

**SOPHIA GIRLS' COLLEGE,  
AJMER  
(AUTONOMOUS)**



**SYLLABUS**

**(Batch)  
2018-19**

**FOR**

**MATHEMATICS**

**Semester – I to VI**

# BACHELOR OF SCIENCE

Eligibility for admission in First Year of B.Sc. Mathematics is 10+2 examination of any Board with at least 50% marks. With regard to admission on reserved category seats government rules will be applicable.

## SCHEME OF EXAMINATION

The number of the paper and the maximum marks for each paper, together with the minimum marks required for a pass are shown against each subject separately. It will be necessary for a candidate to pass in the theory as well as the practical part of a subject/paper, wherever prescribed, separately.

Classification of successful candidates shall be as follows:

First Division	60%	of the aggregate marks prescribed in Semesters I to VI taken together
Second Division	48%	

All the rest shall be declared to have passed the examination.

1. For passing a candidate shall have to secure at least 40% marks in each course (Theory and Practical separately).
2. No division shall be awarded in Semesters I to V.
3. Wherever a candidate appears for a due paper examination, she will do so according to the syllabus in force at the time of her admission.
4. A candidate not appearing in any examination/absent in any paper of term end examination shall be considered as having DUE in those papers.

## End Semester Examination Pattern

**Maximum Marks: 50**

**Duration: 2 ½ Hrs.**

### **Section A**

Contains 10 Questions of 1 mark each and all are compulsory.

10 x 1 = 10 marks

Three questions from each unit and one extra question from any one unit.

3 + 3 + 4 = 10 Questions

### **Section B**

Contains 3 questions with internal choice (Two questions from each unit).

Each Question carries 5 marks.

A student has to attempt 3 questions, choosing at least one question from each unit.

5 x 3 = 15 marks

### **Section C**

Contains 3 questions with internal choice (Two questions from each unit).

Each Question carries 10 marks.

A student has to attempt 3 questions, choosing at least one question from each unit.

3 x 15 = 45 marks

## Examination Scheme for Science (2018-19 Batch)

<b>Semester – I</b>					
<b>Theory Papers</b>	<b>Internal</b>	<b>External</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Duration</b>
MAT – 101 Matrices	30	70	100	40	2 ½ Hr.
MAT– 102 Algebra	30	70	100	40	2 ½ Hr.
<b>Total</b>			<b>200</b>	<b>80</b>	
<b>Semester – II</b>					
<b>Theory Papers</b>	<b>Internal</b>	<b>External</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Duration</b>
MAT – 201 Vector calculus and Geometry	30	70	100	40	2 ½ Hr.
MAT– 202 Calculus	30	70	100	40	2 ½ Hr.
<b>Total</b>			<b>200</b>	<b>80</b>	

## Examination Scheme for Science (2018-19 Batch)

<b>Semester – III</b>					
<b>Theory Papers</b>	<b>Internal</b>	<b>External</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Duration</b>
MAT – 301 Linear Algebra	30	70	100	40	2 ½ Hr.
MAT– 302 Differential Equations	30	70	100	40	2 ½ Hr.
<b>Total</b>			<b>200</b>	<b>80</b>	
<b>Semester –IV</b>					
<b>Theory Papers</b>	<b>Internal</b>	<b>External</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Duration</b>
MAT – 401 Real Analysis	30	70	100	40	2 ½ Hr.
MAT – 402 Mechanics	30	70	100	40	2 ½ Hr.
<b>Total</b>			<b>200</b>	<b>80</b>	

## Examination Scheme for Science (2018-19 Batch)

<b>Semester – V</b>					
<b>Theory Papers</b>	<b>Internal</b>	<b>External</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Duration</b>
MAT – 501 Metric spaces and Complex Analysis	30	70	100	40	2 ½ Hr.
MAT– 502 Linear Programming	30	70	100	40	2 ½ Hr.
<b>Total</b>			<b>200</b>	<b>80</b>	
<b>Semester – VI</b>					
<b>Theory Papers</b>	<b>Internal</b>	<b>External</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Duration</b>
MAT – 601 Statistics	30	70	100	40	2 ½ Hr.
MAT – 602 Numerical Analysis	30	70	100	40	2 ½ Hr.
<b>Total</b>			<b>200</b>	<b>80</b>	

# **SEMESTER - I**

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – I (2018-19 Batch)**

**Max. Marks: 100(Ext: 70, Int: 30)**

**Min. Marks: 40**

**Time: 2 ½ Hrs**

**MAT – 101 Matrices**

**Objectives:** To make students understand the Applications of Matrices.

**Unit – I**

Matrix, Types of matrix, Elementary operations on matrices, Symmetric and Skew Symmetric matrices, Hermitian and Skew Hermitian matrices, unitary matrix. Inverse of matrix, Linear Independence of row and column matrices, Row rank, Column rank and Rank of matrix, Equivalence of column and row rank.

**Unit - II**

Applications of matrices to solve a system of linear (both homogeneous and non-homogenous) equations, Theorems on consistency of a system of linear equation, Eigen values, Eigen vectors and the Characteristic equation of a matrix, Cayley-Hamilton theorem and its use in finding Inverse of a matrix.

**Unit - III**

Relation between roots and coefficients of general polynomial equation in one variable Transformation of equations, Descartes' rule of signs, Solution of cubic equation by Cardoan method, Solution of Biquadratic equations by Ferrari's method.

**Reference Books :**

1. Narayan, S. (1957). A Text Book of Matrices, 2<sup>nd</sup> Edition, S. Chand, New Delhi.
2. Prasad, C. (2017). Text Book on Algebra and Theory of Equations, 11th Edition, Pothishala Pvt. Ltd., Allahabad.
3. Datta, K.B. (2004). Matrix and Linear Algebra, Prentice hall of India Pvt. Ltd., New Delhi.



**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – I (2018-19 Batch)**

**Max. Marks: 100(Ext: 70, Int: 30)**

**Min. Marks: 40**

**Time: 2 ½ Hrs**

**MAT – 102 Algebra**

**Objectives:** To make students understand the Theorems related to Group and ring.

**Unit – I**

Definition of a group with examples, Order of finite group, General properties of groups, Integral power of an element of a group, Order of an element of a group, Subgroup, Generation of groups. Cyclic group, cosets decomposition, Lagrange's theorem and its consequences .–

**Unit – II**

Normal subgroups and Quotient groups, Permutation, permutation group, cyclic permutation, Even and odd permutation, The alternating group  $A_n$ . Morphism of groups, Homomorphism and isomorphism, The fundamental theorem of homomorphism.

**Unit - III**

Ring, ring with unity, zero divisors, integral domain and field and their properties. Characteristic of a ring and integral domain, Subring, subfield, prime field, Ring morphism, Ideals (Principle, Prime and Maximal) and field of quotients of an Integral Domain.

**Reference Books:**

1. Sharma, J.N. and Vasishtha, A.R. (2014). Modern Algebra, Krishna Prakashan, Meerut.
2. Sharma K.C., Gokhroo, D.C. and Saini, S.R. (2001). Abstract Algebra, 2<sup>nd</sup> Edition, Jaipur Publication House.
3. Herstein, I.N. (2006). Topics in Algebra, 2<sup>nd</sup> Edition, Wiley Eastern Ltd. New Delhi.
4. Hall, H.S. and Knight, S.R. (1994). Higher Algebra, 4<sup>th</sup> Edition, H. M. Publication.



# SEMESTER - II Sophia Girls' College,

## Ajmer (Autonomous) B. Sc. Semester – II (2018-19 Batch)

**Max. Marks: 100(Ext: 70, Int: 30)**

**Min. Marks: 40**

**Time: 2 ½ Hrs**

### MAT– 201 Vector calculus and Geometry

**Objectives:** To make students understand of Vector Point Function and 3-D Geometry.

#### Unit I

Vector differentiation, Gradient, Divergence and Curl, Identities involving these operators and related problems, Vector integration, Line and surface integral, Theorem of Gauss, Green's and Stoke's (statements and verification only).

#### Unit II

General equation of second degree, Tracing of conics, centre of a conic, coordinates of the centre. Equation of the conic referred to centre as origin, Asymptotes of a conic, Length and position of axes of a standard conic, Tracing of Ellipse, Parabola and Hyperbola.

The Polar equation of Conic: polar equation of a straight line, circle and conic chord, Auxiliary circle, Tracing of conic  $l/r = 1 + e \cos \theta$ .

#### Unit III

Sphere, Plane section of a sphere, tangent line and tangent plane of sphere, Cone, Enveloping cone, Tangent plane of cone, Reciprocal cone, Cylinder, Right circular cylinder, enveloping cylinder.

#### Reference Books :

1. Chatterji, P.N. (1964). Solid Geometry, Rajhans Prakashan Mandir, Meerut.
2. Prasad, G. and Gupta, H.C. (2000). Text Book on Coordinate Geometry, Pothishala Pvt. Ltd., Allahabad.
3. Jain, P.K. and Ahamad, K. (2007). A Text Book of Analytical Geometry of two Dimensions, Wiley Eastern Ltd.
4. Narayan, S. (1987). Text Book of Vector Calculus, S.Chand and Co., New Delhi.

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – II (2018-19 Batch)**

**Max. Marks: 100(Ext: 70, Int: 30)**

**Min. Marks: 40**

**Time: 2 ½ Hrs**

**MAT – 202 Calculus**

**Objectives:** To make students understand the Asymptotes, Double and Triple integral.

**Unit – I**

Derivative of length of an arc, Asymptotes in Cartesian coordinates, intersection of curve and its asymptote, Curvature, radius of curvature for (Cartesian, polar, parametric and pedal curves) Curvature, chord of curvature, tests for concavity and convexity, test for point of inflexion, singular points, curve tracing(in Cartesian and polar co-ordinates).

**Unit – II**

Partial Differentiation, Change of variables, Euler's theorem on homogeneous functions, Differentiation of implicit functions, Jacobians, Envelopes, Evolutes, Maxima, Minima and saddle points of function of two variables.

**Unit – III**

Beta and Gamma function, Double integral, change of order of integration, Triple integral, Dirichlet's integral and Liouville's extension of dirichlet's integral (statement only)

**Reference Books:**

1. Chatterji, P.N. (2001). Differential Calculus, 4<sup>th</sup> Edition, Rajhans Prakashan Mandir, Meerut.
2. Narayan, S. (1962). Differential Calculus, 10<sup>th</sup> Edition, Jaipur Publication House.
3. Apostol, T.M. (2007). Mathematical Analysis, Marcel Dekkar, Inc. New Delhi.
4. Prasad, G. (1959). Differential Calculus, Pothishala Pvt. Ltd, Allahabad.
5. Narayan, S. (2005). Course Book of Mathematical Analysis ,S.Chand and Company. New Delhi.
6. Malik , S.C. .Mathematical Analysis, 4<sup>th</sup> Edition, Wiley Eastern Ltd. New Delhi.



# SEMESTER - III Sophia Girls' College,

**Ajmer (Autonomous)**  
**B. Sc. Semester – III (2018-19 Batch)**

**Max. Marks : 100(Ext:70, Int:30)**

**Min. Marks: 40**

**Time : 2 ½ Hrs**

## **MAT – 301 Linear Algebra**

**Objectives:** To make students understand the Applications of Linear Algebra.

### **Unit – I**

Vector space: Definition and examples of vector space, subspace, sum and direct sum of subspace, linear span, linear dependence, independence and their basic properties, Basis, Finitely generated vector space, Existence theorem for basis of a finitely generated vector space, Invariance of the number of elements of basis set, dimensions, Quotient space and its dimension.

### **Unit – II**

Homomorphism and isomorphism of vector space, theorems on space morphism, Rank and Nullity, Sylvester law of nullity, Algebra of linear transformation .Dual spaces, Bidual spaces, Adjoint of a linear transformation, Matrix representation of a linear transformation.

### **Unit - III**

Eigen values and Eigen vectors, similar matrices, equivalent matrices, minimal polynomial, Diagonalization of matrices, Jordan blocks and Jordan forms.

### **Reference Books:**

1. Herstein, I.N. (2006). Topics in Algebra, 2<sup>nd</sup> Edition, Wiley Eastern Ltd., New Delhi.
2. Sahai, V. and Bist, V. (2013). Linear Algebra, 2<sup>nd</sup> Edition, Narosa Publishing House.
3. Sharma, J.N. and Vasishtha, A.R. (2014). Linear Algebra, Krishna Prakashan Meerut.

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – III (2018-19 Batch)**

**Max. Marks : 100(Ext:70, Int:30)**

**Min. Marks: 40**

**Time : 2 ½ Hrs**

**MAT – 302 Differential Equations**

**Objectives:** The general purpose of this paper is to provide an understanding of ordinary differential equations and to give methods for solving them.

**Unit – I**

Concept and formation of a differential equation, Order and degree of a differential equation, Differential equations of first order and first degree, Bernoulli's equation, Exact differential equation, integrating factors, First order higher degree equations solving for x, y, p. Lagrange's equation, Clairaut's equation, equation reducible to Clairaut's form, Singular solution.

**Unit – II**

Linear differential equations with constant coefficients: Homogeneous and non-homogeneous linear ordinary differential equation, Geometrical meaning of a differential equation and orthogonal trajectories, Linear differential equation of second order: Reduction to normal form, Method of variations of parameters, Ordinary Simultaneous differential equations. Simultaneous equation of the form  $dx/P = dy/Q = dz/R$ .

**Unit - III**

Partial differential equation: Formation, order and degree, linear and non-linear partial differential equation of first order. Complete solution, singular solution, General solution, solution of Lagrange's linear equations, non-linear partial differential equation of first order: solution by four standard forms. Solution of non-linear differential equation by Charpit's method, Homogeneous and non-Homogeneous linear partial differential equation with constant coefficients, Partial differential equation with variable coefficients reducible to equations with constant coefficients, their complimentary function and particular integrals.

**Reference Books:**

1. Ahsan, Z. (2016). Differential Equations and Their Applications, 3<sup>rd</sup> Edition, Prentice-Hall of India, New Delhi
2. Bansal, J.L. and Dhama, H.S. ,Differential Equations, Jaipur Publishing House.
3. Raisinghania, M.D. (2009). Advanced Differential Equations, 12<sup>th</sup> Edition, S.Chand and Company Ltd.

# **SEMESTER – IV**



**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – IV (2018-19 Batch)**

**Max. Marks : 100(Ext:70, Int:30)**

**Min. Marks: 40**

**Time : 2 ½ Hrs**

**MAT – 401 Real Analysis**

**Objectives:** To make students understand the Applications of real analysis.

**Unit - I**

Real number system as a complete ordered field: Field and its properties, ordered field, lower bound, upper bound, supremum and infimum of sets, the completeness property of Real number system, the Archimedean property, Definition of sequence theorems on limits of sequences, bounded and monotonic sequences, Cauchy's convergence criterion.

**Unit – II**

Infinite series of non-negative terms, different tests of convergence of infinite series comparison test, ratio test, Logarithmic, Morgen and Bertrand test (without proof). Alternating series, Leibnitz' theorem Absolute and conditional convergence, Pointwise convergence of sequence of functions, Uniform convergence.

**Unit – III**

Limit, continuity, differentiability of two variable functions, mean value theorems: Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Riemann integral, Fundamental theorem of integral calculus.

**Reference Books:**

1. Apostol, T.M. (1985). Mathematical Analysis, 2<sup>nd</sup> Edition, Welsey Publishing Company.
2. Goldberg, R.R. (1970). Real analysis, 2<sup>nd</sup> Edition, John Wiley and sons.
3. Somasundaram, D. and Choudhary, B. (2013). A First Course in Mathematical Analysis, 5<sup>th</sup> Edition, Narosa Publishing House, New Delhi.
4. Narayan, S. A Course of Mathematical Analysis, S. Chand & Co., New Delhi.

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – IV (2018-19 Batch)**

**Max. Marks : 100(Ext:70, Int:30)**

**Min. Marks: 40**

**Time : 2 ½ Hrs**

**MAT – 402    Mechanics**

**Objectives:** To make students understand the Applications of mechanics.

**Unit – I**

General Conditions of equilibrium of coplanar forces: Reduction of coplanar forces into a force with couple, Equilibrium of a rigid body under three forces, Equilibrium of rigid body under more than three forces, Friction, Common Catenary.

**Unit – II**

Kinematics and Kinetics Rectilinear motion, Velocity and acceleration along radial, transverse, tangential and normal directions, Simple harmonic motion, Rectilinear motion in resisting medium, Hook's law and related problems.

**Unit – III**

Constrained motion in vertical and horizontal circles, central orbit, inverse square law (Planetary motion), Impact (Direct and Oblique).

**Reference Books:**

1. Chorlton F , Dynamics,CBS Publishers, New Delhi.
2. Mittal P.K., Dynamics, S.J. Publication, Meerut.
3. Gaur Y.N., Mathur A.K., Dynamics, Ramesh Book Depot, Jaipur.
4. Loney S.L., Statics ,Macmillan Company, London.

# **SEMESTER – V**

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – V (2018-19 Batch)**

**Max. Marks : 100(Ext:70, Int:30)**

**Min. Marks: 40**

**Time : 2 ½ Hrs**

**MAT – 501 Metric Spaces and Complex Analysis**

**Objectives:** To make students understand the Applications of Metric space and Complex number.

**Unit – I**

Definition and examples of a metric space, Diameter of a set, Bounded set, Open sphere, Closed sphere, Open set, Properties of open set, Interior point and interior of a set, Closed set, Properties of closed set, Limit point of a set, Derived and closure of a set, Boundary point of a set.

**Unit – II**

Continuity and Differentiability of complex valued function, Analytic function, Necessary and Sufficient condition for analytic function, Cauchy –Riemann Equations (Cartesian and Polar form) Harmonic function, Conjugate Harmonic function, Construction of an analytic function by Milne Thomson method.

**Unit – III**

Conformal mapping, Isogonal mapping, Necessary and sufficient conditions for a conformal mapping. Some elementary transformations: Translation, Rotation, Magnification, Inversion. Linear transformation, Bilinear transformation, Properties of Bilinear transformation, Cross ratio, Invariant point of Bilinear transformation.

**Reference Books :**

1. Ponnusamy S.(2013). Foundations of Complex Analysis, 5<sup>th</sup> Edition, Narosa Book Distributors.
2. Sharma, J.N. Functions of a Complex Variable, 49<sup>th</sup> Edition, Krishna Prakashan, Meerut.
3. Searcoid M.O., Metric Spaces, Springer.
4. Singh, M.P., Complex Analysis, Omega Publication.

# **Sophia Girls' College, Ajmer (Autonomous)**

## **B. Sc. Semester – V (2018-19 Batch)**

**Max. Marks : 100(Ext:70, Int:30)**

**Min. Marks: 40**

**Time : 2 ½ Hrs**

### **MAT – 502 Linear Programming**

**Objectives:** To make students understand the application of linear programming.

#### **Unit - I**

Linear programming problem: Definition of Linear programming problem, Formulation and Solution of Linear programming problem, Feasible solution, Basic Feasible solution, Optimal solution, Convex set and their properties, Hyperplane, Basic solutions and properties.

#### **Unit II**

Theory of Simplex method, Fundamental Theorem of Linear Programming (Statement only), The Simplex algorithm, Simplex method in tableau format, introduction to artificial variables, case of unbounded solutions, Big- M method, Two phase method, Degeneracy in linear programming problem.

#### **Unit III**

Duality in Linear programming problem: Formulation of the dual problem, Primal-Dual relationships, Symmetric and Un-symmetric dual problem with restriction in sign, Theorems related to dual problem, Revised Simplex method (standard form I and II).

#### **Reference Books:**

1. Singh, B. (2009). Linear programming, 11<sup>th</sup> Edition, Meerut.
2. Gauss, (2002). Linear programming, 5<sup>th</sup> Edition, Narosa Publishing House.

# **SEMESTER – VI**

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – VI (2018-19 Batch)**

**Max. Marks : 100(Ext:70, Int:30)**

**Min. Marks: 40**

**Time : 2 ½ Hrs**

**MAT – 601 Statistics**

**Objectives:** To make students understand the Applications of statistics in various fields.

**Unit – I**

Random experiment, Sample space, Definition of Probability, Conditional probability, Addition theorem of probability, Multiplication theorem of compound probability, Bayes' theorem, Random variate, Probability distribution, Mathematical expectation, Moment, Mathematical expectation of the Sum and product of two random variate, Covariance, Curve fitting, Regression and Correlation Coefficient.

**Unit – II**

Moment Generating Functions, Theorems on moment generating function, Cumulants, Properties of Cumulants, Characteristic function. Discrete probability distributions: Binomial, Poisson distribution and their Mean, Variance, Moment, Recurrence relation, Moment generating function.

**Unit – III**

Continuous probability distribution: Rectangular distribution, Normal distribution, derivation of normal distribution from binomial distribution, Mean, Variance, Moment, Recurrence relation, Moment generating function, Additive property of normal distribution, Problems related to area property of normal distribution.

**Reference Books:**

1. Freund, J.E. (2000). Mathematical Statistics, Prentice Hall of India.
2. Gupta, S.C. and Kapoor, V.K. (2014). Fundamental of Mathematical Statistics, 11<sup>th</sup> Edition, S.Chand and Sons.

# Sophia Girls' College, Ajmer (Autonomous)

## B. Sc. Semester – VI (2018-19 Batch)

**Max. Marks : 100(Ext:70, Int:30)**

**Min. Marks: 40**

**Time : 2 ½ Hrs**

### **MAT – 602 Numerical Analysis**

**Objectives:** To make students understand the Applications of numerical methods.

#### **Unit – I**

Numerical operators, Properties of operators, Fundamental theorem of difference calculus, Factorial function, Interpolation with equal intervals: Newton's forward and Newton's backward interpolation formula.

#### **Unit – II**

Divided differences and their properties, Newton's formula for unequal intervals, Lagrange's formula, Central difference, Gauss forward and backward formula, Stirling interpolation formula  
Bessel formula, Numerical Differentiation: Derivative from interpolation formulae, approximate expressions for the derivatives of a function.

#### **Unit – III**

Numerical Integration: General quadrature formula for equidistant ordinates, Trapezoidal, Simpson's one-third, three-eighth rule, Weddle's rule, Gauss' Quadrature formula, Euler –McLaurin's summation formula, Solution of algebraic and transcendental equation, Newton Rapson method, Regular Falsi method.

#### **Reference Books:**

1. Saxena, H.C. (2010). Numerical Analysis, S. Chand, New Delhi.
2. Bansal, J.L. and Ojha, J.P.N. (1991) Numerical Analysis, J.P.H., Jaipur.
3. Vasistha, A.R., Sharma S.K .and Vasishtha, H. (2014). Numerical Analysis, Krishna prakashan media (P) Ltd.