ಬೆಂಗಳೂರು ನಗರ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

BENGALURU CITY UNIVERSITY

BENGALURU CITY UNIVERSITY, BENGALURU

Syllabi for Mathematics Papers of

BSc First and Second Semesters

Under

State Education Policy

Effective from the academic year
2024 – 2025

Board of Studies in Mathematics for UG

(No. BCU/BoS/Mathematics (UG)/147/2023-24 dated: 31-08-2023)

1.	Dr Ramesh B Kudenatti	Chairman

Name of the Degree Program	**:**	**Bachelor of Science- BSc**
Discipline Course	**:**	**Mathematics**
Starting Year of Implementation	**:**	**2024-25 (I & II Semesters)** **2025-26 (III & IV Semesters)** **2026-27 (V & VI Semesters)**

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

PO 1	**Disciplinary Knowledge:** Bachelor degree with Mathematics as one of subjects in chosen combination 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's to solve system of algebraic equation and differential equations.
PO 7	**Self – directed learning**: The student completing this program will develop 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	20%	80 %
Practical	20%	80 %

BSc Degree with Mathematics as one of the Major Subjects

Draft Structure for BSc Mathematics Course

Semester	Course Code	Paper Title	Teaching Hours / Week	Marks		Duration of Exam in Hours	Credits
				Exam	IA		
I	Theory	Algebra-I, Calculus-I & Geometry	04	80	20	03	03
	Practical	Algebra-I, Calculus-I & Geometry	04	40	10	03	02
II	Theory	Algebra-II, Calculus-II & Polar Coordinates	04	80	20	03	03
	Practical	Algebra II, Calculus II & Polar Coordinates	04	40	10	03	02
III	Theory		04	80	20	03	03
	Practical		04	40	10	03	02
	Elective-I	Linear Programming	03	80	10	03	02
IV	Theory		04	80	20	03	03
	Practical		04	40	10	03	02
	Elective-II	Mathematical Logic	03	80	10	03	02
	SEC-I	Mathematical Statistics	03	80	10	03	02
V	Theory		04	80	20	03	03
	Theory		04	80	20	03	03
	Practical		04	40	10	03	02
	Practical		04	40	10	03	02
	SEC-II	Machine Learning	03	80	10	03	02
VI	Theory		04	80	20	03	03
	Theory		04	80	20	03	03
	Practical		04	40	10	03	02
	Practical		04	40	10	03	02
	SEC-III	Internship/Project	--	--	--	--	02

Syllabus for B.Sc. with Mathematics as one of the Major Subjects

SEMESTER – I

Theory	Algebra-I Calculus-I Geometry
Teaching Hours : 4 Hours/Week	Credits: 03
Duration of Exam: 03 Hours	Maximum Marks:100 (Exam 80 + IA 20)

Course Learning Outcomes:

The overall expectation from this course is that the student builds a basic understanding on Algebra, Calculus and Geometry. The broader course outcomes are listed as follows. At the end of this course, the student will be able to:

1. ABC
2. ABC
3. ABC
4. ABC

Algebra-I

Unit I Matrices

Recapitulation of matrices, Elementary row and column transformations (operations). equivalent matrices, theorems on it. Row reduced echelon form. Normal forms of a matrix, Rank of a matrix, problems. Homogenous and non-homogenous systems of linear equations in unknowns, Consistency Criterion - Criterion for uniqueness of solutions. Eigenvalues and Eigenvectors of a square matrix of order 2 and 3, standard properties. Cayley-Hamilton theorem with proof, Finding A^{-1}, A^{-2} *and* $A^2, A^3,\ A^4$. (14 Hours)

Calculus -I

Unit II Differential Calculus

Successive differentiation: An n^{th} derivative of the function $e^{ax+b}, (ax+b)^n$, $\log(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$ $e^{ax}\sin(bx+c)$, $e^{ax}\cos(bx+c)$ and problems, Leibnitz theorem with proof and its applications. Partial differentiation- function of two and three variables- first and higher order derivatives. Homogeneous function- Euler's theorem and its extension with proof, Total derivative and differentiation of implicit function and composite function problems Jacobian properties of Jacobian problems. (14 Hours)

Integral Calculus

Unit III Integral Calculus

Recapitulation of integration reduction formulas for

$\int x\,dx, \int x\,dx, \int x\,dx\ , \int x\,dx, \int x\,dx, \int cosec^n x\,dx, \int x\,dx x\,dx$

with definite limit problem differentiation under integral sign b lebintz rule problems.

(14 Hours)

Analytical Geometry

Unit IV Analytical Geometry

Analytical geometry of three-dimensional, recapitulations of elements of three-dimensional geometry. Planes, distance of a point from plane angle between two planes bisectors of

equation angle between two planes equation of a plane in different forms (without proof) and problems, spheres in different forms, tangent plane to a sphere orthogonal of spheres standard equation of right circular cone and right circular cylinder and problems. (14 Hours)

References

1.

Practical	**Algebra-I Calculus-I Geometry**
Teaching Hours : 4 Hours/Week	**Credits: 02**
Duration of Exam: 03 Hours	**Maximum Marks: 50 (Exam 40 + IA 10)**

Course Learning Outcomes: This course will enable the students to

1. Learn *Free and Open Source Software (FOSS)* tools for computer programming
2. ABC
3. ABC

Practical/Lab Work to be performed in Computer Lab using Python which is FOSS

Suggested Programs

1. Introduction to Python
2. Basics of software with simple examples.
3. Basics of software with simple examples.
   i. compare two numbers using if statements
   ii. sum of natural numbers using while loop
   iii. finding the factors of a number using for loop
   iv. to check the given number is prime or not (use if…..else statement)
   v. find the factorial of a number(use… if…if…else)
   vi. simple programmes to illustrate logical operators (and or not)
2. Computation of a rank of matrix by row reduced and normal forms
3. Solving the system of homogeneous and non homogeneous linear equations
4. Computation of inverse of a matrix by using Cayley Hamilton theorem
5. Finding the n^{th} derivative of a function without lebintz theorem
6. Finding the n^{th} derivative of a function with lebintz theorem
7. Partial differentiation of some standard functions and Jacobian
8. Verification of Eulers theorems with examples
9. Program to find Jacobians
10. Program to find reduction formula with or without limits
11. Program to find angle between the two planes
12. Program to find equation and plot sphere
13. Program to find equation and plot cones
14. Program to find equation and plot cylinders

SEMESTER II

Theory	Algebra-II, Calculus-II & Polar Coordinates
Teaching Hours : 4 Hours/Week	Credits: 03
Duration of Exam: 03 Hours	Maximum Marks: 100 (Exam 80 + IA 20)

Course Learning Outcomes:

The overall expectation from this course is that the student builds a basic understanding on Algebra, Calculus and Polar Coordinates. The broader course outcomes are listed as follows. At the end of this course, the student will be able to:

1 ABC
2. ABC
3. ABC
4. ABC

Algebra II

Unit I Groups

Binary operations algebraic structure- problems on finding identity and inverse definition of semi group and group, abelian group, problems on finite and infinite groups, properties of groups with proof- standard problems on groups-finite semi group with both the cancellation laws in a group- any group of orders less than five is abelian, subgroups theorems on subgroups with proof problems. (14 Hours)

Calculus II

Unit II Differential Calculus

Limits and continuity, differentiability and properties of continuous functions. Intermediate value theorem, mean value theorem, Roll's theorem, Lagrange's mean value theorem, Cauchy mean value theorem and examples. Indeterminate forms and evaluation of limits using L'Hospital rule. (14 Hours)

Polar Coordinates

Unit III Polar Coordinates

Polar coordinates, angle between the radius vector and tangent, angle of intersection of two curves (polar forms), length of perpendicular form pole to the tangent, pedal equation derivative of an arc in Cartesian parametric and polar forms, curvature of plane curve, radius of curvature formula in Cartesian, parametric polar and pedal forms, center of curvature evolutes asymptotes, singular points and double points. (14 Hours)

Integral calculus

Unit IV Integral calculus

Application of integral calculus computation of length of arc, plane area and surface area and volume of solids of evaluations for standard curves in Cartesian and polar forms improper integrals, improper integrals of first, second and third kinds with examples , improper integral has the limit of proper integral. (14 Hours)

Practical	Algebra-II, Calculus-II and Polar Coordinate
Teaching Hours : 4 Hours/Week	**Credits: 02**
Duration of Exam: 03 Hours	**Maximum Marks: 50 (Exam 40 + IA 10)**

Course Learning Outcomes: This course will enable the students to

1. Learn *Free and Open Source Software (FOSS)* tools for computer programming
2. ABC
3. ABC

Practical/Lab Work to be performed in Computer Lab using Python which is FOSS

Suggested Programs

1. Verifying weather given operator is binary or not.
2. To find identity and inverse element of a group
3. Program to illustrate continuity of a function
4. Program to illustrate differentiability of a function
5. Program to verify Rolls theorem
6. Program to verify Lagrange's theorem
7. Evaluation of limits by L'Hospital rules.
8. Finding the angle between the radius vector and tangent
9. Finding the angle between two curves
10. Finding the radius of curvature of the given curve
11. Plotting of standard Cartesian curves (part I)
12. Plotting of standard Cartesian curves (part II)
13. Plotting of standard polar curves
14. Plotting of standard parametric curves
15. Program to compute surface area
16. Program to compute volume of revolution.