	-	3	2
	21BSC5C5MATMN1P	Theory based Practical's on Complex Analysis	25	25	50	-	-	3	2	3

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
SEMESTER-VI										
			IA	SEE	Total	L	T	P		
DSC6 As a Minor Subject	21BSC6C6MATMN1L	Numerical Analysis	40	60	100	3	-	-	3	2
	21BSC6C6MATMN1P	Theory based Practical's on Numerical Analysis	25	25	50	-	-	3	2	3

Concept Note, Abbreviation Explanation and Coding:

Concept Note, Abbreviation Explanation and Coding:

Concept Note:

1. **CBCS** is a mode of learning in higher education which facilitates a student to have some freedom in selecting his/her own choices, across various disciplines for completing a UG/PG program.

2. A credit is a unit of study of a fixed duration. For the purpose of computation of workload as per UGC norms the following is mechanism be adopted in the University:
   One credit (01) = One Theory Lecture (L) period of one (1) hour.
   One credit (01) = One Tutorial (T) period of one (1) hour.
   One credit (01) = One practical (P) period of two (2) hours.

3. Course: paper/subject associated with AECC, DSC, DSEC, SEC, VBC, OEC, VC, IC and MIL

4. In case of **B.Sc**. **Once a candidate chose two courses/subjects of a particular two department in the beginning, he/she shall continue the same till the end of the degree, then there is no provision to change the course(s) and Department(s).**

5. A candidate shall choose **one of the Department's courses as major and other Department course as minor in fifth and sixth semester and major course will get continued in higher semester.**

6. Wherever there is a practical there will be no tutorial and vice-versa

7. A major subject is the subject that's the main focus of Core degree/concerned.

8. A minor is a secondary choice of subject that complements core major/ concerned.

9. Vocational course is a course that enables individual to acquire skills set that are required for a particular job.

10. Internship is a designated activity that carries some credits involving more than **25 days** of working in an organization (either in same organization or outside) under the guidance of an identified mentor. Internship shall be an integral part of the curriculum.

11. **OEC: For non-mathematics students. Mathematics students have to opt for OEC from departments other than major and minor disciplines.**

Abbreviation Explanations:

1. AECC: Ability Enhancement Compulsory Course.
2. DSC: Discipline Specific Core Course.
3. DSEC: Discipline Specific Elective Course.
4. SEC: Skill Enhancement Course.
5. VBC: Value Based Course.
6. OEC: Open/Generic Elective Course
7. VC: Vocational Course.
8. IC: Internship Course
9. L1: Language One
10. L2: MIL
11. L= Lecture; T= Tutorial; P=Practical.
12. MIL= Modern Indian Language; English or Hindi or Telugu or Sanskrit or Urdu

Program Coding:

1. Code 21: Year of Implementation
2. Code BSC: BSC Program under the faculty of Applied Science of the University
3. Code 1: First Semester of the Program, (2 to 6 represent higher semesters)
4. Code AE: AECC, (C for DSC, S for SEC, V for VBC and O for OEC)
5. Code 1: First "AECC" Course in semester, similarly in remaining semester for such other courses
6. Code LK: Language Kannada, similarly Language English, Language Hindi, Language Telugu, Language Sanskrit, &Language Urdu
7. Code 1: Course in that semester.
8. MAT: Mathematics

ASSESSMENT METHODS
Evaluation Scheme for Internal Assessment:

Theory:

Assessment Criteria	30 marks
1st Internal Assessment Test for 30 marks of duration 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1 hr after 15 weeks. Average of two tests should be considered.	30
Assignment	10
Total	**40**

Assessment Criteria	25 marks
1st Internal Assessment Test for 20 marks of duration 1/2 hr after 8 weeks and 2nd Internal Assessment Test for 20 marks of duration 1 hr after 15 weeks. Average of two tests should be considered.	20
Assignment	05
Total	**25**

Practical:

Assessment Criteria	25 marks
Semester End Internal Assessment Test for 20 marks of duration 2 hrs	20
Journal (Practical Record)	05
Total	**25**

Question Paper Pattern:
RANI CHANNAMMA UNIVERSITY
Department of Mathematics
I Semester B.Sc (Mathematics)

Sub: **Code:**   **Maximum Marks: 70**

a.   **Answer any Six Questions from Question 1**

b.   **Answer any Three Questions from Question 2,3,4 and 5**

Q.No.1.	**Answer any Five Questions (Two question from Each Unit)** a. b. c. d, e. f. g. h.	**2X6=12**
Q.No.2.	**(Should cover Entire Unit-I)** a. b. c. d.	**4X3=12**
Q.No.3.	**(Should cover Entire Unit-II)** a. b. c. d.	**4X3=12**
Q.No.4.	**(Should cover Entire Unit-III)** a. b. c. d.	**4X3=12**
Q.No.5.	**(Should cover Entire Unit-IV)** a. b. c. d.	**4X3=12**

COURSE-WISE SYLLABUS

Semester I

Year	I	**Course Code:** 21BSC1C1MAT1L		Credits	04
Sem.	1	**Course Title:** Algebra - I and Calculus – I		Hours	56
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60		Duration of ESA:.02 hrs.	
Course Outcomes		This course will enable the students to • 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, finding eigen values and eigen vectors. • Sketch curves in Cartesian, polar and pedal equations • 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.			
Unit No.		**Course Content**		**Hours**	
Unit I		**Matrix:** 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. Eigen values and Eigen vectors of square matrices, real symmetric matrices and their properties, reduction of such matrices to diagonal form,		14	
Unit II		**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, evolutes and envelops.		14	
Unit III		**Differential Calculus-I:** Limits, Continuity, Differentiability and properties. Properties of continuous functions. 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		14	

	L'Hospital rule.	
Unit IV	**Successive Differentiation**: nth Derivatives of Standard functions e^{ax+b}, $(ax + b)^m$, $\log(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$, $e^{ax} \sin(bx + c)$, $e^{ax} \cos(bx+c)$, Leibnitz theorem and its applications. Tracing of curves (standard curves)	14

<div align="center">

Recommended Leaning Resources

</div>

Print Resources	**References:** 1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited 2. Theory of Matrices - B S Vatsa, New Age International Publishers. 3. Matrices - A R Vasista, Krishna Prakashana Mandir. 4. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi. 5. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019. 6. Calculus – Lipman Bers, Holt, Rinehart & Winston. 7. Calculus - S Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II. 8. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA:Mc. Graw. 9. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.

Year	I	**Course Code:** 21BSC1C1MAT1P	**Credits**	02
Sem.	I	**Course Title:** Practical's on Algebra - I and Calculus – I	**Hours**	56

Course Pre-requisites, if any:	Knowledge of Programming	
Formative Assessment Marks: 25	Summative Assessment Marks: 25	Duration of ESA: 03 hrs.

Course 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 software. Acquire knowledge of applications of algebra and calculus through FOSS Practical/Lab Work to be performed in Computer Lab (FOSS) - Suggested Software's: Maxima/Scilab/Maple/MatLab/Mathematica/Phython/R
	Lab Practical's: **Part A:** Introduction to the software and commands related to the topic. 1. Computation of addition and subtraction of matrices, 2. Computation of Multiplication of matrices. 3. Computation of Trace and Transpose of Matrix 4. Computation of Rank of matrix and Row reduced Echelon form. 5. Computation of Inverse of a Matrix using Cayley-Hamilton theorem. 6. Solving the system of homogeneous and non-homogeneous linear algebraic equations. **Part B:** 7. Finding the nth Derivative of e^{ax} , trigonometric and hyperbolic functions 8. Finding the nth Derivative of algebraic and logarithmic functions. 9. Finding the nth Derivative of $e^{ax+b} \sin(bx + c)$, $e^{ax+b} \cos(bx + c)$. 10. Finding the Taylor's and Maclaurin's expansions of the given functions. 11. Finding the angle between the radius vector and tangent. 12. Finding the curvatures of the given curves. 13. Tracing of standard curves (Cartesian, polar and parametric)

Evaluation Scheme for Lab Examination

Assessment Criteria		Marks
Program – 1 from Part A	Writing Program	03
	Execution of Program	07
Program -2 from Part B	Writing Program	03
	Execution of Program	07
Viva-Voce		05
Total		**25**

OPEN-ELECTIVE SYLLABUS :

A: For students of Science stream who have not chosen Mathematics as one of Core Subjects

Year	I	**Course Code:** 21BSC1O1MAT1	**Credits**	03
Sem.	I	**Course Title:** Mathematics – I	**Hours**	42

Course Pre-requisites, if any	NA	
Formative Assessment Marks: 40	Summative Assessment Marks: 60	Duration of ESA:.02 hrs.

Course 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 No.	Course Content	Hours
Unit I	**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, 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, reduction of such matrices to diagonal form.	14
Unit II	**Differential Calculus:** Limits, Continuity, Differentiability and properties. 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 examples.	14
Unit III	**Successive Differentiation**: nth Derivatives of Standard functions e^{ax+b}, $(ax + b)^m$, $\log(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$, $e^{ax} \sin(bx + c)$, $e^{ax} \cos(bx+c)$, Leibnitz theorem and its applications. Tracing of curves (standard curves)	14
Recommended Leaning Resources		

Print Resources	**References:** 1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited 2. Theory of Matrices - B S Vatsa, New Age International Publishers. 3. Matrices – A. R. Vasista, Krishna Prakashana Mandir. 4. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019. 5. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi. 6. Calculus – Lipman Bers, Holt, Rinehart & Winston. 7. Calculus – S. Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd.,vol. I & II. 8. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc.Graw. 9. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.

B: For Students of other than Science Stream

Year	I	Course Code: 21BSC1O1MAT1		Credits	03
Sem.	I	**Course Title:** Business Mathematics – I		Hours	42
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60		Duration of ESA:.02 hrs.	
Course Outcomes		This course will enable the students to • Translate the real word problems through appropriate mathematical modellling. • 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 No.		**Course Content**		**Hours**	
Unit I		**Algebra** – Set theory and simple applications of Venn Diagram, relations, functions, indices, logarithms, permutations and combinations. Examples on commercial mathematics.		14	
Unit II		**Matrices**: Definition of a matrix; types of matrices; algebra of matrices. Properties of determinants; calculations of values of determinants upto 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	
Unit III		**Differential Calculus**: Constant and variables, functions, Limits & continuity. Differentiability and Differentiation, partial differentiation, rates as a measure, maxima, minima, Partial Derivatives up to second order; Homogeneity of functions and Euler's Theorem; Total Differentials; Differentiation of implicit function with the help of total differentials, Maxima and Minima; cases of one variable involving second or higher order derivatives; Cases of two variables involving not more than one constraint		14	
Recommended Leaning Resources					
Print Resources		**References:** 1. Basic Mathematics, Allel R.G.A, Macmillan, New Delhi. 2. Mathematics for Economics, Dowling, E.T. , Schaum's Series, McGraw Hill, London. 3. Quantitative Techniques in Management, Vohra, N.D., Tata McGraw Hill, New Delhi.			

	4. Business Mathematics, Soni R.S., Pitamber Publishing House, Delhi

Semester II

Year	I	Course Code: 21BSC1C1MAT1L		Credits	04
Sem.	II	**Course Title:** Algebra - II and Calculus –II		**Hours**	56
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.		
Course 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.			
Unit No.		**Course Content**		**Hours**	
Unit I		**Real Number System:** Recapitulation of number system. Countable and uncountable sets, standard theorems. Real line, bounded sets, suprimum and infimum of a set, completeness properties of R, Archimedean property of R. Intervals, neighborhood of a point, open sets, closed sets, limit points and Bolzano-Weierstrass theorem (Without proof).		14	
Unit II		**Groups:** Definition of a group with examples and properties, congruence, 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, Euler's ϕ		14	
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	
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		14	

	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.	

Recommended Leaning Resources	
Print Resources	**References** 1. Topics in Algebra, I N Herstein, Wiley Eastern Ltd., New Delhi. 2. Higher algebra, Bernard & Child, Arihant, ISBN: 9350943199/ 9789350943199. 3. Modern Algebra, Sharma and Vasista, 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.

Year	I	**Course Code:** 21BSC1C1MAT1P	**Credits**	02
Sem.	II	**Course Title:** Practical's on Algebra - II and Calculus – II	**Hours**	56

Course Pre-requisites, if any:	Knowledge of Programming	
Formative Assessment Marks: 25	Summative Assessment Marks: 25	Duration of ESA: 03 hrs.

Course 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 software's. • Acquire knowledge of applications of algebra and calculus through FOSS Practical/Lab Work to be performed in Computer Lab Suggested　　　　　　　　　　　　　　　　　　　　　　Software's: Maxima/Scilab/Maple/MatLab/Mathematica/Phython/R.
	Lab Practical's: **Part A:** 1. Program for verification of binary operations. 2. Computation of identity and inverse elements of a group. 3. Program to construct Cayley's table and test abelian for given finite set. 4. Program to find all possible cosets of the given finite group. 5. Program to find generators and corresponding possible subgroups of a cyclic group. 6. Programs to verification of Lagrange's theorem with suitable examples. **Part B:** 7. Program to verify the Euler's ϕ function for a given finite group. 8. Program to verify the Euler's theorem and its extension 9. Programs to construct series using Maclaurin's expansion for functions of two variables. 10. Program to evaluate the line integrals with constant and variable limits. 11. Program to evaluate the Double integrals with constant and variable limits 12. Program to evaluate the Triple integrals with constant and variable limits.

Evaluation Scheme for Lab Examination

Assessment Criteria		Marks
Program – 1 from Part A	Writing Program	03
	Execution of Program	07
Program -2 from Part B	Writing Program	03
	Execution of Program	07
Viva-Voce		05
Total		**25**

OPEN-ELECTIVE SYLLABUS :
A: For students of Science stream who have not chosen Mathematics as one of Core Subjects

Year	I	Course Code: 21BSC1O1MAT1		Credits	03
Sem.	II	**Course Title:** Mathematics – II		**Hours**	42
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60		Duration of ESA:.02 hrs.	
Course 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 No.	**Course Content**			**Hours**	
Unit I	**Groups**: Definition of a group with examples and properties, congruence, 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 ϕ function.			14	
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	
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			14	

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.	
Recommended Leaning Resources	

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

B: For Students of other than Science Stream

Year	I	**Course Code:** 21BSC1O1MAT1		**Credits**	03
Sem.	II	**Course Title:** Business Mathematics – II		**Hours**	42
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60		Duration of ESA:.02 hrs.	
Course 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 No.		**Course Content**		**Hours**	
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 Instalments (EMI) by Interest of Reducing Balance and Flat Interest methods, Examples and Problems.		14	
Unit II		**Measures of central Tendency and Dispersion**: 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.		14	
Unit III		**Correlation and regression**: Concept and types of correlation, Scatter diagram,		14	

	Interpretation with respect to magnitude and direction of relationship. Karl Pearson'scoefficient 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.	
Recommended Leaning Resources		
Print Resources	**References:** 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, New Delhi.	