JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

B N ROAD, MYSURU- 570 025

DEPARTMENT OF MATHEMATICS

Syllabus

CHOICE BASED CREDIT SYSTEM

For B.Sc programmes

- **Physics, Mathematics, Chemistry**
- **Physics, Mathematics, Computer Science**
- **Physics, Mathematics, Electronics**
- **Physics, Mathematics, Computer Maintenance**

2017-18

PROGRAMME: BSc PCM, PROGRAMME CODE: BSc-01 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27001	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27001	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27001	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27001	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27001	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27001	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27201	2	0	0	0

PROGRAMME: BSc PMCS, PROGRAMME CODE: BSc-02 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27002	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27002	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27002	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27002	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27002	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27002	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27202	2	0	0	0

PROGRAMME: BSc PMCM, PROGRAMME CODE: BSc-03 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27003	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27003	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27003	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27003	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27003	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27003	5	0	1	6

7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27203	2	0	0	0

PROGRAMME: BSc PME, PROGRAMME CODE: BSc-04 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27004	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27004	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27004	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27004	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27004	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27004	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27204	2	0	0	0

Scheme of Assessment:

Credits L:T:P	Percentage			Maximum marks in the Exam /Assessment			Exam Duration	
	Th	Pr	IA	Th	Pr	IA	Th	Pr
4:0:2	50	20	30	70	70	30	3h	3h
4:0:1	70	-	30	70	-	30	3h	-
2:0:0	70	-	30	50	-	30	2h	-

Note: L-Lecture, T-Tutorial, P-Practical; Th- Theory, Pr-Practical,

I A- Internal Assessment

Programme Outcome for Bachelor of Science in Physics, Chemistry, Mathematics:

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Demonstrate proficiency in Mathematics and the Mathematical concepts needed for a proper understanding of Physics.

PO2. Demonstrate the ability to justify and explain their thinking and/or approach.

PO3. Develop state-of-the-art laboratory and professional communication skills.

PO4. Apply the scientific method to design, execute, and analyze an experiment

PO5. Explain scientific procedures and experimental observations.

PO6. Appreciate the role of chemistry in the society.

PO7. Use this as a basis for ethical behaviour in issues facing chemists /drugs.

PO8. Understand chemistry as an integral part for addressing social, economic, and environmental problems.

PO9. Understand the value of Mathematical proof .

PO10. Demonstrate proficiency in writing and understanding proofs.

PO11. Apply mathematical problems and solutions in aspects of science and technology.

PO12. Gain experience to investigate the real world problems

PO13. Apply mathematical ideas and models to those problems.

Programme Specific Outcome for Bachelor of Science in Physics, Chemistry, Mathematics

After completing the graduation in Physics, Chemistry and Mathematics the students are able to:

PSO1. Find career opportunities.

PSO2. Develop competence to write competitive examinations.

PSO3. Develop proficiency in the analysis of complex physical problems.

PSO4. Mathematical or other appropriate techniques to solve problems.

PSO5. Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.

PSO6. Create a hypothesis and appreciate how it relates to broader theories.

PSO7. Demonstrate skills in the use of Computers.

Programme Outcome for Bachelor of Science in Physics, Mathematics, Computer Science:

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Demonstrate proficiency in Mathematics and the Mathematical concepts needed for a proper understanding of Physics.

PO2. Demonstrate the ability to justify and explain their thinking and/or approach.

PO3. Develop state-of-the-art laboratory and professional communication skills.

PO4. Apply the scientific method to design, execute, and analyze an experiment.

PO5. Explain scientific procedures and experimental observations.

PO6. Understand the value of Mathematical proof.

PO7. Demonstrate proficiency in writing and understanding proofs.

PO8. Apply mathematical problems and solutions in aspects of science and technology.

PO9. Gain experience to investigate the real world problems

PO10. Apply mathematical ideas and models to those problems.

PO11. Apply Mathematical principles for computing and logical design.

PO12. Design, implement, and evaluate a computational system to meet desired needs within realistic constraints.

PO13. Use the System principles in the design and development of software for systems of varying complexity.

Programme Specific Outcome for Bachelor of Science in Physics, Mathematics, Computer Science

After completing the graduation in the Bachelor of Science the students are able to:

PSO1. Find career opportunities.

PSO2. Develop competence to write competitive examinations.

PSO3. Develop proficiency in the analysis of complex physical problems.

PSO4. Mathematical or other appropriate techniques to solve problems.

PSO5. Create a hypothesis and appreciate how it relates to broader theories.

PSO6. Demonstrate skills in the use of Computers.

PSO7. Join as Entry level Technical job role for an IT Industry.

PSO8. Build small database ERP software/ web applications.

Programme Outcome for Bachelor of Science in Physics, Mathematics, Computer Maintenance:

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Demonstrate proficiency in Mathematics and the Mathematical concepts needed for a proper understanding of Physics.

PO2. Demonstrate the ability to justify and explain their thinking and/or approach.

PO3. Develop state-of-the-art laboratory and professional communication skills.

PO4. Apply the scientific method to design, execute, and analyze an experiment.

PO5. Explain scientific procedures and experimental observations.

PO6. Understand the value of Mathematical proof.

PO7. Demonstrate proficiency in writing and understanding proofs.

PO8. Apply mathematical problems and solutions in aspects of science and technology.

PO9. Gain experience to investigate the real world problems

PO10. Apply mathematical ideas and models to those problems.

PO11. Design, implement, and evaluate a computational system to meet desired needs within realistic constraints.

PO12. Apply System design and development principles in the construction of software systems of varying complexity.

PO13. Apply the knowledge, techniques, skills, and modern tools in computer maintenance.

PO14. Understand networking applications to include basic electronics, programming, operation, and computer networks.

Programme Specific Outcome for Bachelor of Science in Physics, Mathematics, Computer Maintenance

After completing the graduation in the Bachelor of Science the students are able to:

PSO1. Find career opportunities.

PSO2.Develop competence to write competitive examinations

PSO3. Develop proficiency in the analysis of complex physical problems.

PSO4. Mathematical or other appropriate techniques to solve problems.

PSO5. Create a hypothesis and appreciate how it relates to broader theories.

PSO6. Demonstrate skills in the use of Computers.

PSO7. Start small enterprise in PC Maintenance/ Networking field.

PSO8. Join organizations related to Computer Hardware and Networking Maintenance.

Programme Outcome for Bachelor of Science in Physics, Mathematics, Electronics:

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Demonstrate proficiency in Mathematics and the Mathematical concepts needed for a proper understanding of Physics.

PO2. Demonstrate the ability to justify and explain their thinking and/or approach.

PO3. Develop state-of-the-art laboratory and professional communication skills.

PO4. Apply the scientific method to design, execute, and analyze an experiment.

PO5. Explain scientific procedures and experimental observations.

PO6. Understand the value of Mathematical proof.

PO7. Demonstrate proficiency in writing and understanding proofs.

PO8. Apply mathematical problems and solutions in aspects of science and technology.

PO9. Gain experience to investigate the real world problems

PO10. Apply mathematical ideas and models to those problems.

PO11. Apply appropriate troubleshooting techniques to electronic circuits or systems and perform test procedures.

PO12. Assist, Assemble, modify and test electronic circuits in accordance with job requirements, f.

PO13. Communicate effectively in technical and non-technical environments.

Programme Specific Outcome for Bachelor of Science in Physics, Mathematics, Electronics

After completing the graduation in the Bachelor of Science the students are able to:

PSO1. Find career opportunities.

PSO2. Develop competence to write competitive examinations

PSO3. Develop proficiency in the analysis of complex physical problems.

PSO4. Mathematical or other appropriate techniques to solve complex physical problems.

PSO5. Create a hypothesis and appreciate how it relates to broader theories.

PSO6. Demonstrate skills in the use of Computers for control, data acquisition, and data analysis in experimental investigations.

PSO7. Apply knowledge of Physics, Mathematics and Electronics fundamentals to solve problems in electronic circuits & communication systems.

PSO8. Apply appropriate troubleshooting techniques to electronic circuits or systems and perform test procedures.

SEMESTER -I

Course code: CMA27001/ CMA27002/ CMA27003/ CMA27004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1. Learn in details with examples curvature
CO2. Learn in depth applications of taylor's theorem
CO3. Understand the details of mean value theorems
CO4. Learn the details of linear approximation theorem
CO5. Understand in details with examples partial derivatives
CO6. Specify in details with examples asymptotes
CO7. Identify the classification and characteristics of envelopes
CO8. Deliberate the details of maxima and minima
C09. Understand in details with examples indeterminate forms

DSC I: Differential Calculus

Unit I : Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions.

Unit II: Linear Approximation theorem, Tangents and normals, Monotone functions, Maxima and Minima, Curvature, Radius of curvature, Centre of curvature , Evolutes

Unit III : Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of sinx, cosx, e^x, log(l+x), $(1+x)^m$, Maxima and Minima, Indeterminate forms.

Unit IV: Asymptotes, Envelopes, Singular points – Multiple points – Cusp, Node and conjugate points, Orthogonal Trajectories, Tracing of curves,

Reference Books:

1. Frank Ayres and Elliott Mendelson, Schaum's Outline of Calculus, 5th ed.USA: Mc. Graw Hill., 2008.
2. G B Thomas and R L Finney, Calculus and analytical geometry, Addison Wesley, 1995.
3. H.Anton,I.Birens and S. Davis,Calculus,John Wiley and Sons, Inc.,2002
4. J Edwards, An elementary treatise on the differential calculus: with Applications and numerous example, Reprint. Charleston, USA BiblioBazaar, 2010.

5. Lipman Bers – Calculus, Volumes 1 and 2
6. N. Piskunov – Differential and Integral Calculus
7. N P Bali, Differential Calculus, India: Laxmi Publications (P) Ltd.., 2010.
8. Serge Lang – First Course in Calculus
9. S Narayanan & T. K. Manicavachogam Pillay, Calculus.:S. Viswanathan Pvt. Ltd., vol. I & II 1996.
10. Shanthi Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: S Chand and Co. Pvt. Ltd., 2014.

PRACTICAL COMPONENT-1

1. Introduction to Scilab.
2. Operators; trigonometric, inverse trigonometric functions in scilab.
3. Plotting of standard Cartesian curves using Scilab.
4. Plotting of standard polar curves using Scilab.
5. Plotting of standard parametric curves using Scilab.
6. Introduction to Maxima.
7. Creating variables, functions.
8. Creating a Maxima program (simple examples, loops, control sequence).
9. Differentiation and integration using maxima inbuilt functions.
10. Plotting of standard curves- Cartesian, Polar using Maxima.
11. Plotting of standard parametric curves using Maxima.
12. Geometrical meaning of Rolle's theorem of the functions on the given interval.
13. To verify Rolle's theorem , Lagrange's theorem and cauchy's mean value theorem
14. Finding Taylor's theorem for a given function.
15. To illustrate left hand and right hand limits for discontinuous functions.
16. To illustrate continuity of a function.
17. To illustrate differentiability of a function.

SEMESTER-II

Course code: CMB27001/ CMB27002/ CMB27003/ CMB27004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1. Understand in depth variable separable

CO 2. Specify the characteristics of homogeneous equations

CO3. Identify the details of exact equation

CO4. Learn in depth simultaneous differential equations

CO5. Write down in depth total differential equation

CO6. Identify in depth linear non homogeneous equations

CO7. Write down in depth linear partial differential equation

CO8. Deliberate the characteristics of lagrange's method

DSC II: Differential Equations

Unit I: Linear differential equations of First order, Separation of variables, Equations with homogeneous coefficients, Exact differential equations, Linear differential equations of the form $\frac{dy}{dx} + Py = Q$, Integrating factors, rules to find an integrating factor ,Bernoulli's Equations, Equations with coefficients linear in x and y.

Unit II: First order higher degree equations solvable for x, y, p, Clairaut's form. Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order, Simultaneous differential equations and Total differential equations.

Unit III: Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, Exact equations, Inverse Differential operators, The Cauchy-Euler equation.

Unit IV: Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Reference Books:

1. Daniel A Murray – Introductory Course to Differential equations
   Earl David Rainville and Philip Edward Bedient – A short course in Differential equations, Prentice Hall College Div; 6th edition.
2. M D Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt. Ltd., 2013.
   F.Ayres, Schaum's outline of theory and problems of Differential Equations, 1st ed. USA McGraw-Hill, 2010
3. S Narayanan and T K Manicavachogam Pillay, Differential Equations .: S V Publishers Private Ltd., 1981.
4. G F Simmons, Differential equation with Applications and historical notes, 2nd ed.: McGraw-Hill Publishing Company, Oct 1991.
5. G. Stephonson – An introduction to Partial Differential Equations.
6. B. S. Grewal – Higher Engineering Mathematics
   E. Kreyszig – Advanced Engineering Mathematics
7. E. D. Rainville and P E Bedient – A Short Course in Differential Equations
8. D. A Murray – Introductory Course in Differential Equations.
9. G. P. Simmons – Differential Equations
10. F. Ayres – Differential Equations (Schaum Series)
11. Martin Brown – Application of Differential Equations.
12. Shepley L.Ross,Differential Equations, 3rd Ed,John Wiley and Sons,1984.

PRACTICAL COMPONENTS-II

1. Obtaining partial derivatives of some standard functions
2. Solution of Differential equation and plotting the solution-I
3. Solution of Differential equation and plotting the solution-II
4. Solution of Differential equation and plotting the solution-III
5. Solution of Differential equation and plotting the solution-IV
6. Finding complementary function and particular integral of constant coefficient second and higher order ordinary differential equations.
7. Solving second order linear partial differential equations in two variables with constant coefficient.

8. Solutions to the problems on total and simultaneous differential equations.
9. Solutions to the problems on different types of partial differential equations.
10. Solution of Cauchy problem for first order partial differential equation.
11. Plotting the characteristics for the first order partial differential equation.
12. Plot the integral surfaces of a given first order partial differential equation with initial data.

SEMESTER III

Course code: CMC27001/ CMC27002/ CMC27003/ CMC27004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOMES:

After successful completion of the course, the student is able to

CO1. Deliberate in details with examples finite and infinite sets

CO2. Identify the details of countable and uncountable sets

CO3. Specify the details of sequence

CO4. Learn the characteristics of infinite series

CO5. Deliberate in details with examples comparison test

CO6. Identify the characteristics of sequence and series of function

CO7. Learn the details of uniform convergence

CO8. Understand in details with examples power series and radius of convergence.

DSC III: **Real Analysis**

Unit I: Finite and infinite sets, examples of countable and uncountable sets.Real line, bounded sets, supremum and infimum, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano-Weistrass theorem.

Unit II: Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence .

Unit III: Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test , Definition and examples of absolute and conditional convergence.

Unit IV: Sequences and series of functions, Point wise and uniform convergence. Mn-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.

Reference Books:

1. S.C Malik –Real Analysis
2. Murray R Speigel – Laplace Transforms
3. S.C.Malik and Savita Arora, *Mathematical Analysis*, 2nd ed. New Delhi, India: New Age international (P) Ltd., 1992
4. Richard R Goldberg, Methods of Real Analysis, Indian ed.
5. Asha Rani Singhal and M .K Singhal, A first course in Real Analysis
6. E.Kreyszig- Advanced Engineering Mathematics, Wiely India Pvt. Ltd.
7. Raisinghania M. D., Laplace and Fourier Transforms S. Chand publications.

Practical components-III

1. Illustration of convergent, divergent and oscillatory sequences.
2. Plotting of recursive sequences.
3. Study of convergence of sequences through plotting
4. Illustration of convergent, divergent and oscillatory series.
5. To study the convergence and divergence of infinite series by plotting their sequences of partial sums.
6. Using Cauchy's criterion on the sequence of partial sums of the series to determine convergence of series.
7. Cauchy's root test by plotting n^{th} roots.
8. Ratio test by plotting the ratio of n^{th} and $(n+1)^{th}$ terms.

9. Testing the convergence of binomial, exponential and logarithmic series and finding the sum.
10. To find the sum of the series and it's radius of convergence.

SEMESTER IV

CMD27001/ CMD27002/ CMD27003/ CMD27004

(Credits: Theory-04, Practicals-02) **Theory: 60**

Lectures

COURSE OUTCOMES:

After successful completion of the course, the student is able to

CO1. Understand in details with examples abelian group

CO2. Identify in details with examples permutation group

CO3. Learn the details of subgroups

CO4. Identify the classification and characteristics of cosets

CO5. Specify the details of commutative ring

CO6. Write down in depth ideals

CO7. Deliberate the characteristics of integral domains and fields

CO8. Write down in details with examples homomorphism

DSC IV: Algebra

Unit I: Definition and examples of groups, examples of abelian and non-abelian groups, the group Zn of integers under addition modulo n and the group U(n) of units under multiplication modulo n. Cyclic groups from number systems, complex roots of unity, cyclic group, groups of symmetries ,the permutation group , Group of quarter nion's.

Unit II: Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets, Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

Unit III: Definition and examples of rings, examples of commutative and non- commutative rings: rings from number systems, Zn the ring of integers modulo n, ring of real quaternion's, rings of matrices, polynomial rings, and rings of continuous functions. Sub rings and ideals.

Unit IV: Integral domains and fields, examples of fields: Zp, Q, R, and C. Field of rational functions. Homeomorphisms', Isomorphism'.

Reference Books :

1. Natarajan, Manicavasagam Pillay and Ganapathy – Algebra
2. I. N. Herstien – Topics in Algebra.
3. Joseph Gallian – Contemporary Abstract Algebra, Narosa Publishing House, New Delhi, Fourth Edition.
4. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
5. J B Fraleigh – A first course in Abstract Algebra.
6. Michael Artin – Algebra, 2nd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2011.
7. Vashista, A First Course in Modern Algebra, 11th ed.: Krishna Prakasan Mandir, 1980.
8. R Balakrishan and N.Ramabadran, A Textbook of Modern Algebra, 1st ed. New Delhi, India: Vikas publishing house pvt. Ltd., 1991.
9. T. K. Manicavasagam Pillai and K S Narayanan – Modern Algebra Volume 2

Practical component-IV

1. Verifying whether a given operator is binary or not.
2. To find identity element of a group.
3. To find inverse element of a group.
4. Finding all possible subgroups of a finite group.
5. Examples to verify Lagrange's theorem.

6. Illustrating homomorphism and isomorphism of groups.
7. Verification of normality of a given subgroup.
8. Verifying Cayley's theorem and isomorphism theorems.
9. Examples for finding left and right coset and finding the index of a group.
10. Examples on different types of rings.
11. Examples on integral domains and fields.
12. Examples on subrings, ideals and subrings which are not ideals.
13. Homomorphism and isomorphism of rings – illustrative examples.
14. Solving polynomial equations.
15. Findind G.C.D of polynomials.
16. Finding units and associates.
17. Test for rational roots.

SEMESTER V

CME 27001/CME27002/CME27003/CME27004

(Credits: Theory-04, Practicals-02) **Theory: 60 Lectures**

COURSE OUTCOMES:

After successful completion of the course, the student is able to

CO1. Understand the details of vector space

CO2. Specify the characteristics of dimension of subspaces

CO3. Write down the characteristics of euclidean vectorspace

CO4. Understand the details of orthogonal projection

CO5. Learn in depth linear transformations

CO6. Understand in details with examples rank and nullity

CO7. Learn in details with examples eigen values and eigen vectors

CO8. Write down the characteristics of isomorphism, automorphism theorems

DSE I: Linear Algebra

Unit I: Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces, Direct sum of two subspaces.

Unit II: Inner Product, Inner Product of any two vectors in V (R), Euclidean Vectorspace, Orthogonal Vectors, Ortho normal Basis, Orthogonal Projection, Orthogonal Compliment.

Unit III: Linear transformations, algebra of linear transformations , matrix representation of a linear transformation, null space, range, rank and nullity of a linear transformation,

Unit IV: Eigen values and Eigen vectors, Characteristic Polynomial. Isomorphism, Auto morphism, theorems, invertibility of non singular linear transformation, change of coordinate matrix.

Reference Books:

1. I. N. Herstien – Topics in Algebra.
2. Stewart – Introduction to Linear Algebra
3. S. Kumaresan – Linear Algebra
4. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
5. Gopalakrishna – University Algebra
6. Saymour Lipschitz – Theory and Problems of Linear Algebra.
7. S.C Mallik –Real Analysis.
8. B.S Grewal – Higher engineering mathematics.

Practical components –V

Credit :2 Hour: 4 Hour per week

1. Vector space, subspace – illustrative examples.
2. Expressing a vector as a linear combination of given set of vectors.
3. Examples on linear dependence and independence of vectors.

4. Basis and Dimension – illustrative examples.
5. Verifying whether a given transformation is linear.
6. Finding matrix of a linear transformation.
7. Problems on rank and nullity.
8. Find characteristics polynomials.
9. To find Eigen values and their multiplicity.
10. Calculation of Eigen vector.
11. Change of basis.
12. Linear transformations to matrices and vice versa.
13. Matrix with respect to change of basis.
14. Orthogonal and orthonormal sets.
15. Gram- Schmidt orthogonalisation of the columns.

SEMESTER VI

CMF 27001/CMF27002/CMF27003/CMF27004

\(Credits: Theory-04, Practicals-02) **Theory: 60 Lectures**

COURSE OUTCOMES:

After successful completion of the course, the student is able to

CO1. Understand the details of complex numbers

CO2. Write down the details of Cauchy-Riemann equations

CO3. Deliberate the characteristics of analytic function

CO4. Understand in depth harmonic function

CO5. Write down the characteristics of Cauchy integral formula

CO6. Identify the details of the fundamental theorem of algebra

CO7. Write down in depth bilinear transformations

CO8. Deliberate in depth conformal mapping

DSE II: Complex Analysis

Unit I: Complex numbers, Polar and exponential form of complex numbers, Triangular inequality, Geometry of complex numbers, Equations of lines and circles in complex form ,Functions of complex variables, Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.

Unit II: Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, Harmonic functions, Construction of Analytic functions.

Unit III: Definite integrals of functions. Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursat theorem, Cauchy integral formula, Cauchy's inequality, Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences and series.

Unit IV: Linear and Bilinear Transformations, Cross ratio of four points , Conformal mapping, Transformations of the form z^2, $\frac{1}{z}$, $sinz$, $cosz$, e^z , $\sinh z$, $\cosh z$ etc , Laurent series and its examples, Poles and residues.

Reference Books:

1. L. V. Ahlfors – Complex Analysis
2. Bruce P. Palica – Introduction to the Theory of Function of a Complex Variable
3. Serge Lang – Complex Analysis
4. Shanthinarayan – Theory of Functions of a Complex Variable
5. S. Ponnuswamy – Foundations of Complex Analysis
6. R. P. Boas – Invitation to Complex Analysis.
7. R V Churchil & J W Brown, Complex Variables and Applications,5th ed.:McGraw Hill Companies., 1989.
8. A R Vashista, Complex Analysis, Krishna Prakashana Mandir, 2012.

Practical components -VI

1. Declaring a complex number and graphical representation.

2. Complex numbers and their representations, operations like addition, multiplication, division, modulus, graphical representations of polar form.
3. To plot the complex functions and analyze the graph

   (i)$f(z)= z$, (ii) $f(z) = z^3$, (iii) $f(z) =(z^4- 1)^{1/4}$
4. Some problems on Cauchy – Riemann equations (polar forms).
5. Implementation of Milne – Thomson method of constructing analytic functions (simple examples).
6. Illustrating orthogonality of the surfaces obtained from the real and imaginary parts of an analytic function.
7. Verifying real and imaginary parts of an analytic function being harmonic (in polar coordinates)
8. Examples connected with Cauchy's integral theorem.
9. To compute the poles and corresponding residues of complex functions.
10. Illustrating the angle preserving property in a transformation.
11. Illustrating the circles are transformed to circles by a bilinear transformation.
12. To perform conformal mapping and bilinear transformations.

Vector Calculus

CMF 27201/CMF27202/CMF27203/CMF27204

(Credits: Theory-04) **Theory: 60**

Lectures

COURSE OUTCOMES:

After successful completion of the course, the student is able to

CO1. Learn the characteristics of differentiation of vector function.

CO2. Deliberate the characteristics of cross product

CO3. Specify in details with examples dot product

CO4. Write down the characteristics of gradient

CO5. Understand the characteristics of divergence

CO6. Specify in depth curl

Skill Enhancement Course (SEC - II)

Unit I: Differentiation and partial differentiation of a vector function. Derivative of sum, dot product and cross product of two vectors.

Unit II: Gradient, divergence and curl, Standard derivations and Exercise ,

Reference Books:

1. Murray R Spiegel – Theory and problems of vector calculus.
2. Shanthinarayan and J N Kapur – A text book of Vector calculus.
3. B.S Grewal – Higher engineering mathematics.
4. Shanthi Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: S Chand and Co. Pvt. Ltd., 2014.

Question Paper Pattern
Mathematics

Time: 3 Hours Max. Marks: 70

Section – A

I. Answer any five questions. **5 x2 = 10**

1.
2.
3.
4.
5.
6.
7.
8.

Section – B

II. Answer any three questions. **3 x 5 = 15**

1.
2.
3.
4.
5.

III. Answer any three questions. **3 x 5 = 15**

1.
2.
3.
4.
5.

IV. Answer any three questions. **3 x 5 = 15**

1.
2.
3.
4.
5.

V. Answer any three questions. **3 x 5 = 15**

1.
2.
3.
4.
5.