

# **INTERNATIONAL COLLEGE FOR GIRLS**

*(AUTONOMOUS)*

## **DEPARTMENT OF MATHEMATICS**

### **Scheme of Examination & Syllabi**

#### **FOR UNDERGRADUATE COURSES**

*Applicable for students seeking admission to  
B.A./B.Sc. Part I in 2007-2008*

*Semester I Examination: November 2007*

*Semester II Examination: April 2008*

*Semester III Examination: November 2008*

*Semester IV Examination: April 2009*

*Semester V Examination: November 2009*

*Semester VI Examination: April 2010*

**Paper Code : MAT101**

**Max. Marks: 100**

**Credits : 4**

**B.A./B.Sc.**

**Course content: 60 Hours**

**Mathematics**

## **Semester -I**

### **Paper I : Linear and Abstract Algebra**

**Objectives:** To introduce basics in mathematics.

To introduce and develop abstract concepts.

#### **Unit -I**

Symmetric, skew-symmetric, Hermitian and skew Hermitian matrices – Inverse of a matrix ,linear independence of row and column matrices . Rank of a matrix (equivalence of row and column ranks ) , Eigen values , Eigen vectors and the characteristic equation of a matrix. Cayley- Hamilton theorem and its use in finding the inverse of a matrix ..

(10Hours)

#### **Unit-II**

Relations and functions , Binary relations , Equivalence relations , Partial order relations , Definition of a group with examples and simple properties. Subgroups, Cyclic groups , permutation groups , alternating groups .

(15Hours)

#### **Unit III**

Cosets, Normal subgroups , Quotient group , Homomorphism and Isomorphism ,The Fundamental theorem of homomorphism .

(15Hours)

#### **Unit IV**

Rings , Subrings , Ideal of a ring , polynomial ring , characteristic of a ring , Integral domain and Fields - their simple properties.

(10Hours)

#### **Unit V**

Vector space, subspace, linear combination of vector, linearly dependent and independent vectors and their simple properties, bases and dimension.

(10 Hours)

#### **Books Recommended:**

##### **Essential Readings:**

1. K.B.Datta , Matrix and Linear Algebra, Prentice Hall of India Pvt.Ltd., New Delhi.
2. Shanti Narayan, A text book of Matrices,S.Chand & Co, New Delhi
3. G.C.Sharma ,Modern Algebra, Shivalal Agarwal &Co.,Agra.
4. G.C.Sharma ,Matrices, Shivalal Agarwal &Co.,Agra.

##### **References :**

1. Suddhendu Biswas, A text book of Matrix Algebra, New Age Int. Ltd. New Delhi.
2. Deepak Chatterjee, Abstract Algebra. PHI. Ltd. New Delhi.
3. P.B.Bhattacharya , S.K.Jain and S.R.Nagpaul, Basic Abstract Algebra , Cambridge University Press.
4. I.N.Herstein , Topics in Algebra , Wiley Eastern Ltd., New Delhi

**Paper Code : MAT102**

**Max. Marks: 100**

**Credits : 4**

**B.A./B.Sc.**

**Course content: 60 Hours**

**Mathematics**

## **Semester- I**

### **Paper II : Differential Calculus**

**Objectives:** To improve basics in mathematics.  
To improve analytical skill.

#### **Unit I**

Mean Value theorems ( Lagrange's & Cauchy ), Taylor's and Maclaurins series with different remainders ,Expansion of  $\sin x$ ,  $\cos x$ ,  $e^x$ ,  $\log(1+x)$ ,  $(1+x)^m$ , Successive differentiation ,Leibnitz's theorem and its applications  
(12Hours)

#### **Unit II**

Sub-tangent and subnormal , Derivative of an arc  
Pedal equation ( Cartesian and Polar Curves ), Curvature .  
(15Hours)

#### **Unit III**

Partial differntiation , Total sum derivative , Euler's theorem for homogeneous functions, Maxima and Minima of functions of two and three independent variables – necessary and sufficient conditions ( without proof) , Lagrange's undetermined multipliers and simple problems on these concepts.  
(13Hours)

#### **Unit IV**

Envelopes and Evolutes , Asymptotes.  
(10Hours)

#### **Unit V**

Tests for concavity and convexity and points of inflexion. Multiple points,  
Classification of double points – Node, cusp.  
Tracing of curves : Cartesian and Polar form.  
(10Hours)

#### **Books Recommended:**

##### **Essential Readings:**

- 1.Shanti Narayan,Differential Calculus , S.Chand and Co. New Delhi.
- 2.Text Book on Diff.Calculus , Gorakh Prasad , Pothishala Pvt.Ltd, Allahabad
- 3.Sharma & Sharma, Differential Calculus,Shivlal Agarwal&Co.Agra.
- 4.Chaurasia, Goyal ,Agarwal, Jain ;Diff. Calculus, RBD ,Jaipur.

##### **References :**

- 1.Theory and problems of Advanced Cal. - Schaum's outline series New York.
- 2.H.S.Dhami,Differential Calculus,New Age Int. Ltd.,New Delhi.
- 3.Akhtar&Ahsan, A text Book of Differential Calculus,PHI Ltd.New Delhi.
4. A Problem book in Mathematical Analysis, G.N.Berman, Mir Publishers, Moscow.

**Paper Code : MAT 201**

**Max. Marks: 100**

**Credits : 4**

**B.A./B.Sc.**

**Course content: 60 Hours**

**Mathematics**

## **Semester –II**

### **Paper I : Integral and Vector Calculus**

**Objectives:** To introduce basics in mathematics.

To improve analytical skill.

#### **Unit \_I**

Integration of irrational algebraic functions and transcendental functions . Reduction formulae, Gamma and Beta function.

(10Hours)

#### **Unit –II**

Quadrature , rectification, volumes and surfaces of solids of revolution

(15Hours)

#### **Unit III**

Change of order of integration , Double integrals, Triple integrals and their applications Dirichlet's Integral

(15Hours)

#### **Unit –IV**

Scalar and vector point function, Differentiation and Integration of vector point function, directional derivatives.

(05Hours)

#### **Unit – V**

Gradient , Divergence , Curl and identities involving these operators, Gauss divergence theorem , Stoke's and Green's theorem ( without proof ) and their applications .

(15Hours)

#### **Books recommended:**

#### **Essential Readings:**

1. A text book on Integral Calculus , Gorakh Prasad, Pothishala Pvt .Ltd , Allahabad.
2. Integral Calculus, Sharma & Sharma, Shival Agarwal and Co. Agra.
3. Integral Calculus Sharma & Jain Galgotia Publication, New Delhi.
4. Vector Algebra and Calculus, Sharma & Sharma, Student's friends Co. Agra.
5. Integral Calculus : Shanti Narayan , S.Chand and Co., New Delhi.
6. A text book of Vector Calculus, Shanti Narayan , S.Chand and Co. New Delhi

#### **References :**

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley and sons
2. Vector Analysis, Muray R. Spiegel , Schaum Publishing Company , New York.
3. Introduction to Vector Analysis, Saran and Nigam , Pothisala Pvt Ltd, Allahabad.

**Paper Code : MAT 202**

**Max. Marks: 100**

**Credits : 4**

**B.A./B.Sc.**

**Course content: 60 Hours**

**Mathematics**

## **Semester - II**

### **Paper II :Analytical Geometry**

**Objectives:** To introduce basics in mathematics.

To understand the subject as tool applicable to almost all other  
Branches of Sciences Engineering and Technology.

#### **Unit - I (2D)**

General equation of second degree in two variables, tracing of conics, system of conics, focal conics, polar equation of conics.

(15Hours)

#### **Unit – II**

Straight lines and Planes, sphere.

(15Hours)

#### **Unit –III (3D)**

Cone , Cylinder.

(10Hours)

#### **Unit –IV**

Central Conicoids. Plane section of conicoids

(10Hours)

#### **Unit –V**

Generating Lines and Reduction of second degree equation in three variables.

(10Hours)

#### **Books Recommended:**

##### **Essential Readings:**

1. Analytical Geometry of three dimensions , N.Saran and R.S.Gupta , Pothisala Pvt.Ltd , Allahabad.
2. Text book on Coordinate Geometry , Gorakh Prasad and H.C.Gupta , Pothisala Pvt. Ltd., Allahabad
3. A text book of Analytical Geometry of Two dimensions , P.K.Jain and Khalil Ahmad , Wiley Eastern Ltd.
4. Co-ordinate Geometry,Sharma & Jain,Galgotia Publications,Agra.

##### **References:**

- 1.A text book of Analytical Geometry of Three Dimensions , P.K.Jain and Khalil Ahmad , Wiley Eastern Ltd.
- 2.The Elements of Coordinate Geometry , S.L.Loney, Macmillan and Co., London
- 3.Analytic Geometry,PeterHselby HBJ publishers,New York.
- 4.Elementary Treatise on Coordinate Geometry of Three Dimensions , R.J.T.Bill, Macmillan India Ltd

**Paper Code : MAT 301**  
**Credits : 4**  
**Course content: 60 Hours**

**B.A./B.Sc.**  
**Mathematics**

**Max. Marks: 100**

## **Semester – III**

### **Paper I – Real Analysis**

**Objectives:** To introduce basics in mathematics.  
To improve analytical skill.

#### **Unit – I**

Order completeness of Real numbers, open and closed sets, limit point of sets, Bolzano Weirstrass theorem, concept of compactness, Heine Borel theorem. Connected sets.

(10Hours)

#### **Unit – II**

Real Sequences, Limit and convergence of a sequence, monotonic sequences, Cauchy's sequences, sub sequences and Cauchy's General principle of convergence, Infinite series and their convergences – Comparison test, Cauchy's nth root test, D'Alembert test, Raabe's test, Cauchy's test & Logarithmic test

(15Hours)

#### **Unit – III**

Alternating Series – Leibnitz Test, Absolute and conditional convergence, Properties of continuous function and derivable functions. Proof of Rolle's theorem and Darboux's theorem.

(10Hours)

#### **Unit - IV :**

Reimann Integration, Lower and upper Reimann integrals, Properties of Reimann integration, Mean value theorem of Integral calculus, Fundamental theorem of integral calculus.

(10Hours)

#### **Unit – V**

Uniform convergence, Sequence and series of function – pointwise and uniform convergence, Weirstrass M- Test, Abel's and Drihlet's Test for uniform convergence of series of functions. Continuity of the sum functions of the limit functions, termwise differentiation and integrations.

(15Hours)

#### **Books Recommended:**

##### **Essential readings:**

1. A course of Mathematical Analysis, Shanti Narayan, S.Chand and Co. New Delhi.
2. Mathematical Analysis, T.M.Apostol, Norosa Publishing House, New Delhi.
3. Real Analysis and Metric spaces, K.C.Sarangi Ramesh Book Depot, Jaipur.

##### **References :**

1. An introduction to Real Analysis, Jain and Kaushik. S.Chand and Co., New Delhi
2. Undergraduate Analysis, S.Lang, Springer-Verlag, Mathematical Analysis,
3. Real Analysis, R.R.Goldberg, Oxford and IBH publishing Company, New Delhi.

**Paper Code : MAT 302**

**Max. Marks: 100**

**Credits : 4**

**B.A./B.Sc.**

**Course content: 60 Hours**

**Mathematics**

## **Semester - III**

### **Paper II: Differential Equations**

**Objectives:** To improve analytical skill.  
To understand the subject as tool applicable in other branches of Sciences, Engineering and Technology.

#### **Unit – I**

Degree and order of differential equation .Equations of first order and first degree – Variable separable method , Homogeneous equations and equations reducible to homogeneous form , Linear equations and equations reducible to linear form.

(10Hours)

#### **Unit – II**

Exact differential equations and equation which can be made exact. First order higher degree equations – solvable for  $x$ ,  $y$ ,  $p$ . Clairaut's form.and singular solutions with extraneous loci.

(10Hours)

#### **Unit – III**

Linear differential equation with constant coefficients, complimentary function and particular integral. Homogeneous linear differential equations with variable coefficient. Simultaneous differential equations . Exact linear differential equations of  $n$ th order . Existence and uniqueness theorem.

(15Hours)

#### **Unit – IV**

Linear differential equations of second order- Linear independence of solutions . Solution by transformation of the equations by changing the dependent and independent variable. Factorization of operators. Method of variation of parameters, Method of undetermined coefficients.

(15Hours)

#### **Unit – V**

Partial differential equations of the first order. Lagrange's linear equation, Charpit's general method of solution , homogeneous and non homogeneous linear partial differential equations with constant coefficients. Equations reducible to equations with constant coefficients.

(10Hours)

#### **Books Recommended:**

##### **Essential Readings:**

1. Introductory course on Differential Equations, D.A.Murray, Orient Longman
2. Elements of Partial Differential Equations , Lan N. Sneddon, TMH
3. Zafar Ahsan Differential Equations&their applications,PHI ;New Delhi.
4. Differential Equations, Bansal & Dhama,New Age, Delhi.

##### **References :**

1. A Treatise on Differential Equations , A.R.Forsyth , Macmillan and Co. Ltd, London
2. Theory and Problems of Differential Equations, Frank Ayres, TMH
3. Ordinary and partial differential Equations,M.D.Raisinghania.S.Chand & Co.Delhi

**Paper Code : MAT 401**  
**Credits : 4**  
**Course content: 60 Hours**

**B.A./B.Sc.**  
**Mathematics**

**Max. Marks: 100**

## **Semester – IV**

### **Paper – I Mechanics**

*( Unit – I and II Statics )*

*(Unit – III,IV and V Dynamics)*

**Objective:** To enable the learner to apply the principle of Mechanics in daily life

#### **Unit – I**

Parallel forces, Moments and couples, coplanar forces  
(10Hours)

#### **Unit – II**

Friction , virtual work and common catenary  
(15Hours)

#### **Unit – III**

Rectilinear Motion – radial and transverse velocity and acceleration, tangential and normal velocity and acceleration . S.H.M. – Hooke’s Law, Horizontal and vertical elastic strings.  
(15Hours)

#### **Unit – IV**

Motion under inverse square law, Projectiles in inclined plane ,rectilinear motion in a resisting medium.  
(10Hours)

#### **Unit – V**

Work, Energy, Constrained motion in two dimensions: Motion of a particle on the inside of a smooth vertical circle, motion along a smooth cycloid.  
(10Hours)

#### **Books recommended:**

##### **Essential Readings:**

1. Dynamics , Ramsey A.S. , CBS Publishers and distributors
2. Statics , Ray & Sharma, S.Chand & Co. Delhi
3. Dynamics, Ray & Sharma, S.Chand & Co. Delhi

##### **References :**

1. Dynamics , Loney ,Macmillan & Co., London.
2. Statics , Ramsey , CBS Publishers and Distributors



**Paper Code : MAT 402**

**Max. Marks: 100**

**Credits : 4**

**B.A./B.Sc.**

**Course content: 60 Hours**

**Mathematics**

## **Semester- IV**

### **Paper II:Discrete Mathematics**

**Objectives:**To introduce and develop abstract concepts.

To understand the subject as tool applicable in computer science.

#### **Unit – I**

Sets and propositions, cardinality ,Russel’s Paradox, Principle of inclusions and exclusions , Mathematical induction , pigeon hole principle , Computability and Formal languages- Ordered sets, Languages , Phrasestructure, Grammar - types of grammars and languages .(15Hours)

#### **Unit -II**

Graphs- basic terminology , multigraphs, weighted graphs , paths and circuits, shortest path , Eulerian and Hamilton paths and circuits, travelling salesman problem ,planar graphs. Graph colouring and chromatic number. (15Hours)

#### **Unit III**

Trees, rooted trees, Paths Lengths in Rooted Trees ,Prefix Codes , Binary Search Trees Spanning Trees , Minimum Spanning Trees . Finite state machines, equivalent machines, finite state machine as language recognizers (10Hours)

#### **Unit –IV**

Recurrance relations and Recursive algorithms Method of generating functions. Lattices: duality distributive and complemented lattices . (10Hours)

#### **Unit – V**

Boolean algebra with lattices ,Boolean function and expression , propositional calculus , Design and implementation of digital networks , switching circuits. (10Hours)

#### **Books Recommended:**

##### **Essential Readings:**

- 1.Elements of Discrete Mathematics , C.L.Liu, MacGraw Hill Intl, Edition
- 2.Discrete Mathematical Structures , Kolman , Prentice Hall, New Delhi
- 3.Schaum’s Outlines Discrete Mathematics , Lipschutz, Seymour, TMH, NewDelhi
4. Advance Discrete mathematics,Sharma & Jain Laxmi Publication Meerut.
- 5-Graph Theory. Narsingh Rao,
- 6.Graph Theory, Herrary,

##### **References :**

1. Discrete Mathematics 5<sup>th</sup> Edition ,Johnsonbaugh, Richard, Addison-Wesley Publishing Company
2. Discrete Mathematics : Elementary and Beyond , Lovasz,L. Pelikan ,J. Springer, New York
3. Discrete Mathematics with Graph Theory , Goodaire , Edgar G , Prentice Hall of India
4. Discrete Mathematics ,Motto
5. Discrete Mathematics , R. Manohar

**Paper Code : MAT 501**

**Max. Marks: 100**

**Credits : 4**

**B.A./B.Sc.**

**Course content: 60 Hours**

**Mathematics**

## **Semester – V**

### **Paper I: Numerical Analysis**

Objectives: **To** improve analytical skill.

To understand the subject as tool applicable in other branches of Sciences, Engineering and Technology.

#### **Unit – I**

Differences , Relation between differences and derivatives, difference of polynomials, Newton's forward and backward interpolation formula ( including proof) .Divided differences: Newton's and Lagrange's divided differences formulae.

(15Hours)

#### **Unit – II**

Central differences : Gauss's , Stirling's and Bessel's interpolation formulae.

Numerical differentiation and Numerical integration – Quadrature formula- trapezoidal rule , Simpson's 1/3 rd and 3/8 th formulae .

(15Hours)

#### **Unit – III**

Numerical solution of algebraic and transcendental equations- Bisection method , regula-falsi method, method of iteration and Newton Raphson's Method. Solution of system of linear equation : Gauss elimination method , Jacobi and Gauss Seidal method .

(10Hours)

#### **Unit – IV**

**Solutitons of ordinary differential equations with initial boundary conditions :**

Picard's method, Euler's and modified Euler's method, Runga Kutta Method.

Milni- Simpson's Method.

(10Hours)

#### **Unit – V**

(10Hours)

#### **Books Recommended:**

##### **Essential Readings:**

1. Calculus of Finite Differences and Numerical Analysis, Gupta and Malik, Krishna Prakashan Mandir
2. Numerical Methods Problems and Solutions , M.K.Jain, Iyengar,New Age International Ltd
3. Finite Differences and Numerical Analysis,H.C.Saxena, S. Chand & Co., Delhi
4. Numerical Analysis, Sharma & Sharma, Ratan Prakash Mandir,Agra

##### **References:**

1. Applied Numerical Analysis , Gerald, Addison Wesley Publishing Company
2. .Applied Numerical Methods, Gourdin; Boumahrat, Prentice Hall of India
3. Numerical Methods Problems and Solutions , M.K.Jain, Iyengar,New Age International Ltd
5. Numerical Analysis a Practical Approach , Melvin J.Maroon, Machmillon Publishing Company, New York
6. Numerical Analysis , Kincaid,

**Paper Code : MAT 502**

**Max. Marks: 100**

**Credits : 4**

**B.A./B.Sc.**

**Course content: 60 Hours**

**Mathematics**

## **Semester – V**

### **Paper : II Operation Research**

Objectives: To improve analytical skill.

To understand the subject as tool applicable in Business Management And Industries.

#### **Unit – I**

Introduction –historical background –objective of OR- scope of OR. Introduction – general L.P.P. Formulation of the problem- Graphical method for the solution of the L.P.P. Simplex Method – Big M method- Two phase Method And special cases.Duality in L.P.P.

(20Hours)

#### **Unit – II**

Transportation problem : Optimality test. Degeneracy in transportation problem.

Unbalanced transportation problems. Assignment problems.

(08Hours)

#### **Unit- III**

Theory of Games- Introduction –Description and characteristics of game theory –Two person zero sum game- solution of mixed strategy problems – principle of dominance .Solution of mix game by Linear programming method .Simulation –advantages and disadvantages. Queing Theory – M/M/1:  $\infty$ /FIFO , M/M/1: N/FIFO

M/M/C:  $\infty$ /FIFO , M/M/1: N/FIFO.

(12Hours)

(12Hours)

#### **Unit – IV**

Simulation technique. Monte Carlo Method- simple problems

Inventory control : Introduction , EOQ models , Quantity Discounts, Stock Levels , Buffer stocks , ABC analysis.

(10Hours)

#### **Unit – V**

Sequencing ,Dynamic Programming ,Network Analysis Techniques : PERT and CPM – Time cost trade analysis. Floats , Network replanning – requirements for the application of the PERT technique- practical limitations in using PERT. Differences in PERT and CPM.

(10 Hours)

#### **Books Recommended:**

##### **Essential Readings:**

1. Problems in O.R. Kanti Swaroop, Gupta P.K. and Manmohan , Sultan Chand and sons ,
2. Operations Research , H.A.Taha , Macmillan Publishing Company , New York.
3. Operation Research, V.K.Kapoor,Sultan Chand & Sons

##### **References :**

- 1..Linear Programming , Gauss S.I., MaGraw Hills Book Company.
- 2.Problems in O.R. Gupta P.K. and Hira D.S., S.Chand and Co.
- 3.Operation Research , Hedley,
4. Operation Research , S.D.Sharma,
5. Operation Research , J.K.Sharma, Macmillan & Co. London.

**Paper Code : MAT 601**  
**Credits : 4**  
**Course content: 60 Hours**

**Max. Marks: 100**  
**B.A./B.Sc.**  
**Mathematics**

## **Semester : VI**

### **Paper – I Complex Analysis**

**Objectives:**To improve basics in mathematics.  
To improve analytical skill.

#### **Unit – I**

Complex Plane, connected and compact sets, curves and regions in complex plane. Statement of Jordan curve theorem. Extended complex plane. Complex valued functions, limits, continuity, differentiability, analytic functions, C-R equation, Harmonic equations. Construction of an analytic functions.  
(15Hours)

#### **Unit – II**

Complex Integration, Complex line Integrals, Cauchy's Integral theorem, Indefinite integrals, fundamental theorem of Integral Calculus for complex functions, Cauchy's Integral Formula, Analyticity of the derivative of an analytic function.  
(10Hours)

#### **Unit – III**

Lioville's theorem, Poisson's Integral formula, Morera's theorem. Maximum modulus principle. Taylor's and Laurent's Series.  
(10Hours)

#### **Unit- IV**

Singularities. Meromorphic functions and Entire functions. Riemann's theorem, Casorati- Weirstrass theorem, Argument principle. Rouchy's theorem. Fundamental theorem of algebra. Cauchy's Residue theorem. Evaluation of definite integrals by Contour integration.  
(15Hours)

#### **Unit – V**

Conformal mapping – necessary condition. Bilinear transformation and their properties. Power series- Hadamard theorem and its applications.  
(10Hours)

#### **Books Recommended:**

##### **Essential Readings**

1. Complex Analysis, Purohit and Goyal, Jaipur Publishing House
2. Complex variables, Elhforce, PHI
3. Complex Variables, Sharma & Jain, Galgotia publications, Delhi.
4. introduction to Complex Analysis, S.Ponnuswamy, Narosa Publishers.

##### **Reference :**

1. .Complex Variables : Theory and Applications, H.S.Kasana, Prentice Hall, Delhi
2. Theory and Problems of Complex Variables, R.Murray Spiegel, Schaum Outline Series

**Paper Code : MAT 602**

**Max. Marks: 100**

**Credits : 2**

**B.A./B.Sc.**

**Course content: 30 Hours**

**Mathematics**

## **Semester : VI**

### **Paper : II (A): Dissertation**

The student is expected to familiarize herself with popular softwares like MATLAB,LINDO, MATHEMATICA, MAPLE for numerical/statistical computation and optimization .The topics will depend on the specialization of the supervisor ( internal/external)

#### **References :**

**MATLAB: High performance numeric computation and visualization software.**

**MATHEMATICA Stephen Wolfram , Cambridge.**

**Optimization modeling with LINDO : Linus Schrage.**

**Paper Code : MAT 603**

**Max. Marks: 100**

**Credits : 2**

**B.A./B.Sc.**

**Course content: 30 Hours**

**Mathematics**

**Semester : VI**

**PAPER-II (B) : MATHEMATICS PRACTICAL**

**Group A**

Numerical Integration-Simpson's  $1/3^{\text{rd}}$  &  $3/8^{\text{th}}$  rule, Solution of system of linear equations-Gauss elimination method, Jacobi and Gauss Seidel method.

**Group B**

Solution of ordinary differential and partial differential equations-Euler's and modified Euler's method, Runge Kutta method.