VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
JNANASAGARA CAMPUS, BALLARI-583105

Department of Studies in

Mathematics

I & II Semester Syllabus

BACHELOR OF MATHEMATICS

Programme as per State Education Policy 2024

Under Choice Based Credit System (CBCS)

With effect from 2024-25 and onwards

Department Name: Mathematics

Semester - I

Course Title: Differential Calculus and Algebra-I	Course Code: 24MJMATH1L
Total Contact Hours: 4 hours/week	No. of Credits: 4
L:T:P- 4:0:0	
Internal Assessment Marks: 20	Duration of SEE: 3 Hours
Semester End Exam Marks: 80	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Solve system of linear equations.
2. 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 eigenvectors.
3. Sketch curves in Cartesian, polar and pedal equations.
4. Recognize the mathematical objects called Groups.
5. Link the fundamental concepts of groups and symmetries of geometrical objects.
6. Explain the significance of the notions of Cosets, normal subgroups and factor groups.
7. Find the extreme values of functions of two variables.

Unit	Description	Hours
1	**Matrix:** 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. Symmetric and Skew Symmetric matrices, Cayley-Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof). Eigen values and Eigen vectors of square matrices	12
2	**Groups and subgroups:** 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 Phi-function.	12
3	**Successive Differentiation:** nth Derivatives of Standard functions Successive Differentiation: nth Derivatives of Standard functions $e^{ax+b}, (ax+b)^n, \log(ax+b), \sin(ax+b), \cos(ax+b), e^{ax}\sin(bx+c), e^{ax}\cos(bx+c)$ Leibnitz theorem and its applications. Tracing of curves(standard curves)	10
4	**Partial Derivatives:** Functions of two or more variables-explicit and implicit	10

	functions, Partial derivatives. Homogeneous functions-Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples.	
5	**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, polar, and pedal forms- centre of curvature asymptotes.	**12**

References:

1. Matrices - A R Vasista, Krishna Prakashana Mandir, 2003.
2. Theory of Matrices - B S Vatsa, New Age International Publishers, 2005.
3. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited, 1986.
4. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi, 2005.
5. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
6. Calculus – Lipman Bers, Holt, Rinehart & Winston, 1969.
7. Calculus - S Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II, 1996.
8. Topics in Algebra, I N Herstein,Wiley Eastern Ltd., New Delhi.
9. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company, 2018
10. Text Book of B.Sc. Mathematics G B Gururajachar, Academic Excellence series, 2019
11. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw Hill., 2008.

*****

Department Name: Mathematics

Semester - I

Course Title: Differential Calculus and Algebra-I Lab	Course Code: 24MJMATH1P
Total Contact Hours: 4 hour/week	No. of Credits: 2
L:T:P- 0:0:4	
Internal Assessment Marks: 10	Duration of SEE: 3 Hours
Semester End Exam Marks: 40	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Learn Free and Open Source Software (FOSS) tools for computer programming.
2. Solve problem on Differential Calculus and Algebra theory studied in 24MJCC1L using FOSS software's.
3. Acquire knowledge of applications of algebra and calculus through FOSS Practical/Lab Work to be performed in Computer Lab.

List of Experiments / Programs (For a Lab Course)

Sl.No	Experiment / Program
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.
7	Finding the nth Derivative of exponential, trigonometric and hyperbolic functions.
8	Finding the nth Derivative of algebraic and logarithmic functions.
9	Finding the nth Derivative of $e^{ax}\left(Sin(bx+c)\right), e^{ax}\left(Cos(bx+c)\right)$
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.

References:

1. Matrices - A R Vasista, Krishna Prakashana Mandir, 2003.

2. Theory of Matrices - B S Vatsa, New Age International Publishers, 2005.
3. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited, 1986.
4. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi, 2005.
5. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.

*****

Department Name: Mathematics

Semester - II

Course Title: Integral calculus and Algebra-II	Course Code:24MJMATH2L
Total Contact Hours:4Hrs/Week	No. of Credits:4
L:T:P-4:0:0	
Internal Assessment Marks:20	Duration of SEE: 3Hours
Semester End Exam Marks: 80	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Learn reduction formula's and applications of integral calculus.
2. Students able to solve double integral equations and triple integral equations.
3. Acquire knowledge of Improper integrals and beta-gamma functions.
4. Acquire knowledge of applications of algebra and calculus.

Unit	Description	Hours
1	**Integral Calculus:** Reduction formulae for $\int \sin nx dx$, $\int \cos nx dx$, $\int \tan nx dx$, $\int \cot nx dx$, $\int \sec nx dx$, $\int \operatorname{cosec} nx dx$, $\int \sin mx \cos nx dx$ with define limit –Problems. Application of integral Calculus: Computation of length of arc, plane area and surface area and volume of solids of revolutions for standard curves in Cartesian and polar forms.	12
2	**Double integral:** Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Computation of plane surface areas, volume underneath a surface of revolution using double integral. Triple integral: Definition of triple integrals and evaluation – change of variables, volume as triple integral.	12
3	**Improper Integrals:** Improper integrals of the first, second and third kind with examples. Improper integral as the limit of the proper integral. **Beta-Gamma Functions:** Definitions, Properties and examples, relations between beta and gamma functions, standard theorems, applications of definite integrals, duplication formula and its applications.	12
4	**Ring Theory:** Definition and examples of rings, properties of rings, subrings, necessary and sufficient condition for a nonempty subset of a ring to be a subring, integral domains	10
5	**Fields:** Fields, subfield. Ideal, ideal generate by a subset of a ring, factor rings, operations on ideals, principal, prime and maximal ideals. Ring homomorphisms, properties of ring homomorphisms. Ring isomorphism and its properties	10

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. Integral Calculus, Shanti Narayan and P K Mittal, S. Chand and Co. Pvt. Ltd.,
5. Schaum's Outline Series, Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc.Graw Hill. 2008.
6. Mathematical Analysis, S C Malik, Wiley Eastern.
7. A Course in Abstract Algebra, Vijay K Khan and S K Bhambri, Vikas Publication.
8. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand and Company.
9. Ajit Kumar and S. Kumaresan, A Basic Course in Real Analysis, Taylor and Francis Group, 2014.

*****

Department Name: Mathematics

Semester - II

Course Title: Integral calculus and Algebra-II Lab	Course Code:24MJMATH2P
Total Contact Hours: 4Hrs/Week	No. of Credits:2
L:T:P-0:0:4	
Internal Assessment Marks: 10	Duration of SEE: 3 Hours
Semester End Exam Marks: 40	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Learn Free and Open-Source Software (FOSS) tools for computer programming.
2. Solve problem on algebra and calculus theory studied in 24MJCC2L using FOSS software's.
3. Acquire knowledge of applications of algebra and calculus through FOSS.

List of Experiments / Programs (For a Lab Course)

Sl.No	Experiment / Program
1	Evaluation of the integrals using Gamma function.
2	Evaluation of the integrals using Beta function.
3	Program to verify the given Reduction formula with or without limits.
4	Program to evaluate the Surface area, volume of solid of revolutions for standard curves
5	Program to evaluate the volume of solid of revolutions for standard curves
6	Program to evaluate the Double integrals with constant and variable limits.
7	Program to evaluate the Triple integrals with constant and variable limits.
8	Fundamental elements of Ring Theory and Linear Algebra using FOSS tool.
9	Program to verify the illustrative examples on different types of rings.
10	Program to verify the illustrative examples on integral domains and fields.
11	Program to verify the illustrative examples on subrings, ideals
12	Program to verify the illustrative examples on subrings, which are not ideals.
13	Program to verify the illustrative examples on Homomorphism and isomorphism of ring

References:

10. Introduction to Programming Using Python, An 1st Edition by David I. Schneider (PDF)
11. Introduction to Computation and Programming Using Python, 2nd Edition,
12. R for data science, by Handley Wickham and Garrett Gorlemund.
13. Hands-on programming with R: write your own functions and simulations, by Garrett

Gorlemund**.**
14. Mathematical Analysis, S C Malik, Wiley Eastern.
15. A Course in Abstract Algebra, Vijay K Khan and S K Bhambri, Vikas Publication.
16. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand and Company.
17. Ajit Kumar and S. Kumaresan, A Basic Course in Real Analysis, Taylor and Francis Group, 2014

*****

QUESTION PAPER PATTERN FOR THEORY SEMESTER END EXAMINATION

PART-A

Answer all Questions

1. Answer any TEN questions **10X2=20**

a.

b.

c.

d.

e.

f.

g.

h.

i.

j.

k

l.

Note: Two questions from each unit

PART-B

Answer any EIGHT questions **8X5=40.**

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

Note: TWO question from each unit

PART-C

Answer any TWO questions

12. Question from unit-I and unit-II

13.Question from unit-III and unit-IV

14.Question from unit-I and unit-V

NOTE: Each question in section-c has subdivision i),ii),iii) questions and marks 4+4+2=10 distribution

QUESTION PAPER PATTERN FOR ELECTIVE PAPER SEMESTER END EXAMINATION

Duration: 120 Minutes 40 Marks

Answer all the questions.

PART-A

1. Answer any Five questions. (5*2=10M)

a
b
c
d
e
f
g

Note: Two questions from each unit and One question from: I to III units.

PART-B

Answer any Four questions. (4*5=20M)

3

4

5

6

7

Note: Two questions from each unit.

PART-C

Answer any One questions. (1*10=10M)

8

9

10

Note: One question from each unit. Questions distribution in each question is a), b), Sub-questions i.e., (5+5=10M)

EVALUATION METHOD FOR PRACTICALS SEMESTER END EXAMINATION

DURATION: 3 Hrs **Maximum Marks: 40**

1. To write two Scilab/Maxima program -	2*5=10
2. To execute TWO program -	10*2=20
3. Viva -	5
4. Record Book(Certified Record Book)	05
Total Marks	**40**

INTERNAL ASSESSSMENT METHOD FOR PRACTICALS

Maximum Marks: 10

Internal Test	05 Marks
Journal/ Observations	05 Marks
Total Marks	**10**