GOVERNMENT COLLEGE (AUTONOMOUS) KALABURAGI

Department of Mathematics

Proposed Undergraduate Syllabus as per State Education Policy for the academic year 2024-25

	Type of Paper	Title of the Paper	No of teaching hours / week	No of Credits	Theory marks	IA Marks	Total Marks
I	DSC-1T	Algebra and Calculus	03	03	80	20	100
	DSC-1P	Practical-I	04	02	40	10	50
II	DSC-2T	Real Analysis and Differential Calculus	03	03	80	20	100
	DSC-2P	Practical-II	04	02	40	10	50

Semester -I

DSC-1T : Algebra and Calculus	
Teaching Hours: 3 Hours/Week	**Credits:03**
Total Teaching Hours: 48 hours	**Max. Marks :100 (SEE 80 + I.A -20)**

Course Learning Objectives:

The primary objective of this course is to

a) Introduce the basic tools of theory of equations and matrices to understand their linkage to the real-world problems. Perform matrix algebra with applications.

b) Theory of Equations: The primary objective of this course is to find the roots of Quadratic and bi-Quadratic Equations

c) Successive Differentiation: The primary objective of this course is to find the nth derivatives of algebraic, logarithmic and trigonometric functions.

d) Polar Coordinates: The course will be develop a deep and rigorous understanding of Curvature , Evolutes and Envolops

i) Course outcomes:

a) Learn to solve system of linear equation

b) Students will be familiar with the techniques to find the roots of Quadratic and bi-Quadratic Equations

c) Students will be Understand Concepts of derivatives of different functions and Sketch curves in Cartesian and polar forms

d) Students will be familiar with the techniques to find the roots of Quadratic and bi-Quadratic Equations.

Unit-I Matrix

Symmetric and skew symmetric matrices, 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.

Cayley-Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem.

(Lecturer hours -12)

Unit-II Theory of Equation

Relation between roots and co-efficient, Nature of roots – Descarte's rule of signs and example. Solution of cubic equation, Cardan's method to solve cubic equation, dividing the polynomial by using the synthetic division method and examples trigonometric method, Biquadratic equation.

(Lecturer hours -12)

Unit-III Successive Differentiation

Limits, continuity and bounds of a function, Algebra of continuous functions, theorems on continuous functions. Successive Differentiation, formulae for n^{th} derivatives of the following 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.

(Lecturer hours -12)

Unit-IV Polar co-ordinates

Polar co-ordinates, 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 in Cartesian, Parametric, polar and pedal forms, center of curvature, circle of curvature, Evolutes & Involute and Envelops with examples. Asymptotes and Tracing of curves

(Lecturer hours -12)

Reference Books

1. Matrices-A R Vasista, Krishna Prakashana Mandir
2. Application of Calculus-Debasish Sengupta
3. College Mathematics –N R Jayaram , R V Prabhakara, Sanathkumar Sastry, G S Sundareshan.
4. Schaum,s outline of calculus- frank Ayres and Elliott MAndelson 5th ed USA: Mc. Graw
5. Differential Calculus – Shanti Narayan
6. Calculus-Lipman Bers, Holt, Rinehart and sinston
7. Calculus- S Barayanan and T. K. Manicavachogam pillay, S Viswanathan
8. Higher Engineering Mathematics by B. S. Grewal

PRACTICALS

DSC-1P: Practicals on Algebra and Calculus	
Teaching Hours: 4 Hours/Week	**Credits:02**
Total Teaching Hours: 56 hour	**Max. Marks :50 (SEE 40 + I.A -10)**

Course Learning Objectives: This course will enable the students

1. Learn Free and SciLab/Maxima software.
2. Tools for computer programming.
3. Solve problem on algebra and calculus theory studied in **DSC-1T** by using SciLab/Maxima software .
4. Acquire knowledge of application of algebra and calculus through SciLab/Maxima software

- **Introduction to SciLab/Maxima and commands related to the topic.**
  1. Computation of addition, subtraction and multiplication of matrix.
  2. Computation of trace , transpose and inverse of matrix
  3. Computation of rank of matrix and row reduces echelon form.
  4. Computation of inverse of matrix using Cayley-Hamilton Method.
  5. Solutions of homogeneous system of linear equations.
  6. Solution of non-homogeneous system of linear equations.
  7. Finding Root OF Cubic and biquadratic equations.
  8. Finding the n^{th} derivatives of exponential, hyperbolic and trigonometric function.
  9. Finding the n^{th} derivatives of algebraic function.
  10. Finding the n^{th} derivatives of Logarithmic function.
  11. Finding the n^{th} derivatives of $e^{ax}\sin(bx+c)$, $e^{ax}\cos(bx+c)$.
  12. Computation of angle between the radius vector and the tangent.
  13. Tracing of standard curves in 2D.

Note: Use the SciLab/Maxima software to execute the practical problem and verify manually.

Semester -II

DSC-2T: Real Analysis and Differential Calculus	
Teaching Hours: 3 Hours/Week	**Credits:03**
Total Teaching Hours:48 hours	**Max. Marks :100 (SEE 80 + I.A -20)**

Course Learning Objectives:

The main objectives of this course are

a.) To introduce the Convergence and Divergence of Sequences by using different tests.

b.) To introduce the Convergence and Divergence of Series by using different tests.

c) Objective of this course is to know the Geometric meaning of derivatives by using Intermediate value Theorems

d) Objective of this course is to know the basic tools of calculus and to understand the extension of the studies of single variable differential calculus to functions of two or more independent variables

Course outcomes:

a) Student should learn the concept of convergence and divergence of a sequence.
b) Able to handle and understand the limits and their use in sequences, series,
c) Learn the conceptual variations when advancing in calculus from one variable to multivariable discussions.
d) Understand the concept of differentiation and fundamental theorems in differentiation and various rules intermediate value theorems and L'Hospitals rule

Unit-I Sequences

Definition of finite and infinite sequence, Bounded and unbounded sequence. Limit of a sequence, Convergent, divergent and oscillatory sequences, Monotonic sequence, Related theorems, Cauchy's Sequence, Cauchy's General Principle of Convergence.

(Lecturer hours -12)

Unit- II Infinite Series

Definition of series, positive terms series, Geometric Series, p-series, Comparison tests for positive term series, D 'Alembert's ratio test, Raabe's test, Cauchy's root test, Alternating series, Leibnitz's theorem (without Proof) and examples. Summation of Series, Exponential ,Logarithmic, Binomial Series and Related Examples

(Lecturer hours -12)

Unit-III Differential Calculus

Differentiability of function. Some basic theorems on differentiability. Intermediate value theorem, Rolle's Theorem, Lagrange's mean value theorem. Cauchy's mean value theorem and examples. Taylor's theorem, and Taylor's series. Maclaurin's series, Indeterminate forms and evaluation of limits using L'Hospital rule.

(Lecturer hours -12)

Unit-IV Functions of two and three variable

Limit , continuity, partial derivatives of function of two and three variables, homogenous functions, Euler's theorem (up to Second order), Total derivatives, Jacobin's and its properties, Maxima and minima for function of two variables.

(Lecturer hours -12)

Reference Books

1. Real analysis ; S. C. Malik
2. Introduction to Real Analysis ; S Narayan and Raisighaniya
3. Introduction to Sequences, Series: OE Stanitics
4. Differential Calculus by Shanthi Narayan
5. Advanced Calculus by Mury R Spiegel
6. Higher Engineering Mathematics by B. S. Grewal

JBShetty

PRACTICALS

DSC-2P : Practical's on Real Analysis and Differential Calculus	
Teaching Hours: 4 Hours/Week	**Credits:02**
Total Teaching Hours: 56 hour	**Max. Marks :50** **(SEE 40 + I.A -10)**

Learning Outcomes: This course will enable the students

1. Learn Free and SciLab/Maxima software tools for computer programming.
2. Solve problem on Real Analysis and Differential Calculus studied in **DSC-2T:** by using SciLab/Maxima software .
3. Acquire knowledge of application of Real Analysis and Differential Calculus through SciLab/Maxima software

- **Introduction to SciLab/Maxima and commands related to the topic.**

1. Examining the convergence of sequence.
2. Example on $\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n \cong e$.
3. Example on convergence of + ve terms series.
   Example on ratio test,
4. Example on Raabe's test
5. Example on Cauchy's root test.
6. Example on convergence of Alternating series,
7. Verification of Leibnitz's theorem examples.
8. Examples on Rolle's theorem.
9. Examples on Lagrange's theorem.
10. Examples on Cauchy's theorem.
11. Taylor's and Maclaurin's series.
12. Verification of Euler's Theorem
13. Verification of Homogeneous Theorem

Note: Use the SciLab/Maxima software to execute the practical problem and verify manually.