University of Rajasthan
Jaipur

SYLLABUS

I-VI Semester
Examination-2024-25 AND ONWARDS
UNDER NEP-2020

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

SYLLABUS

SCHEME OF EXAMINATION AND COURSE OF STUDY

UNDER NEP 2020
for

(SEMESTER SCHEME: I-VI Semester)

UG0803- Three/Four Years Bachelor of Science

Medium of Instruction: Hindi and English

(SEMESTER SCHEME)

EXAMINATION 2024-2025 AND ONWARDS

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

Name of University	**University of Rajasthan, Jaipur**
Name of Faculty	**Science**
Name of Discipline	**Mathematics**
Type of Discipline	**Major**
List of Programme were offered as Minor Discipline	
Offered to Non-Collegiate Students	**Yes**

SEMESTER-WISE PAPER TITLES WITH DETAILS

UG0803-Three/Four Year Bachelor of Science (Maths Group)								
				Mathematics	**Credits**			
#	**Level**	**Sem**	**Type**	**Title**	**L**	**T**	**P**	**Total**
1.	**5**	**I**	**MJR**	**UG0803-MAT-51T-101** **Discrete Mathematics & Optimization Techniques-I**	**6**	**0**	**0**	**6**
2.	**5**	**II**	**MJR**	**UG0803-MAT-52T-102** **Calculus**	**6**	**0**	**0**	**6**
3.	**6**	**III**	**MJR**	**UG0803-MAT-63T-201** **Real Analysis-I & Differential Equations-I**	**4**	**0**	**0**	**4**
4.	**6**	**III**	**MJR**	**UG0803-MAT-63P-202** **Introduction to Scilab: A Mathematical Tool**	**0**	**0**	**2**	**2**
5.	**6**	**IV**	**MJR**	**UG0803-MAT-64T-203** **Real Analysis-II & Numerical Analysis**	**4**	**0**	**0**	**4**
6.	**6**	**IV**	**MJR**	**UG0803-MAT-64P-204** **Introduction to C Programming: As Mathematical Tool**	**0**	**0**	**2**	**2**

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

7.	**7**	**V**	**MJR**	**UG0803-MAT-75T-301** **Abstract Algebra & Three Dimensional Geometry**	**6**	**0**	**0**	**6**
8.	**7**	**VI**	**MJR**	**UG0803-MAT-76T-302** **Complex Analysis & Mechanics**	**6**	**0**	**0**	**6**

Examination Scheme

1. 1 credit = 25 marks for examination/evaluation

2. For Regular Students there will be Continuous assessment, in which sessional work and the terminal examination will contribute to the final grade. Each course in Semester Grade Point Average (SGPA) has two components- Continuous assessment (20% weightage) and (End of end-semester examination) EoSE (80% weightage).

3. For Regular Students,75% Attendance is mandatory for appearing in the EoSE.

4. To appear in the EoSE examination of a course/subject a regular student must appear in the mid-semester examination and obtain at least a C grade in the course/subject.

5. Credit points in a Course/Subject will be assigned only if, the regular student obtains at least a C grade in the CA and EoSE examination of a Course/Subject.

6. In the case of Non-Collegiate Students there will be no Continuous assessment and credit points in a course/subject will be assigned only if, the non-collegiate student obtains at least a C grade in the EoSE examination of a Course/Subject.

Examination Scheme for Continuous Assessment (CA)

DISTRIBUTION OF CONTINUOUS ASSESSMENT (CA) MARKS

S. No.	CATEGORY	Weightage (out of total internal marks)	THEORY					PRACTICAL		
			CORE (Only Theory)	CORE (Theory + Practical)	AEC	SEC	VAC	CORE (Theory +Practical)	SEC	VAC
	Max Internal Marks		30	20	20	10	10	10	10	10
1	Mid-term Exam	*50%*	15	10	10	5	5	5	5	5
2	Assignment	*25%*	7.5	5	5	2.5	2.5	2.5	2.5	2.5
3	Attendance	*25%*	7.5	5	5	2.5	2.5	2.5	2.5	2.5

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

		Regular Class Attendance	= 75%	3	2	2	1	1	1	1	1
			75-80%	4	3	3	1.5	1.5	1.5	1.5	1.5
			80-85%	5	4	4	2	2	2	2	2
			> 85%	7.5	5	5	2.5	2.5	2.5	2.5	2.5

Note:

1. Continuous assessment will be the sole responsibility of the teacher concerned.
2. For continuous assessment no remuneration will be paid for paper setting, Evaluation, Invigilation etc.
3. For continuous assessment Paper setting and Evaluation responsibility will be of teacher concern.
4. For continuous assessment no Answer sheets/question papers etc. will be provided by the University.
5. Colleges are advised to keep records of continuous assessment, attendance etc.

Examination Scheme for EoSE-

CA – Continuous Assessment
EoSE – End of Semester Examination

Regular Students –

[Courses which have Practical Examination]

The question paper will consist of **two** parts **A** & **B**.

PART-A: 20 Marks

Part A will be compulsory having question no. 1 of 10 very short answer-type questions of two marks each.

PART-B: 60 Marks

Part B of the question paper shall be comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 15 marks.

[Courses which do not have Practical Examination]

The question paper consists of **three** parts A, B & C.

PART-A: 20 Marks

Part A will be compulsory having question no. 1 of 10 very short answer-type questions of two marks each.

PART-B: 20 Marks

Part B of the paper shall consist of 4 questions viz. Question no. 2-5 having one question from each unit and the student shall attempt any 2 questions that carry 10 marks each.

PART-C: 80 Marks

Part C of the question paper shall be divided into four units comprising question numbers 6-9. There will be one question from each unit with internal choice. Each question will carry 20 marks.

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

[Examination Scheme for Practical Examination]

The question paper consists of three practicals, one practical each from Group A, Group B and Group C.

(i) One Practical from Group A : 10 Marks

(i) One Practical from Group B : 10 Marks

(i) One Practical from Group C : 10 Marks

(i) Viva-voce : 05 Marks

(i) Practical Record : 05 Marks

Total : 40 Marks

Non-Collegiate Students –

[courses which have Practical Examination]

The question paper will consist of **two** parts **A** & **B**.

PART-A: 20 Marks

Part A will be compulsory having question no. 1 of 10 very short answer-type questions of two marks each.

PART-B: 80 Marks

Part B of the question paper shall be comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 20 marks.

[courses which do not have Practical Examination]

The question paper consists of **three** parts A, B & C.

PART-A: 40 Marks

Part A will be compulsory having question no. 1 of 10 very short answer-type questions of two marks each.

PART-B: 30 Marks

Part B of the paper shall consist of 4 questions viz question no. 2-5 having one question from each unit. The student shall attempt any 2 questions that carry 15 marks each.

PART-C: 80 Marks

Part C of the question paper shall be comprising question numbers 6-9. There will be one question from each unit with internal choice. Each question will carry 20 marks.

[Examination Scheme for Practical Examination]

The question paper consists of three practicals, one practical each from Group A, Group B and Group C.

(i) One Practical from Group A : 12 Marks

(i) One Practical from Group B : 12 Marks

(i) One Practical from Group C : 12 Marks

(i) Viva-voce : 07 Marks

(i) Practical Record : 07 Marks

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

Total : 50 Marks

Syllabus
[UG0803-Three/Four Year Bachelor of Science (Maths Group)] - [UG0803-MAT-51T-101] - [Discrete Mathematics & Optimization Techniques-I]
I-Semester - [Mathematics]

Regular Students –

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Passing Marks (CA + EoSE)
Theory	UG0803-MAT-51T-101 Discrete Mathematics & Optimization Techniques-I	1 Hrs-CA 3 Hrs-EoSE	30 Marks-CA 120 Marks-EoSE	12 Marks-CA 48 Marks-EoSE

Non-Collegiate Students –

Type	Paper code and Nomenclature	Duration of Examination (EoSE)	Maximum Marks (EoSE)	Minimum Passing Marks (EoSE)
Theory	UG0803-MAT-51T-101 Discrete Mathematics & Optimization Techniques-I	3 Hrs	150 Marks	60 Marks

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
I	UG0803-MAT-51T-101	Discrete Mathematics & Optimization Techniques-I				5	6
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Introductory	UG	6	0	6	Yes	Lecture, Ninety lectures	
List of Programme Codes in which Offered as Minor Discipline							
Prerequisites		Mathematics courses of XIIStd.ofCentral Board of Secondary Education or equivalent.					
Objectives of the Course:		The objective of the course is to expose discrete structures and involved topology, an optimization of real world problems.					

Detailed Syllabus
[UG0803-MAT-51T-101] - [Discrete Mathematics & Optimization Techniques-I]

Unit - I

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

Relations on a set, Equivalence class, partial order relations, Chains and Anti-chains. Lattices, Distributive and Complemented Lattices. Boolean algebra, conjunctive normal form, disjunctive normal form. Principle of inclusion and exclusion. Propositional calculus, Basic logical operations, Truth tables, Tautologies and contradictions. **(22 Lectures)**

Unit -II

Discrete numeric functions, Generating functions, Recurrence relations, linear recurrence relation with constant coefficients and their solutions: Total solutions, Solution by the method of generating functions.Basic concepts of graph theory, Types of graphs, Walks, Paths & Circuits, Shortest path problem.

(23 Lectures)

Unit -III

Planar graphs, Operations on graphs (union, join, products). Matrix representation of graphs, Adjacency matrices, Incidence matrices. Hamiltonian and Eulerian graphs.Tree, Spanning tree, Minimum spanning tree, Distance between vertices, Center of tree, Binary tree, Rooted tree.

(22 Lectures)

Unit-IV

Linear programming problems. Feasible solution, Basic feasible solution. Some basic properties and theorems on convex sets. Simplex algorithm, Transportation problems. Assignment problems.

(23 Lectures)

Suggested Books and References –

1. V.K.Balakrishnan, Introductory Discrete Mathematics, Prentice-Hall, 1996.
2. N. Deo, Graph Theory with Applications to Computer Science, Prentice-Hall of India.
3. C.L. Liu, Elements of Discrete Mathematics, (Second Edition), McGraw Hill, International Edition, 1986.
4. Kenneth H. Roson, Discrete Mathematics and Its Applications, Tata Mc-GrawHiils, New Delhi, 2003.
5. G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.
6. Hamdy A. Taha, Operations Research, An Introduction (9th edition), Prentice-Hall, 2010.

Suggested E-resources:

1. **Online Lecture Notes and Course Materials**

Course Learning Outcomes:

The course would enable the student

1. To understand the ideas in discrete structures viz. Partially ordered sets, Lattices , Graphs etc. and allied conceptual intricacies with applications.
2. To understand mathematical formulation of optimization problems and allied theoretical concepts for solution methodologies for linear programming problems, Transportation problems and assignment problems.

Syllabus
[UG0803-Three/Four Year Bachelor of Science (Maths Group)] - [UG0803-MAT-52T-102] - [Calculus]
II-Semester - [Mathematics]

Regular Students –

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Passing Marks (CA + EoSE)
Theory	UG0803-MAT-52T-102 Calculus	1 Hrs-CA 3 Hrs-EoSE	30 Marks-CA 120 Marks-EoSE	12 Marks-CA 48 Marks-EoSE

Non-Collegiate Students –

Type	Paper code and Nomenclature	Duration of Examination (EoSE)	Maximum Marks (EoSE)	Minimum Passing Marks (EoSE)
Theory	UG0803-MAT-52T-102 Calculus	3 Hrs	150 Marks	60 Marks

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
II	UG0803-MAT-52T-102	Calculus				5	6
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Introductory	UG	6	0	6	Yes	Lecture, Ninety lectures	
List of Programme Codes in which Offered as Minor Discipline							
Prerequisites		Mathematics course of XII std. of Central Board of Secondary Education or equivalent.					
Objectives of the Course:		The objective of the course is to provide students with a comprehensive understanding of the fundamental concepts of calculus as a tool for dynamic systems, diverse topics which find applications in many branches of science.					

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

Detailed Syllabus

[UG0803-MAT-52T-102] - [Calculus]

Unit - I

Taylor's theorem. Maclaurin's theorem. Power series expansion of a function. Power series expansion of sin(x), cos(x), e^x, $\log_e(1+x)$, $(1+x)^n$. Derivative of the length of an arc. Pedal equations. Curvature: Various formulae, Centre of curvature and Chord of curvature.

(22 Lectures)

Unit -II

Partial differentiation. Euler's theorem for homogeneous functions. Chain rule of partial differentiation. Total differentiation, Differentiation of implicit functions. Envelopes: One parameter family of curves when two parameters are connected by a relation. Maxima and Minima of functions of two variables. Lagrange's method of undetermined multipliers.

(23 Lectures)

Unit -III

Asymptotes: Definition, Parallel to coordinate axes, General rational algebraic curves, inspection method, Intersection of a curve and its asymptotes. Multiple points. Curve tracing of Cartesian, Polar and parametric curves. Beta and Gamma functions.

(22 Lectures)

Unit-IV

Double integrals in Cartesian and Polar Coordinates, Change of order of integration. Triple integrals. Dirichlet's integral. Rectification, Area, Volume and Surface of solids of revolution.

(23 Lectures)

Suggested Books and References –

1. Shanti Narayan and P.K. Mittal, Integral Calculus, S. Chand & Co., N. D., 2013.
2. H.S.Dhami, Differential Calculus, Age Int. Ltd., New Delhi, 2012.
3. M. J. Strauss, G. L. Bradley and K. J. Smith, Calculus (3rd Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
4. H. Anton, I. Bivens and S. Davis, Calculus (7th Edition), John Wiley and sons (Asia), Pt Ltd., Singapore, 2002.
5. G.B. Thomas, R. L. Finney, M. D. Weir, Calculus and Analytic Geometry, Pearson Education Ltd, 2003.

Suggested E-resources:

1. **Online Lecture Notes and Course Materials:**

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Understand the concept of curvature, padel equations, partial differentiation, envelope, asymptotes.
2. Understand the concept of maxima-minima, curve tracing, double triple integration and their applications.

Syllabus
[UG0803-Three/Four Year Bachelor of Science (Maths Group)] - [UG0803-MAT-63T-201] - [Real Analysis-I & Differential Equations-I]
III-Semester - [Mathematics]

Regular Students –

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Passing Marks (CA + EoSE)
Theory	UG0803-MAT-63T-201 Real Analysis-I & Differential Equations-I	1 Hrs-CA 3 Hrs-EoSE	20 Marks-CA 80 Marks-EoSE	08 Marks-CA 32 Marks-EoSE

Non-Collegiate Students –

Type	Paper code and Nomenclature	Duration of Examination (EoSE)	Maximum Marks (EoSE)	Minimum Passing Marks (EoSE)
Theory	UG0803-MAT-63T-201 Real Analysis-I & Differential Equations-I	3 Hrs	100 Marks	40 Marks

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
III	UG0803-MAT-63T-201	Real Analysis-I & Differential Equations-I				6	4
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Introductory	UG	4	0	4	Yes	Lecture, Sixty Lectures	
List of Programme Codes in which Offered as Minor Discipline							
Prerequisites		Mathematics course of XII std. of Central Board of Secondary Education or equivalent.					
Objectives of the Course:		The primary objective of this course is to introduce the real line with algebraic, order,completeness properties, and convergence/ divergence of sequences. The course also provides the types of ordinary differential equations and their solution strategies.					

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

Detailed Syllabus

[UG0803-MAT-63T-201] - [Real Analysis-I & Differential Equations-I]

Unit - I

Bounded set, Neighbourhood, Limit point, Bolzano-Weierstrass theorem, closed and Open sets. Concept of compactness and connectedness. Heine-Borel theorem.

(15 Lectures)

Unit - II

Real sequences- Limit and Convergence of a sequence, Monotonic sequences. Cauchy's sequences, Subsequences, Cauchy's general principle of convergence. Continuous functions: Properties of continuous functions on closed intervals.

(15 Lectures)

Unit -III

Exact differential equations and equations which can be made exact. First order but higher degree differential equations solvable for x,y and p. Linear differential equations with constant coefficients, Complementary function and Particular integral.

(15 Lectures)

Unit-IV

Homogeneous linear differential equations, Linear differential equations of second order. Solution by transformation of the equation by changing the dependent variable/the independent variable, Method of variation of parameters, Method of undetermined coefficients.

(15 Lectures)

Suggested Books and References –

1. Royden H, Fitzpatrick PM. Real analysis. China Machine Press; 2010.
2. Rudin W. Principles of mathematical analysis. New York: McGraw-hill; 1964.
3. Bartle RG, Sherbert DR. Introduction to real analysis. New York: Wiley; 2000.
4. Mapa SK. Introduction to Real Analysis. Sarat Book Distributors; 2014.
5. Malik SC, Arora S. Mathematical analysis. New Age International; 1992.
6. Ross SL, Differential Equation-Jhon Wiley & Sons. Inc. New York. 1984.
7. Raisinghania MD, Ordinary and partial differential equations. S. Chand Publishing; 2013.

Suggested E-resources:

1. **Online Lecture Notes and Course Materials:**

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Apply Bolzano-Weierstrass and Heine-Borel theorems to real number sets.
2. Test sequence convergence using Cauchy's principle and analyse continuous functions on closed intervals.
3. Solve first-order and higher-degree differential equations and linear differential equations with constant coefficients.
4. Solve second-order linear differential equations using transformation techniques and assess linear

independence of solutions.

Syllabus
[UG0803-Three/Four Year Bachelor of Science (Maths Group)] - [UG0803-MAT-63P-202] - [Introduction to Scilab: A Mathematical Tool]
III-Semester - [Mathematics]

Regular Students –

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Passing Marks (CA + EoSE)
Practical	UG0803-MAT-63P-202 Introduction to Scilab: A Mathematical Tool	2 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	04 Marks-CA 16 Marks-EoSE

Non-Collegiate Students –

Type	Paper code and Nomenclature	Duration of Examination (EoSE)	Maximum Marks (EoSE)	Minimum Passing Marks (EoSE)
Practical	UG0803-MAT-63P-202 Introduction to Scilab: A Mathematical Tool	3 Hrs	50 Marks	20 Marks

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
III	UG0803-MAT-63P-202	Introduction to Scilab: A Mathematical Tool				6	2
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Introductory	UG	0	2	2	Yes	Practical, Sixty Hours of Practical	
List of Programme Codes in which Offered as Minor Discipline							
Prerequisites		Mathematics course of XII std. of Central Board of Secondary Education or equivalent.					
Objectives of the Course:		The objective of the course is to equip students with skills to create, analyze, and understand graphs. To teach the use of computational and programming functions within Scilab. To understand and apply methods for solving linear equations and other mathematical problems.					

Detailed Syllabus

[UG0803-MAT-63P-202] - [Introduction to Scilab: A Mathematical Tool]

Group-A

1. Plotting the graphs of the following functions : ax, $\sqrt{(ax+b)}$, $|ax+b|$, $c \pm |ax+b|$, $x^{\pm n}$, e^{ax+b}, $\log(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $|\sin(ax+b)|$, $|\cos(ax+b)|$. explaining the effects of

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

change in the real constant a, b and c on graphs. Plotting graphs of hyperbolic functions and inverse trigonometric functions, plotting and analyzing the graphs of polynomials and their derivatives.

2. Complex numbers: Operations like addition, subtraction, multiplication, division, Modulus and inbuilt functions conj, imag, imult, isreal, real. **(20 Hours)**

Group-B

1. Matrix operations: addition, multiplication, inverse, transpose, determinant, rank and inbuilt functions eye, ones, zeros. Solving the system of linear equations by using Matrix Division (\ Operator), using 'linsolve' function, using 'inv' function, using 'mldivide' function.
2. Finding Roots of equations by using 'fsolve' function, using 'roots' function, using 'mnewton' function.

(20 Hours)

Group-C

1. Solving linear programming problems by using inbuilt functions of Scilab.
2. Solving Ordinary Differential Equations (ODEs) by using the 'ode' function.

(20 Hours)

Suggested Books and References –

1. Sandeep Nagar, Introduction to Scilab: For Engineers and Scientists, APress; 1st ed. Edition.
2. Claude Gomez, Engineering and Scientific Computing with Scilab, Birkhauser Boston Inc; 1999th edition.
3. Tejas Sheth, Scilab: A Practical Introduction to Programming and Problem Solving, Createspace Independent Pub.

Suggested E-resources:

1. **Online Lecture Notes and Course Materials:**

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Understand graphical and numerical techniques and be able to apply them using Scilab.
2. Students should gain practical expertise in solving problems involving graphs, matrices, and equations.
3. Students should be prepared to utilise various mathematical techniques to solve different mathematical problems.

Syllabus
[UG0803-Three/Four Year Bachelor of Science (Maths Group)] - [UG0803-MAT-64T-203] - [Real Analysis-II & Numerical Analysis]
IV-Semester - [Mathematics]

Regular Students –

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Passing Marks (CA + EoSE)
Theory	UG0803-MAT-64T-203 Real Analysis-II & Numerical Analysis	1 Hrs-CA 3 Hrs-EoSE	20 Marks-CA 80 Marks-EoSE	08 Marks-CA 32 Marks-EoSE

Non-Collegiate Students –

Type	Paper code and Nomenclature	Duration of Examination (EoSE)	Maximum Marks (EoSE)	Minimum Passing Marks (EoSE)
Theory	UG0803-MAT-64T-203 Real Analysis-II & Numerical Analysis	3 Hrs	100 Marks	40 Marks

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
IV	UG0803-MAT-64T-203	Real Analysis-II & Numerical Analysis				6	4
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Introductory	UG	4	0	4	Yes	Lecture, Sixty Lectures	
List of Programme Codes in which Offered as Minor Discipline							
Prerequisites		UG0803-MAT-63T-201 Real Analysis-I & Differential Equations-I					
Objectives of the Course:		The primary objective of this course is to enable students to understand fundamental concepts of differentiable functions, apply Darboux's, Rolle's theorems, Riemann integration, mean value theorems, and to learn numerical techniques viz. Interpolation, Numerical integration, roots of equation, solution of initial value problem.					

Detailed Syllabus
[UG0803-MAT-64T-203] - [Real Analysis-II & Numerical Analysis]

Unit - I

Properties of derivable functions, Darboux's and Rolle's theorem. Notion of limit, continuity and differentiability for functions of two variables. Directional derivative, total derivative, expression of total derivative in terms of partial derivatives.

(15 Lectures)

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

Unit - II

Riemann integration – Lower and Upper Riemann integrals, Riemann integrability, Mean value theorems of integral calculus, Fundamental theorem of integral calculus. Functions of bounded variations.

(15 Lectures)

Unit -III

Differences. Relation between differences and derivatives. Differences of a polynomial. Newton's formulae for forward and backward interpolation. Divided differences. Newton's divided difference, Lagrange's interpolation formula. Numerical Differentiation. Derivatives from interpolation formulae.

(15 Lectures)

Unit-IV

Numerical integration, Derivations of general quadrature formulas, Trapezoidal rule. Simpson's one-third, Simpson's three-eighth and Gauss's quadrature formulae. Numerical solution of Algebraic and Transcendental equations: Bisection method, secant method, Regula-Falsi method, Iteration method, Newton- Raphson Method. Numerical solutions of ordinary differential equations of first order with initial conditions using Euler and modified Euler's method.

(15 Lectures)

Suggested Books and References –

1. Royden H, Fitzpatrick PM. Real analysis. China Machine Press; 2010.
2. Rudin W. Principles of mathematical analysis. New York: McGraw-hill; 1964.
3. Bartle RG, Sherbert DR. Introduction to real analysis. New York: Wiley; 2000.
4. Mapa SK. Introduction to Real Analysis. Sarat Book Distributors; 2014.
5. Malik SC, Arora S. Mathematical analysis. New Age International; 1992.
6. Burden RL, Faires JD. Numerical analysis, brooks;1997.
7. Iyengar SR, Jain RK. Numerical Methods. New Age International; 2009.
8. Sastry SS. Introductory methods of numerical analysis. PHI Learning Pvt. Ltd.; 2012.

Suggested E-resources:

1. **Online Lecture Notes and Course Materials:**

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Analyse multivariable functions using differentiability and partial derivatives.
2. Solve problems using Riemann integrability and integral calculus theorems.
3. Use interpolation formulas for data approximation and numerical differentiation.
4. Apply numerical methods to solve equations and differential equations.

Syllabus
[UG0803-Three/Four Year Bachelor of Science (Maths Group)] - [UG0803-MAT-64P-204] - [Introduction to C Programming: As Mathematical Tool]
IV-Semester - [Mathematics]

Regular Students –

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Passing Marks (CA + EoSE)
Practical	UG0803-MAT-64P-204 Introduction to C Programming: As Mathematical Tool	2 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	04 Marks-CA 16 Marks-EoSE

Non-Collegiate Students –

Type	Paper code and Nomenclature	Duration of Examination (EoSE)	Maximum Marks (EoSE)	Minimum Passing Marks (EoSE)
Practical	UG0803-MAT-64P-204 Introduction to C Programming: As Mathematical Tool	3 Hrs	50 Marks	20 Marks

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
IV	UG0803-MAT-64P-204	Introduction to C Programming: As Mathematical Tool				6	2
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Introductory	UG	0	2	2	Yes	Practical, Sixty Hours of Practical	
List of Programme Codes in which Offered as Minor Discipline							
Prerequisites		Mathematics course of XII std. of Central Board of Secondary Education or equivalent.					
Objectives of the Course:		The objective of the course is to enable students learn the basic knowledge of developing algorithms for various Mathematical problems and preparing codes for these algorithms in C language.					

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

Detailed Syllabus

[UG0803-MAT-64P-204] - [Introduction to C Programming: As Mathematical Tool]

Programming languages and problem solving on computers, Algorithm, Flow chart, Programming in C-Constants, Variables, Arithmetic and logical expressions, Input-Output, Conditional statements, Implementing loops in Programs, Defining and manipulating arrays and functions.

Group-A

1. Printing n terms of Fibonacci sequence and finding factorial n, summation n, summation of square of n etc.
2. Defining a function and finding sum of n terms of a series/sequence whose general term is given.
3. Finding gcd and lcm of two numbers by Euclid's algorithm.
4. Checking prime/composite numbers and finding the number of primes less than n, where n is a positive integer.
5. Finding mean, standard deviation and Permutation, Combination.

(20 Hours)

Group-B

6. Numerical integration using Trapezoidal rule.
7. Numerical integration using Simpson's ⅓ rule.
8. Numerical integration using Simpson's 3/8 rule.
9. Numerical integration using Waddle rules.
10. Preparing forward and backward difference tables.

(20 Hours)

Group-C

11. Solution of algebraic and transcendental equations by Bisection method.
12. Solution of algebraic and transcendental equations by Regula-falsi method.
13. Solution of algebraic and transcendental equations by Newton-Raphson method.
14. Solution of Initial value problems by Euler's method.
15. Solution of Initial value problems by Runga-Kutta fourth order method.

(20 Hours)

Suggested Books and References –

1. B. W. Kernighan and D. M. Ritchi : The C-Programming Language, 2nd Edi.(ANSI Refresher), Prentice Hall, 1977.
2. E. Balagurnsamy : Programming in ANSI C, Tata McGraw Hill, 2004.
3. Y. Kanetkar : Let Us C ; BPB Publication, 1999.
4. C. Xavier : C-Language and Numerical Methods, New Age International, 2007.
5. V. Rajaraman : Computer Oriented Numerical Methods, Prentice Hall of India, 1980.

Suggested E-resources:

1. **Online Lecture Notes and Course Materials:**

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Understand the logic for a given problem.
2. Write the algorithm of a given problem.
3. Draw a flow chart of a given problem.
4. Recognize and understand the syntax and construction of C programming code.

Syllabus
[UG0803-Three/Four Year Bachelor of Science (Maths Group)] - [UG0803-MAT-75T-301] - [Abstract Algebra & Three Dimensional Geometry]
V-Semester - [Mathematics]

Regular Students –

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Passing Marks (CA + EoSE)
Theory	UG0803-MAT-75T-301 Abstract Algebra & Three Dimensional Geometry	1 Hrs-CA 3 Hrs-EoSE	30 Marks-CA 120 Marks-EoSE	12 Marks-CA 48 Marks-EoSE

Non-Collegiate Students –

Type	Paper code and Nomenclature	Duration of Examination (EoSE)	Maximum Marks (EoSE)	Minimum Passing Marks (EoSE)
Theory	UG0803-MAT-75T-301 Abstract Algebra & Three Dimensional Geometry	3 Hrs	150 Marks	60 Marks

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
V	UG0803-MAT-75T-301	Abstract Algebra & Three Dimensional Geometry				7	6
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Introductory	UG	6	0	6	Yes	Lecture, Ninety lectures	
List of Programme Codes in which Offered as Minor Discipline							
Prerequisites		Mathematics course of XII std. of Central Board of Secondary Education or equivalent.					

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

Objectives of the Course:	The objective of the course on Group Theory, Ring Theory, and three dimensional geometry, as outlined in the syllabus, is to provide students with a thorough understanding of fundamental algebraic structures, their applications and basic three dimensional geometrical shapes.

Detailed Syllabus

[UG0803-MAT-75T-301] - [Abstract Algebra & Three Dimensional Geometry]

Unit - I

Binary operations, Algebraic structure, Groups, Order of group, finite and infinite order groups and their order specific theorems, Subgroups and their properties, Permutation group, Cyclic group. Cosets, Lagrange's theorem.

(22 Lectures)

Unit - II

Morphism of groups, Cayley's theorem. Normal subgroups and Quotient groups. Fundamental theorems of Homomorphism.

(23 Lectures)

Unit -III

Definition and simple properties of Rings and Subrings. Morphism of rings. Integral domain and field. Characteristics of a Ring and Field.

(22 Lectures)

Unit-IV

Sphere: Equation of Sphere, Plane section of sphere, intersection of a sphere by a line, tangent line and tangent plane of a sphere, angle of intersection of two spheres. Cone: Equation of cone, tangent plane of a cone, right circular cone, enveloping cone. Cylinder: Equation of cylinder, enveloping cylinder, right circular cylinder.

(23 Lectures)

Suggested Books and References –

1. Kenneth Hoffman, Ray Alden Kunze, Linear Algebra 2nd Ed., Prentice-Hall Of India Pvt. Limited, 1971.
2. I.N.Herstein, Topics in Algebra, Wiley-Eastern Ltd., New Delhi.
3. Joseph A. Gallian, Contemporary Abstract Algebra (4th Edition), Narosa Publishing House, New Delhi, 1999.(IX Edition 2010).
4. N.S.Gopalkrishnan, University Algebra, New Age International, 1986.
5. G.C.Sharma, Modern Algebra, Shivlal Agrawal & Co., Agra,1998.
6. S.L. Loney, The Elements of Coordinate Geometry, Macmillan and co. London, 1895.
7. R.J.T. Bell, Elementary Treatise on Co-ordinate geometry of three dimensions, Macmillan India Ltd., 1994.

Suggested E-resources:

1. **Online Lecture Notes and Course Materials:**

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Develop a solid theoretical foundation in algebraic structures including groups, rings, integral domains and fields.
2. Apply theoretical concepts to solve problems involving group theory, ring theory.
3. Analyze and differentiate algebraic structures and their interrelations.
4. Understand the applications of algebraic structures in various mathematical and scientific disciplines.

Syllabus
[UG0803-Three/Four Year Bachelor of Science (Maths Group)] - [UG0803-MAT-76T-302] - [Complex Analysis & Mechanics]
VI-Semester - [Mathematics]

Regular Students –

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Passing Marks (CA + EoSE)
Theory	UG0803-MAT-76T-302 Complex Analysis & Mechanics	1 Hrs-CA 3 Hrs-EoSE	30 Marks-CA 120 Marks-EoSE	12 Marks-CA 48 Marks-EoSE

Non-Collegiate Students –

Type	Paper code and Nomenclature	Duration of Examination (EoSE)	Maximum Marks (EoSE)	Minimum Passing Marks (EoSE)
Theory	UG0803-MAT-76T-302 Complex Analysis & Mechanics	3 Hrs	150 Marks	60 Marks

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
VI	UG0803-MAT-76T-302	Complex Analysis & Mechanics				7	6
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Introductory	UG	6	0	6	Yes	Lecture, Ninety lectures	
List of Programme Codes in which Offered as Minor Discipline							
Prerequisites		Mathematics course of XII std. of Central Board of Secondary Education or equivalent.					

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

Objectives of the Course:	The objective of the course is to enable students to understand and apply complex analysis, principles of equilibrium and work, and solve mechanical motion problems.

Detailed Syllabus

[UG0803-MAT-76T-302] - [Complex Analysis & Mechanics]

Unit - I

Complex valued function: Limits, Continuity and Differentiability. Analytic functions, Cauchy-Riemann equations. Harmonic functions, Construction of an analytic function. Complex integration, Complex line integrals, Cauchy integral theorem, Indefinite integral, Fundamental theorem of integral calculus for complex functions. Cauchy integral formula, Analyticity of the derivative of an analytic function.

(22 Lectures)

Unit - II

Taylor's theorem. Laurent's theorem. Maximum modulus theorem. Singularities of an analytic function, Branch point, Meromorphic and Entire functions, Residue at a singularity, Cauchy's residue theorem.

(23 Lectures)

Unit -III

Velocity and acceleration – along radial and transverse directions, along tangential and normal directions, Motion in resisting medium – Resistance varies as velocity and square of velocity, Motion on a smooth curve in a vertical plane.

(22 Lectures)

Unit-IV

Equilibrium of coplanar forces, moments, Friction, Virtual Work and catenary.

(23 Lectures)

Suggested Books and References –

1. Brown JW, Churchill RV. Complex variables and applications. McGraw-Hill,; 2009.
2. Kasana HS. Complex variables: theory and applications. PHI Learning Pvt. Ltd.; 2005.
3. Ponnusamy S, Silverman H. Complex variables with applications. Springer Science & Business Media; 2007.
4. A.S.Ramsey, Statics, CBS Publishing & Distributors, New Delhi.
5. M. Ray, A Text Book of Dynamics, S. Chand & Co., 2003.
6. J.L. Synge & B.A. Griffith - Principles of Mechanics, Tata McGraw-Hill, 1959.
7. R.C. Hibbeler and Ashok Gupta, Engineering Mechanics: Statics and Dynamics (11th Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.

Suggested E-resources:

1. **Online Lecture Notes and Course Materials**

Course Learning Outcomes:

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

By the end of the course, students would have achieved the following:

1. Grasped the concepts of Taylor's and Laurent's theorems as they apply to complex functions.
2. Conducted analysis on the singularities of analytic functions, including branch points, meromorphic functions, entire functions, and residues at singularities using the Cauchy residue theorem.
3. Understand and calculate velocity and acceleration in various directions and analyze motion in resisting media.
4. Analyze the equilibrium of coplanar forces, calculate moments, and understand the effects of friction.
5. Apply the principles of virtual work to mechanical systems and analyze motion on smooth curves in vertical planes.
6. Mathematical treatment to the configuration called Catenary.