MAHARAJA SURAJMAL BRIJ UNIVERSITY
BHARATPUR (RAJASTHAN)
SYLLABUS

(Three/Four Year Undergraduate Programme)

Faculty of Science

(Maths Group)

III & IV Semester

Examination 2024-25 & onwards

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Name of University	**MAHARAJA SURAJMAL BRIJ UNIVERSITY BHARATPUR (RAJASTHAN)**
Name of Faculty	Science
Name of Programme	Three/Four Year Undergraduate Programme in Science (Maths Group)
Name of Discipline	Mathematics

PROGRAMME PREREQUISITES
Mathematics course of XIIth std. of Central Board of Secondary Education, Rajasthan board of secondary education or equivalent.
PROGRAMME OUTCOME
The program would enable student to take on advanced course in Mathematics with global needs and to serve as a formidable skill-force in research, academia, industry, government, and other sectors where mathematics is reckoned as a strong devising and design tool with diverse interdisciplinary applications.

Scheme of Examination-

1 credit = 25 marks for examinations/evaluation.

Each course in Semester Grade Point Average (SGPA) has two components-

(1) Class Assignment. (20% weightage)

(2) End of the Semester Examination (EoSE) (80% weightage)

1. Class Assignment- Sessional work consists of class tests and Mid-term examinations as determined by the faculty in charge of the course of study.
2. Each Paper of EoSE shall carry 80% of the total marks of the course/subject. The EoSE will be of 3 hours duration. Each question will carry equal marks and have two parts as –
   - Part-A of the question paper shall consist of first question with 10 short answer type questions of 2 marks each, these 10 short questions are selected from all the units at least two questions from each unit. The first question shall be based on knowledge, understanding and applications of the topics/texts covered in the syllabus.
   - The Part-B of the question paper shall consist of four questions of 20 marks each, one from each unit. Each Question will have four parts. A Candidate is required to attempt all four units by taking any two parts from each question.
3. 75% Attendance is mandatory for appearing in EOSE.
4. To appear in the EoSE examination of a course/subject student must appear in the Practical examination and obtain at least a "C" grade in the course/subject.
5. Credit points in a course/Subject will be assign only if, the student obtains at least a C grade in Practical and EoSE examination of the course/subject.

Exit and Entrance Policy: -

1. Students who opt to exit after completion of the first year and have secured 48 credits will be awarded a UG Certificate if, in addition, they complete one internship of 4 credits during the summer vacation of the first year. These students are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.
2. Students who opt to exit after completion of the second year and have secured 96 credits will be awarded the UG diploma if, in addition, they complete one internship of 4 credits during the summer vacation of the second year. These students are allowed to re-enter within a period of three years and complete the degree programme within the maximum period of seven years.
3. Students who wish to undergo a 3-year UG programme will be awarded UG Degree in the Major discipline after successful completion of three years, securing 150 credits and satisfying the minimum credit requirement.
4. A four-year UG Honours degree in the major discipline will be awarded to those who complete a four-

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year degree programme with 200 credits and have satisfied the minimum credit requirements.

5. Students who secure 75% marks and above in the first six semesters and wish to undertake research at the undergraduate level can choose a research stream in the fourth year. They should do a research project or dissertation Render the guidance of a faculty member of the University/College. The research project/dissertation will be in the major discipline. The students who secure 200 credits, including 12 credits from a research project/dissertation, are awarded UG Degree (Honours with Research).

Letter Grades and Grade Points-

Letter Grade	Grade Point	Marks Range (%)
O(Outstanding)	10	91-100
A+ (Excellent)	9	81-90
A (Very Good)	8	71-80
B+ (Good)	7	61-70
B (Above Average)	6	51-60
C (Average)	5	40-50
P (Pass)	4	
F (Fail)	0	
Ab (Absent)	0	

Syllabus - Three/Four Year Undergraduate Programme in Science
(Maths Group)
III-Semester (Mathematics)
(2024-2025 & onwards)

Type	Paper Code and Nomenclature	Duration of Examination	Maximum Marks (MT+ EoSE)	Minimum Passing Marks (MT+ EoSE)
Theory	MAT-20T-301 Real Analysis and Differential Equations	1 Hrs- MT 3Hrs- EoSE	25 Marks- MT 100 Marks- EoSE	10 Marks- MT 40 Marks- EoSE
Practical	MAT-20P-302 MATH-Lab-I	1 Hrs- MT 2Hrs- EoSE	05 Marks- MT 20 Marks- EoSE	2 Marks- MT 08 Marks- EoSE

Semester	Code of the course	Title of the course/paper	NHEQF Level	Credit
III	MAT-20T-301	Real Analysis and Differential Equations	5	5
III	MAT-20P-302	MATH-Lab-I	5	1
Level of Course	Type of the Course	Delivery Type of the Course		
Introductory	UG	Lecture, sixty lecture		
Prerequisites	Mathematics course of XIIth std. of Central Board of Secondary Education, Rajasthan board of secondary education or equivalent.			
Objectives of the courses	The objective of the course is to expose discrete structures and involved topology, learn the basic problems of calculus			

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Syllabus

Paper Code – MAT-20T-301

Paper – Real Analysis and Differential Equations

Duration of Examination	Maximum Marks	Minimum Marks
1 Hours	Midterm (MT) - 25 Marks	Midterm (MT) - 10 Marks
3 Hours	EoSE- 100 Marks	EoSE- 40 Marks

Teaching: 6 hrs per week

The Question paper will be divided into two parts, Part-A and Part-B

***Part-A**: Part-A contains one compulsory question consisting of 10 short answer type questions, each carrying 2 Marks. These 10 short questions are selected from all the units at least two questions from each unit. The Part-A of the question paper evaluate the candidate's knowledge, understanding, and application of the topics/texts covered in the syllabus.*

***Part-B**: Part-B comprise four questions with one question from each unit, each carrying 20 marks. Each question in Part-B has four subparts. The candidate must attempt all four units by selecting any two subparts from each question. Each subpart within a question carries equal marks.*

***Note**- The question Paper will be set in both Hindi and English.*

Unit-I: The set of real numbers as a complete ordered field, Incompleteness of Q, Archimedean and Dense properties of R, Absolute value of real numbers, Intervals, Limit point of a set, Bolzano-Weierstrass theorem. Open and Closed sets. Real Sequences- Bounded and unbounded sequences, Monotonic sequences, Limit Point and Limit of a sequence, Convergence of a sequence, Necessary and sufficient condition for convergence, Sub sequence, Cauchy sequence, Cauchy's General principle for convergence. Continuity of a function- Cauchy's and Heine's definition of continuity. Type of discontinuity, Properties of continuous function on closed intervals. Differentiability- Darboux theorem, Rolle's Theorem, Algebraic and geometric interpretation of Rolle's Theorem.

Unit-II: Reimann Integration- Partition of an interval, Darboux sum, Lower and Upper Riemann Integrals, Definition of Riemann Integration, Integrability of continuous, discontinuous, and monotonic functions. Fundamental Theorem of Integral calculus, Mean value theorem. Uniform convergence of Sequences and series of functions- Cauchy's Criterion for uniform convergence, M_n test, Weierstrass M – test, Abel Test, Dirichlet's Test, Uniform convergence, and continuity, term by term integration and term by term differentiation.

Unit-III: Order and degree of differential equations, Differential equations of first and first degree - Method of separation of variables, Homogeneous differential equation, and equations reducible to homogeneous forms, Linear differential equation, and equations reducible to linear forms. Exact differential equation. Differential equations of first order but not of first degree- Differential equations solvable for x, y and p. Linear differential equations with constant coefficients: - Complimentary Functions and Particular integrals. Homogeneous linear differential equations, Differential equations reducible to homogeneous linear differential equations.

Unit-IV: Simultaneous differential equations, Differential equations of the form $dx/P = dy/Q = dz/R$.. Linear differential equations of second order- Solution by finding a part of complimentary function, Solution by transformation into Normal form and by changing the independent variable, Factorisation of operators, Method of variation of parameters. Partial differential equation of first order and first degree, Lagrange's linear equations. Charpit's method. Linear partial differential equations with constant coefficient, Homogeneous and Non-homogeneous linear partial differential equations.

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Practical

Paper code- MAT-20P-302

Paper - MATH-Lab-I

Duration of Examination	Maximum Marks	Minimum Marks
1 Hours	Midterm (MT) - 05 Marks	Midterm (MT) - 02 Marks
2 Hours	EoSE- 20 Marks	EoSE- 08 Marks

Teaching: 2 hrs per week

Practical – Each candidate is required to appear in the practical examination to be conducted by internal and external examiners. External examiner will be appointed by university and internal examiner will be appointed by the principal consultation with Head, department of Mathematics in the college. An internal/External examiner can conduct practical examination of not more than 100 candidate (20 candidate in each batch).

Semester	Code of the course	Title of the course/paper	NHEQF Level	Credit
III	MAT-20P-302	MATH-Lab-I	5	1
Level of Course	Type of the Course	Delivery Type of the Course		
Introductory	UG	Lecture and laboratory, thirty lecture		
Prerequisites	Mathematics course of XIIth std. of Central Board of Secondary Education, Rajasthan board of secondary education or equivalent.			
Objectives of the courses	The objective of the course is to expose discrete structures and involved topology, learn the basic problems of calculus			

Distribution of Marks:

S.No.	Exercise	Marks
1.	Two Exercises one from each group	6+6=12
2.	Practical record	4
3.	Viva-Voce	4
4.	**Total**	**20 Marks**

Group-A: Improper Integrals- Improper integrals and their convergence, Comparison Test, μ-test, Abel's test, Dirichlet's test. Test of convergence of gamma and beta function.

Fourier series – Periodic functions, Dirichlet's condition, Fourier series in interval $(\alpha, \alpha + 2\pi)$ and Particular cases in the interval $(0,2\pi)$ $(-\pi, \pi)$.

Group-B: Singular solutions with extraneous loci. Exact differential equations of n^{th} order.

Each candidate (regular/non-collegiate) must prepare his/her record.

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Syllabus - Three/Four Year Undergraduate Programme in Science
(Maths Group)
IV-Semester (Mathematics)
(2024-2025 & onwards)

Type	Paper Code and Nomenclature	Duration of Examination	Maximum Marks (MT+ EoSE)	Minimum Passing Marks (MT+ EoSE)
Theory	MAT-20T-401 Numerical analysis and Linear Programming Problem	1 Hrs- MT 3Hrs- EoSE	25 Marks- MT 100 Marks- EoSE	10 Marks- MT 40 Marks- EoSE
Practical	MAT-20P-402 MATH-Lab-II	1 Hrs- MT 2Hrs- EoSE	05 Marks- MT 20 Marks- EoSE	2 Marks- MT 08 Marks- EoSE

Semester	Code of the course	Title of the course/paper	NHEQF Level	Credit
IV	MAT-20T-401	Numerical analysis and Linear Programming Problem	5	5
IV	MAT-20P-402	MATH-Lab-II	5	1
Level of Course	Type of the Course	Delivery Type of the Course		
Introductory	UG	Lecture, sixty lecture		
Prerequisites	Mathematics course of XIIth std. of Central Board of Secondary Education, Rajasthan board of secondary education or equivalent.			
Objectives of the courses	The objective of the course is to expose discrete structures and involved topology, learn the basic problems of calculus			

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Syllabus

Paper Code: – MAT-20T-401

Paper: - Numerical analysis and Linear Programming Problem

Duration of Examination	Maximum Marks	Minimum Marks
1 Hours	Midterm (MT) - 25 Marks	Midterm (MT) - 10 Marks
3 Hours	EoSE- 100 Marks	EoSE- 40 Marks

Teaching: 6 hrs per week

The Question paper will be divided into two parts, Part-A and Part-B

***Part-A**: Part-A contains one compulsory question consisting of 10 short answer type questions, each carrying 2 Marks. These 10 short questions are selected from all the units at least two questions from each unit. The Part-A of the question paper evaluate the candidate's knowledge, understanding, and application of the topics/texts covered in the syllabus.*

***Part-B**: Part-B comprise four questions with one question from each unit, each carrying 20 marks. Each question in Part-B has four subparts. The candidate must attempt all four units by selecting any two subparts from each question. Each subpart within a question carries equal marks.*

***Note**- The question Paper will be set in both Hindi and English.*

Unit-I: Calculus of Finite Differences: - Introduction, Difference Operators, Differences of Polynomials, Factorial notation, Relation between difference and derivative, Separation of symbols. Newton-Gregory's formulae for Forward and Backward interpolation with equal intervals, Newton's divided difference interpolation formula. Central differences- Gauss's central difference interpolation formulae, Stirling, and Bessel's interpolation formulae. Numerical differentiation.

Unit-II: Numerical integration: - General quadrature formula, Trapezoidal rule, Simpson's one-third rule, Simpson three-eight rule, Weddle rule, Newton-Cote's quadrature formula, Gauss's quadrature formula. Numerical solution of algebraic and transcendental equations - Graphical method, Iterative method, Bisection Method, Regula-Falsi method, Newton-Raphson method. Solution of system of linear equations: - Gauss's elimination method, Gauss- Jordan's elimination method, method of triangularisation of matrices. Jacobi's method and Gauss-Seidel method.

Unit-III: Numerical solution of ordinary differential equations: - Picard's successive approximation method. Euler's method and Euler's modified method. Runge- Kutta method. Linear programming problem: - Feasible solution, optimal solution, Basic solution. Degenerate and non-degenerate basic solution, convex sets and their properties, Extreme point of a set. Analytic Method, Theory of Simplex method, Optimality criterion, Simplex algorithm. Big-M Method, Applications of L.P.P.

Unit-IV: Duality in linear programming problem - Dual of 1. p. p., properties of the dual, Fundamental theorem of L. p. p., use of duality to solve l. p. p. Transportation problem: - Basic feasible solution and methods to find it. North-west corner rule, least-cost method, Vogel's approximation method. Optimality criterion. Degeneracy, Unbalanced Transportation Problem. Assignment problems- Mathematical formulation, Reduction Theorem, Hungarian method, Travelling Salesman problem. Comparison of transportation problem and Assignment Problems.

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Practical

Paper code: - MAT-20P-402

Paper: – MATH-Lab-II

Duration of Examination	Maximum Marks	Minimum Marks
1 Hours	Midterm (MT) - 05 Marks	Midterm (MT) - 02 Marks
2 Hours	EoSE- 20 Marks	EoSE- 08 Marks

Teaching: 2 hrs per week

Practical – Each candidate is required to appear in the practical examination to be conducted by internal and external examiners. External examiner will be appointed by university and internal examiner will be appointed by the principal consultation with Head, department of Mathematics in the college. An internal/External examiner can conduct practical examination of not more than 100 candidate (20 candidate in each batch).

Semester	Code of the course	Title of the course/paper	NHEQF Level	Credit
IV	MAT-20P-402	MATH-Lab-II	5	1
Level of Course	Type of the Course	Delivery Type of the Course		
Introductory	UG	Lecture and laboratory, thirty lecture		
Prerequisites	Mathematics course of XIIth std. of Central Board of Secondary Education, Rajasthan board of secondary education or equivalent.			
Objectives of the courses	The objective of the course is to expose discrete structures and involved topology, learn the basic problems of calculus			

Distribution of Marks:

S.No.	Exercise	Marks
1.	Two Exercises one from each group	6+6=12
2.	Practical record	4
3.	Viva-Voce	4
4.	**Total**	**20 Marks**

Group-A: Lagrange's interpolation formula. Numerical solution of algebraic and transcendental equations using Bisection method. Secant method, Newton-Raphson method. Jacobi's method and Gauss-Seidel method to solve system of linear equations. Numerical solution of differential equations using Runge-Kutta method.

Group-B: Linear programming problem - Problem Based on simplex method, Assignment problem, Transportations Problems, and their solutions.

Each candidate (regular/non-collegiate) must prepare his/her record

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