

CHAUDHARY BANSI LAL UNIVERSITY, BHIWANI
Scheme of Examination and Syllabi of B.Sc. / B.A. Ist Semester
Mathematics

(w.e.f. 2020-21)

CHAUDHARY BANSI LAL UNIVERSITY, BHIWANI
Scheme And Syllabi of Mathematics for B.Sc./B.A under CBCS
(Semester I to VI)
(w.e.f. 2020-21)

SEMESTER -I					
Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
20UMTH101	Algebra	Core	2	2	40+10=50
20UMTH102	Calculus	Core	2	2	40+10=50
20UMTH103	Mathematical Lab-I	Core	2	4	40+10=50
SEMESTER -II					
20UMTH201	Number Theory & Trigonometry	Core	2	2	40+10=50
20UMTH202	Vector Calculus & Geometry	Core	2	2	40+10=50
20UMTH203	Mathematical Lab-II	Core	2	4	40+10=50
SEMESTER -III					
20UMTH301	Differential Equations	Core	2	2	40+10=50
20UMTH302	Numerical Methods with Programming in C	Core	2	2	40+10=50
20UMTH303	Mathematical Lab-III	Core	2	4	40+10=50
SEMESTER -IV					
20UMTH401	Mechanics	Core	2	2	40+10=50
20UMTH402	Groups & Rings	Core	2	2	40+10=50
20UMTH403	Mathematical Lab-IV	Core	2	4	40+10=50



SEMESTER -V					
Choose One: 20UMTH501 or 20UMTH502	Choose One:	Discipline Specific Elective	2	2	40+10=50
20UMTH501 Or	Statics & Dynamics				
20UMTH502	Statistical Inference				
Choose One: 20UMTH503 OR UMTH504	Choose One:	Discipline Specific Elective	2	2	40+10=50
20UMTH503 OR	Mathematical Analysis				
20UMTH504	Linear Algebra				
20UMTH505	Mathematical Lab-V	Discipline Specific Elective	2	4	40+10=50
SEMESTER -VI					
Choose One: 20UMTH601 OR 20UMTH602	Choose One:	Discipline Specific Elective	2	2	40+10=50
20UMTH601	Special Functions & Integral Transforms				
20UMTH602	Solid Geometry				
Choose One: 20UMTH603 OR 20UMTH604	Choose One:	Discipline Specific Elective	2	2	40+10=50
20UMTH603	Real Analysis				
20UMTH604	Advanced Calculus				
20UMTH605	Mathematical Lab-VI	Discipline Specific Elective	2	4	40+10=50

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Skill Enhancement Courses offered by Department of Mathematics

Scheme of Examination of SEC for B.Sc. (Non-Medical & Computer Science)

(w.e.f. 2020-21)

SEMESTER-IV					
Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
Choose One:	Choose One:	Skill Enhancement	3	3	80+20=100
20USECM401	Logic and sets				
20USECM402	Analytical Geometry				
20USECM403	Probability & Statistics				
20USECM404	Vedic Arithmetic				
SEMESTER-V					
Choose One:	Choose One:	Skill Enhancement	3	3	80+20=100
20USECM501	Integral Calculus				
20USECM502	Theory of Equations				
20USECM503	Discrete Mathematics				
20USECM504	Vedic Algebra				
SEMESTER-VI					
Choose One:	Choose One:	Skill Enhancement	3	3	80+20=100
20USECM601	Boolean Algebra				
20USECM602	Transportation and Game Theory				
20USECM603	Mathematical Finance				
20USECM604	Vedic Geometry				

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**Scheme of Examination and Syllabi of B.Sc. / B.A. Ist Semester
Mathematics
(w.e.f. 2020-21)**

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
20UMTH101	Algebra	Core	2	2	40+10=50
20UMTH102	Calculus	Core	2	2	40+10=50
20UMTH103	Mathematical Lab-I	Core	2	4	40+10=50

20UMTH101

Algebra

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Unit – I

Review of matrices (Algebra of matrices, rank of a matrix, Inverse of a matrix), Linear dependence and independence of rows and columns of matrices. Eigenvalues, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix.

Unit– II

Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices, Diagonalization of a matrices, Bilinear and Quadratic forms.

Unit– III

Relations between the roots and coefficients of general polynomial equation in one variable. Solutions of polynomial equations having conditions on roots. Common roots and multiple roots. Transformation of equations.

Unit– IV

Nature of the roots of an equation, Descartes's rule of signs. Solutions of cubic equations (Cardon's method). Biquadratic equations and their solutions.

Suggested Readings:

1. Hall, H.S., Knight S.R., 1994. Higher Algebra. H.M. Publications.
2. Narayan S., Mittal P.K., 1953. A Text Books of Matrices. S. Chand Publishing House, New Delhi.
3. Ayers, F., 1962. Schaum's Theory and Problems of Matrices. McGraw Hill Book Company, New York.
4. Grewal, B.S. 2015. Higher Engineering Mathematics, Khanna Publications, India

20UMTH102
Calculus

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Unit – I

Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions. Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves. Newton's method. Radius of curvature for pedal curves. Tangential polar equations. Centre of curvature. Circle of curvature. Chord of curvature, evolutes.

Unit – II

Asymptotes in Cartesian and polar coordinates, intersection of curve and its asymptotes. Tests for concavity and convexity. Points of inflexion. Multiple points. Cusps, nodes & conjugate points. Type of cusps.

Unit – III

Reduction formulae. Rectification, intrinsic equations of curve. Applications of single integration: Quadrature (area), Sectorial area. Area bounded by closed curves. Volumes and surfaces of solids of revolution (Applications Only). Theorems of Pappus and Guldin.

Unit – IV

Multiple Integrals: Double integrals in cartesian and polar coordinates, area and volume by Double integrals, Triple integrals cartesian, cylindrical and spherical coordinates, volume of solids by Triple integrals

Suggested Readings:

1. Narayan S., 1962. Differential Calculus. S. Chand and Company. India
2. Spiegel S., Murray R., 1963. Theory and Problems of Advanced Calculus, Mc- Graw Hill, New York.
3. Piskunov N., 1996, Differential and integral Calculus, CBS Publishers, India.
4. Narayan, S. and Mittal P.K., 1962. Integral Calculus. S. Chand and Co. New Delhi, India

20UMTH103

Mathematical Lab- I

Maximum Marks-50
External Practical Examination-40
Internal Assessment-10

Mathematical problem Solving Techniques based on courses **20UMTH101 to 20UMTH102** will be taught. Students will have to solve 15-20 problems based on 20UMTH101 & 20 UMTH102. Also Solve atleast 10 problems using programing software preferably MS-Excel. Programmes will be based on Algebra and Calculus.

Note:- Every student will maintain practical record of problems solved during practical class-work in a file. Examination will be conducted through a question paper set jointly by the external and internal examiners. The question paper will consist of questions based on problem solving techniques/algorithm. An examinee will be asked to write the solutions and run on computer. Evaluation will be made on the basis of the examinee's performance in written solutions and presentation with viva-voce and practical record.

Practical Examination will be conducted externally as per the following distribution of marks:

<i>Writing solutions of problems:</i>	<i>20 marks.</i>
<i>Presentation & Viva voce:</i>	<i>10 marks.</i>
<i>Practical record:</i>	<i>10 marks.</i>
<i>Internal Assessment:</i>	<i>10 marks (Attendance=5 marks, Assignment=5 marks)</i>



**Scheme of Examination and Syllabi of B.Sc. / B.A. IInd Semester
Mathematics
(w.e.f. 2020-21)**

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
20UMTH201	Number Theory & Trigonometry	Core	2	2	40+10=50
20UMTH202	Vector Calculus	Core	2	2	40+10=50
20UMTH203	Mathematical Lab-II	Core	2	4	40+10=50

20UMTH201

Number Theory & Trigonometry

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Unit – I

Divisibility, Greatest common divisor, Least common multiple, Primes, Fundamental theorem of Arithmetic. Linear congruencies, Fermat's theorem, Wilson's theorem and its converse,

Unit – II

Complete residue system and reduced residue system modulo m , Euler's ϕ function and Euler's generalization of Fermat's theorem, Chinese Remainder theorem, Quadratic residues, Legendre symbol, Gauss's lemma, Gauss reciprocity law (Applications only), Greatest integer function, Divisor function ($\tau(n)$), Sum function ($\sigma(n)$),

Unit – III

De Moivre's theorem and its applications, Expansion of trigonometric functions, Direct circular and hyperbolic functions and their properties.

Unit – IV

Logarithm of a complex quantity, Gregory's series, Summation of trigonometric series.

Suggested Readings:

1. Loney, S.L., 2018. Plane Trigonometry, Creative Media Partners, LLC.
2. Verma, R.S., Sukla, K.S., 1969. Text Book on Trigonometry, Pothishala Pvt. Ltd. Allahabad.
3. Niven I., Zuckerman H.S., 1991. An Introduction to the Theory of Numbers, Willey Publication.



20UMTH202

Vector Calculus & Geometry

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Unit – I

Gradient of a scalar point function, Directional derivatives, geometrical interpretation of $\text{grad } \phi$, character of gradient as a point function. Divergence and curl of vector point function and their geometrical significance, characters of $\text{Div. } \vec{f}$ and $\text{Curl } \vec{f}$ as point function, examples. Gradient, divergence and curl of sums and product and their related vector identities. Laplacian operator.

Unit – II

Orthogonal curvilinear coordinates Conditions for orthogonality fundamental triad of mutually orthogonal unit vectors. Gradient, Divergence, Curl and Laplacian operators in terms of orthogonal curvilinear coordinates, Cylindrical co-ordinates and Spherical co-ordinates.

Unit – III

Vector integration; Line integral, Surface integral, Volume integral. Problems based on Theorems of Gauss, Green & Stokes.

Unit – IV

General equation of second degree. Tracing of conics. Tangent at any point to the conic, chord of contact, pole of line to the conic, director circle of conic.

Suggested Readings:

1. Spiegel , Murray R., 2009. Vector Analysis, Schaum Publishing Company, New York.
2. Saran , N. , Nigam, S.N.,1982. Introduction to Vector Analysis, Pothishala Pvt. Ltd., Allahabad.
3. Narayna S., 1955. A Text Book of Vector Calculus, S. Chand & Co., New Delhi.
4. Bill, R.J.T., 1994.Elementary Treatise on Co-Ordinary Geometry of Three Dimensions, MacMillan India Ltd.
5. Jain, P.K., Ahmad, Khalil, 1999 .A Textbook of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd. .

20UMTH203

Mathematical Lab- II

Maximum Marks-50
External Practical Examination-40
Internal Assessment-10

Mathematical problem Solving Techniques based on courses 20UMTH201 to 20UMTH202 will be taught. Students will have to solve 15-20 problems based on 20UMTH201 & 20 UMTH202. Also solve atleast 10 problems using programing software preferably MS-Excel. Programmes will be based on Number Theory & Trigonometry and Vector calculus & Geometry.

Note:- Every student will maintain practical record of problems solved during practical class-work in a file. Examination will be conducted through a question paper set jointly by the external and internal examiners. The question paper will consist of questions based on problem solving techniques/algorithm. An examinee will be asked to write the solutions in the answer book. Evaluation will be made on the basis of the examinee's performance in written solutions and presentation with viva-voce and practical record.

Practical Examination will be conducted externally as per the following distribution of marks:

<i>Writing solutions of problems:</i>	<i>20 marks.</i>
<i>Presentation & Viva voce:</i>	<i>10 marks.</i>
<i>Practical record:</i>	<i>10 marks.</i>
<i>Internal Assesment:</i>	<i>10 marks (Attendance=5 marks, Assignment=5 marks)</i>

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**Scheme of Examination and Syllabi of B.Sc. / B.A. IIIrd Semester
Mathematics
(w.e.f. 2020-21)**

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
20UMTH301	Differential Equations	Core	2	2	40+10=50
20UMTH302	Numerical Methods with Programming in C	Core	2	2	40+10=50
20UMTH303	Mathematical Lab-III	Core	2	4	40+10=50

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20UMTH301

Differential Equations

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Unit – I

Geometrical meaning of a differential equation. Exact differential equations, integrating factors. Reduction to Exact differential equations, First order higher degree equations solvable for x , y , dy/dx , Lagrange's equations, Clairaut's equations. Equation reducible to Clairaut's form. Singular solutions.

Unit – II

Orthogonal trajectories: in Cartesian coordinates and polar coordinates. Self-orthogonal family of curves. Linear differential equations with constant coefficients. Solution by variation of parameters. Homogeneous linear ordinary differential equations. Equations reducible to homogeneous linear ordinary differential equations.

Unit – III

Partial differential equations: Formation, order and degree, Linear and Non-Linear Partial differential equations of the first order: Complete solution, singular solution, General solution, Solution of Lagrange's linear equations, Charpit's general method of solution.

Unit – IV

Jacobi's method, Linear partial differential equations of second and higher orders, Linear and non-linear homogenous and non-homogenous equations with constant co-efficient, Method of separation of variables.

Suggested Readings:

1. Murray, D.A.,1967. Introductory Course in Differential Equations. Orient Longaman India.
2. Bronson,R.and Gabriel,B.C,2006. Schaum's Outline of Differential Equations.McGraw Hill,New York.
3. Ross, S.R.,2004. Differential Equations, John Wiley & Sons
4. Rai,B. & Chaudhary,D.P., Ordinary Differential Equations; Narosa, Publishing House Pvt. Ltd.
5. Sneddon, I.N., 1988.Elements of Partial Differential Equations, McGraw Hill Book Company, New York.
6. Sharma J.N and Singh K.2009. Partial Differential Equations for Engineers and Scientists, Alpha Science International.

20UMTH302

Numerical Methods with Programming in C

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Unit – I

Programmer's model of a computer, Algorithms, Flow charts, Data types, Operators and expressions, Input / outputs functions. Decisions control structure: Decision statements, Logical and conditional statements, Implementation of Loops, Switch Statement & Case control structures. Functions, Preprocessors and Arrays.

Unit – II

Strings: Character Data Type, Standard String handling Functions, Arithmetic Operations on Characters. Structures: Definition, using Structures, use of Structures in Arrays and Arrays in Structures.

Unit – III

Solution of Algebraic and Transcendental equations: Bisection method, Regula-Falsi method, Secant method, Fixed Point iterative method, Newton-Raphson's method. Newton's iterative method for finding nth root of a number, Order of convergence of above methods.

Unit – IV

Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method. Convergence of Gauss Seidal Method.

Suggested Readings:

1. Thareja,R.,Programming in C,2016. Oxford University Press.Oxford.
2. V. Rajaraman,1994. Programming in C, Prentice Hall of India.
3. M.K. Jain, S. R. K. Iyengar, R.K. Jain,1996. Numerical Method, Problems and Solutions, New Age International (P) Ltd.
4. Balagurusamy, E.,2008,Programming in ANSI C, Tata McGraw-Hill Publishing Co. Ltd.
5. Balagurusamy,E.,2010.Numerical Methods, Tata McGraw-Hill Publishing Co. Ltd,India

20UMTH303

Mathematical Lab- III

Maximum Marks-50
External Practical Examination-40
Internal Assessment-10

Mathematical problem Solving Techniques based on courses **20UMTH301 to 20UMTH302** will be taught. Students will have to solve 15-20 problems based on 20UMTH301 & 20 UMTH302. Students will also have to solve atleast 10 problems using C-Language. Programmes will be based on Differential Equations and Numerical Methods.

Note:- Every student will maintain practical record of problems solved during practical class-work in a file. Examination will be conducted through a question paper set jointly by the external and internal examiners. The question paper will consist of questions based on problem solving techniques/algorithm. An examinee will be asked to write the solutions in the answer book. Evaluation will be made on the basis of the examinee's performance in written solutions and presentation with viva-voce and practical record.

Practical Examination will be conducted externally as per the following distribution of marks:

<i>Writing solutions of problems:</i>	<i>20 marks.</i>
<i>Presentation & Viva voce:</i>	<i>10 marks.</i>
<i>Practical record:</i>	<i>10 marks.</i>
<i>Internal Assesment:</i>	<i>10 marks (Attendance=5 marks, Assignment=5 marks)</i>



**Scheme of Examination and Syllabi of B.Sc. / B.A. IVth Semester
Mathematics
(w.e.f. 2020-21)**

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
20UMTH401	Mechanics	Core	2	2	40+10=50
20UMTH402	Groups & Rings	Core	2	2	40+10=50
20UMTH403	Mathematical Lab-IV	Core	2	4	40+10=50

**20UMTH401
Mechanics**

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Unit – I

Composition and resolution of forces, Resultant of two Parallel forces and their applications.

Unit – II

Moments and Couples, Analytical conditions of equilibrium of coplanar forces.

Unit – III

Velocity and acceleration along radial, transverse, tangential and normal directions. Relative velocity and acceleration. Simple harmonic motion.

Unit – IV

Elastic strings, Newton's laws of motion. Work, Power and Energy.

Suggested Readings:

1. Loney, S.L., 1912. Statics, Cambridge University Press
2. Verma, R.S., 1962. A Text Book on Statics, Pothishala Pvt. Ltd.,
3. Loney, S.L., 1956. An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press.
4. Chorlton, F., 2002. Text book of Dynamics, CBS Publishers, New Delhi

20UMTH402

Groups & Rings

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Unit – I

Definition of a group with example and simple properties of groups, Subgroups and Subgroup criteria, Generation of groups, cyclic groups, Cosets, Left and right cosets, Index of a sub-group Coset decomposition, Lagrange's theorem and its consequences, Normal subgroups.

Unit – II

Quotient Groups. Homomorphism, isomorphism, automorphism and inner automorphism of a group. Automorphism of cyclic groups, Permutations groups. Even and odd permutations. Alternating groups, Cayley's theorem.

Unit – III

Introduction to rings, subrings, integral domains and fields, Characteristics of a ring. Ring homomorphism, ideals (prime, maximal and principal) and Quotient rings.

Unit – IV

Euclidean rings, Polynomial rings, Polynomials over the rational field, The Eisenstein's criterion, Polynomial rings over commutative rings, Unique factorization domain.

Suggested Readings:

1. Herstein, I.N., 1975. Topics in Algebra, Wiley Eastern Ltd., New Delhi.
2. Gallian, J.A., 1999. Abstract Algebra, Narosa Publishing House.
3. Ayres, F and Jaisingh L.R., 2005. Schaum's Outlines of Theory and Problems of Abstract Algebra, McGraw Hill Co. New York.



20UMTH403

Mathematical Lab- IV

Maximum Marks-50
External Practical Examination-40
Internal Assessment-10

Mathematical problem Solving Techniques based on courses **20UMTH401 to 20UMTH402** will be taught. Students will have to solve 15-20 problems based on 20UMTH401 & 20 UMTH402. Students will also have to solve atleast 10 problems using programming software preferably MS-Excel/C-Language. Programmes will be based on Mechanics and Groups & Rings.

Note:- Every student will maintain practical record of problems solved during practical class-work in a file. Examination will be conducted through a question paper set jointly by the external and internal examiners. The question paper will consist of questions based on problem solving techniques/algorithm. An examinee will be asked to write the solutions in the answer book. Evaluation will be made on the basis of the examinee's performance in written solutions and presentation with viva-voce and practical record.

Practical Examination will be conducted externally as per the following distribution of marks:

<i>Writing solutions of problems:</i>	<i>20 marks.</i>
<i>Presentation & Viva voce:</i>	<i>10 marks.</i>
<i>Practical record:</i>	<i>10 marks.</i>
<i>Internal Assesment:</i>	<i>10 marks (Attendance=5 marks, Assignment=5 marks)</i>

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**Scheme of Examination and Syllabi of B.Sc. / B.A. Vth Semester
Mathematics
(w.e.f. 2020-21)**

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
Choose One from 20UMTH501 or 20UMTH502 & Choose One from 20UMTH503 or 20UMTH504					
20UMTH501	Statics & Dynamics	Discipline Specific Elective	2	2	40+10=50
20UMTH502	Statistical Inference				
20UMTH503	Mathematical Analysis	Discipline Specific Elective	2	2	40+10=50
20UMTH504	Linear Algebra				
20UMTH505	Mathematical Lab-V	Discipline Specific Elective	2	4	40+10=50

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20UMTH501
Statics & Dynamics

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Unit – I

Friction, Centre of Gravity. Virtual work.

Unit – II

Forces in three dimensions, Poinot's central axis. Wrenches, Null lines and planes.

Unit – III

.Definitions of Conservative forces and Impulsive forces. Projectile motion of a particle in a plane. Vector angular velocity.

Unit – IV

General motion of a rigid body. Central Orbits, Kepler laws of motion. Motion of a particle in three dimensions.

Suggested Readings:

1. Loney,S.L., 1912.Statics, Cambride University Press
2. Verma, R.S., 1962.A Text Book on Statics, Pothishala Pvt. Ltd.,
3. Loney,S.L.,1956. An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press.
4. Chorlton,F.,2002. Text book of Dynamics, CBS Publishers, New Delhi

20UMTH502

Statistical Inference

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Unit – I

Parameter and statistic, sampling distribution and standard error of estimate. Point and interval estimation, Unbiasedness, Efficiency, Consistency and Sufficiency. Method of maximum likelihood estimation.

Unit – II

Null and alternative hypotheses, Simple and composite hypotheses, Critical region, Level of significance, One tailed and two tailed tests, Types of errors, Neyman- Pearson Lemma.

Unit – III

Definition of Chi-square statistic, Chi-square tests for goodness of fit and independence of attributes. Student t-distribution, properties of t-distribution, significance test of single mean and difference between two sample means.

UNIT-IV

Snedcor's F-statistics. Testing for the mean and variance of univariate normal distributions, Testing of equality of two means and two variances of two univariate normal distributions. Related confidence intervals. Analysis of variance(ANOVA) for one-way and two-way classifications.

Suggested Readings:

1. Mood A.M, Graybill, F.A and Boes,D.C., 1974 Introduction to the theory of Statistics, McGraw Hill.
2. Goon,A.M , Gupta,M.K. and Gupta,B.D.,2002 Fundamentals of Statistics, Vol-II. World Press
3. Hogg,R.V. and Craig,A.T.2018, Introduction to Mathematical Statistics.Pearson Education.
4. S.C. Gupta and V.K. Kapoor, 2002. Fundamentals of Mathematical Statistics, Sultan Chand & Sons.



20UMTH503
Mathematical Analysis

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Unit – I

Boundedness of the set of real numbers; least upper bound, greatest lower bound of a set, neighborhoods, interior points, isolated points, limit points, open sets, closed set, interior of a set, closure of a set in real numbers and their properties. Bolzano-Weierstrass theorem(Statement only), Open covers, Compact sets and Heine- Borel Theorem(Statement only).

Unit – II

Sequence: Real Sequences and their convergence, Theorem on limits of sequence, Bounded and monotonic sequences, Cauchy's sequence, Cauchy general principle of convergence, Subsequences, Sub-sequential limits. Infinite series: Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series, Cauchy's general principle of Convergence of series,

Unit – III

Infinite series: Convergence and divergence of geometric series, p-series. Applications of D-Alembert's ratio test, Raabe's test, Cauchy's nth root test, Gauss Test, Cauchy's integral test, Cauchy's condensation test. Alternating series, Leibnitz's test, absolute and conditional convergence.

Unit – IV

Extended Complex Plane, Stereographic projection of complex numbers, Functions of complex variables: exponential, logarithmic, circular, hyperbolic, inverse hyperbolic functions, real and imaginary part of complex functions; continuity and differentiability of complex functions.

Suggested Readings:

1. Goldberg,R.R.,1970. Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi.
2. Malik, S.C. and Arora S,1992. Mathematical Analysis, New Age International, India.
3. Narayan,S.,2013. A Course on Mathematical Analysis, S. Chand and company, New Delhi
4. Wrede,R. and Spiegel M.R.,2002. Theory and Problems of Advanced Calculus, Schaum Publishing co., New York
5. Apostol, T.M.,1985. Mathematical Analysis, Narosa Publishing House, New Delhi.
- 6.. Shanti Narayan: Theory of Functions of a Complex Variable, S. Chand & Co., New Delhi.

20UMTH504
Linear Algebra

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Unit – I

Vector spaces, subspaces, Sum and Direct sum of subspaces, Linear span, Linearly Independent and dependent subsets of a vector space. Finitely generated vector space, Existence theorem for basis of a finitely generated vector space, Finite dimensional vector spaces, Invariance of the number of elements of bases sets, Dimensions, Quotient space and its dimension.

Unit – II

Homomorphism and isomorphism of vector spaces, linear transformations and linear forms on vector spaces, Vector space of all the linear transformations, Dual Spaces, Null Space, Range space of a linear transformation, Rank and Nullity Theorem(Statement and applications).

Unit – III

Algebra of Linear Transformation, Minimal Polynomial of a linear transformation, Singular and non-singular linear transformations, Matrix of a linear Transformation, Change of basis,

Unit – IV

Eigen values and Eigen vectors of linear transformations. Inner product spaces, Cauchy-Schwarz inequality, orthogonal vectors, orthogonal complements, Orthogonal sets and Basis, Bessel's inequality for finite dimensional vector spaces(Statement only), Gram-Schmidt, Orthogonalization process.

Suggested Readings:

1. Herstein, I.N., 1975. Topics in Algebra, Wiley Eastern Ltd., New Delhi.
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal: Basic Abstract Algebra (2nd edition).
3. Vivek Sahai and Vikas Bist: Algebra, Narosa Publishing House.
4. I.S. Luther and I.B.S. Passi: Algebra, Vol.-II, Narosa Publishing House
5. Lipschutz, S. and Lipson, M.L., 2009. Schaum's outline series of Linear Algebra, McGraw Hill Co. New York.

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20UMTH505

Mathematical Lab- V

Maximum Marks-50
External Practical Examination-40
Internal Assessment-10

Mathematical problem Solving Techniques based on courses **20UMTH501/ 20UMTH502 and 20UMTH503/ 20UMTH504** will be taught. Students will have to solve 15-20 problems based on **20UMTH501/ 20UMTH502 and 20UMTH503/ 20UMTH504**.

Students will also have to solve atleast 10 problems using Computer software preferably

Mathematica/MS-Excel. Programmes will be based on Statics & Dynamics / Statistical Inference and Mathematical Analysis/ Linear Algebra.

Note:- Every student will maintain practical record of problems solved during practical class-work in a file. Examination will be conducted through a question paper set jointly by the external and internal examiners. The question paper will consist of questions based on problem solving techniques/algorithm. An examinee will be asked to write the solutions in the answer book. Evaluation will be made on the basis of the examinee's performance in written solutions and presentation with viva-voce and practical record.

Practical Examination will be conducted externally as per the following distribution of marks:

Writing solutions of problems: 20 marks.

Presentation & Viva voce: 10 marks.

Practical record: 10 marks.

Internal Assesment: 10 marks (Attendance=5 marks, Assignment=5 marks)

**Scheme of Examination and Syllabi of B.Sc. / B.A. VIth Semester
Mathematics
(w.e.f. 2020-21)**

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
Choose One from 20UMTH601 or 20UMTH602 & Choose One from 20UMTH603 or 20UMTH604					
20UMTH601	Special Functions & Integral Transforms	Discipline Specific Elective	2	2	40+10=50
20UMTH602	Solid Geometry				
20UMTH603	Real Analysis	Discipline Specific Elective	2	2	40+10=50
20UMTH604	Advanced Calculus				
20UMTH605	Mathematical Lab-VI	Discipline Specific Elective	2	4	40+10=50

20UMTH601

Special Functions & Integral Transforms

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Unit – I

Series solution of differential equations – Power series method, Definitions of Beta and Gamma functions. Bessel equation and its solution: Bessel functions and their properties-Convergence, recurrence. Relations and generating functions, Orthogonality of Bessel functions.

Unit – II

Legendre differential equations and their solutions: Legendre functions and their properties-Recurrence Relations and generating functions. Orthogonality of Legendre functions . Rodrigues' Formula for Legendre , Integral Representation of Legendre polynomial.

Unit – III

Laplace Transforms – Existence theorem for Laplace transforms, Linearity of the Laplace transforms, Shifting theorems, Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem, Inverse Laplace transforms, convolution theorem, Inverse Laplace transforms of derivatives and integrals, solution of ordinary differential equations with constant coefficients using Laplace transforms.



Unit – IV

Fourier transforms: Linearity property, Shifting, Modulation, Convolution Theorem, Fourier Transform of Derivatives, Relations between Fourier transform and Laplace transform, Parseval's identity for Fourier transforms. Solution of ordinary differential Equations using Fourier Transforms.

Suggested Readings:

1. Kreyszing, E.,1999.Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York.
2. Sneddon,I.N.,1956. Special Functions on Mathematical Physics & Chemistry. Interscience Publisher,New York.
3. Debnath L and Bhatta D.,2014. Integral Transform and their Applications,CRC,Press



20UMTH602
Solid Geometry

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Unit – I

General equation of second degree. Tracing of conics. Tangent at any point to the conic, chord of contact, pole of line to the conic, director circle of conic. System of conics. Confocal conics. Polar equation of a conic, tangent and normal to the conic.

Unit – II

Sphere: Plane section of a sphere. Sphere through a given circle. Intersection of two spheres, radical plane of two spheres. Co-axial system of spheres,

Unit-III

cones. Right circular cone, enveloping cone and reciprocal cone. Cylinder: Right circular cylinder and enveloping cylinder.

Unit – IV

Central conicoids: Equation of tangent plane. Director sphere. Normal to the conicoids. Polar plane of a point. Enveloping cone of a coinoid. Enveloping cylinder of a coinoid.

Suggested Readings:

1. Bill, R.J.T., 1994. Elementary Treatise on Co-ordinary Geometry of Three Dimensions, MacMillan India Ltd.
2. Jain, P.K. and Ahmad, K., 1999. A Textbook of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd.



20UMTH603

Real Analysis

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Unit – I

Riemann integral, Integrability of continuous and monotonic functions, The Fundamental theorem of integral calculus. Mean value theorems of integral calculus.

Unit – II

Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests, Frullani's integral, Integral as a function of a parameter. Continuity, Differentiability and Integrability of an integral of a function of a parameter.

Unit – III

Definition and examples of metric spaces, neighborhoods, limit points, interior points, open and closed sets, closure and interior, boundary points, subspace of a metric space, equivalent metrics, Cauchy sequences, completeness, Cantor's intersection theorem(statement and applications), Baire's category theorem(Statements and applications), contraction Principle

Unit – IV

Continuous functions, uniform continuity, compactness for metric spaces, sequential compactness, Bolzano-Weierstrass property, total boundedness, finite intersection property, continuity in relation with compactness.

Suggested Readings:

1. Jain, P.K. and Ahmad, K., 2004 Metric Spaces, 2nd Ed., Narosa Publishing House, N. Delhi
2. Apostol, T.M., 1985. Mathematical Analysis, Narosa Publishing House, New Delhi.
3. Goldberg, R.R., 1970. Real analysis, Oxford & IBH publishing Co., New Delhi.
4. Narayan, S and Mittal P.K., 2013 A Course of Mathematical Analysis, S. Chand & Co., New Delhi
5. Copson, E.T., 1968. Metric Spaces, Cambridge University Press.
6. Simmons, G.F., 1963. Introduction to Topology and Modern Analysis, McGraw Hill.

20UMTH604
Advanced Calculus

Maximum Marks-50
External Examination-40
Internal Assessment-10
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Unit – I

Uniform continuity, chain rule of differentiability. Mean value theorems; Rolle's Theorem and Lagrange's mean value theorem and their geometrical interpretations. Taylor's Theorem with various forms of remainders, Darboux intermediate value theorem for derivatives(statement only), Indeterminate forms.

Unit – II

Limit and continuity of real valued functions of two variables. Partial differentiation. Total Differentials; Composite functions & implicit functions. Change of variables. Homogenous functions & Euler's theorem on homogeneous functions.

Unit – III

Taylor's theorem for functions of two variables. Differentiability of real valued functions of two variables. Schwarz and Young's theorem. Implicit function theorem. Maxima, Minima and saddle points of two variables.

Unit – IV

Lagrange's method of multipliers. Jacobian, Differentiation under integral sign, Applications of Triple integrals, Change of variable in Double and triple integrals.

Suggested Readings:

1. Narayan S., 1962. Differential Calculus. S. Chand and Company.India
2. Spiegel S., Murray R., 1963. Theory and Problems of Advanced Calculus, Mc- Graw Hill, New York.
3. Prasad,G. 1941.Text book on Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
4. Ramana, B.V.,2008. Higher Engineering Mathematics,Tata McGraw Hill Publishing Co.Ltd. New Delhi



20UMTH605

Mathematical Lab- VI

Maximum Marks-50
External Practical Examination-40
Internal Assessment-10

Mathematical problem Solving Techniques based on courses **20UMTH601/ 20UMTH602 and 20UMTH603/ 20UMTH604** will be taught. **20UMTH601/ 20UMTH602 and 20UMTH603/ 20UMTH604**

Students will also have to solve atleast 10 problems using Computer software preferably Mathematica/MS-Excel. Programmes will be based on Special Functions & Integral Transforms / Solid Geometry and Real Analysis/ Advanced Calculus.

Note:- Every student will maintain practical record of problems solved during practical class-work in a file. Examination will be conducted through a question paper set jointly by the external and internal examiners. The question paper will consist of questions based on problem solving techniques/algorithm. An examinee will be asked to write the solutions in the answer book. Evaluation will be made on the basis of the examinee's performance in written solutions and presentation with viva-voce and practical record.

Practical Examination will be conducted externally as per the following distribution of marks:

Writing solutions of problems: 20 marks.

Presentation & Viva voce: 10 marks.

Practical record: 10 marks.

Internal Assessment: 10 marks (Attendance=5 marks, Assignment=5 marks)



Skill Enhancement Courses offered by Department of Mathematics

Scheme of Examination and Syllabi of SEC for B.Sc. (Non-Medical & Computer Science)/ B. A. Mathematics (w.e.f. 2020-21) SEMESTER-IV

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
Choose One out of following four papers:					
20USECM401	Logic and sets	Skill Enhancement	3	3	80+20=100
20USECM402	Analytical Geometry				
20USECM403	Probability & Statistics				
20USECM404	Vedic Arithmetic				

20USECM401 Logic and sets

Maximum Marks-100
External Examination-80
Internal Assessment-20
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Unit – I

Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, bi-conditional propositions, converse, contra positive and inverse propositions and precedence of logical operators.

Unit – II

Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.

Unit – III

Sets, subsets, Set operations, the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set.



Unit – IV

Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation.

Suggested Readings:

1. Grimaldi, R.P. 1998. Discrete Mathematics and Combinatorial Mathematics, Pearson Education.
2. Halmos, P.R., 1974. Naive Set Theory, Springer.
3. Kamke, E. 1950. Theory of Sets, Dover Publishers.

20USECM402

Analytical Geometry

Maximum Marks-100
External Examination-80
Internal Assessment-20
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Unit – I

Techniques for sketching parabola, ellipse and hyperbola.

Unit – II

Reflection properties of parabola, ellipse and hyperbola.

Unit – III

Classification of quadratic equations representing lines, parabola, ellipse and hyperbola.

Unit – IV

Spheres, Cylindrical surfaces. Illustrations of graphing standard quadric surfaces like cone, ellipsoid.

Suggested Readings:

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) Pvt. Ltd., 2002.
3. S.L. Loney, *The Elements of Coordinate Geometry*, McMillan and Company, London. 1920.
4. R.J.T. Bill, *Elementary Treatise on Coordinate Geometry of Three Dimensions*, McMillan India Ltd., 1994.

20USECM403
Probability and Statistics

Maximum Marks-100
External Examination-80
Internal Assessment-20
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Unit – I

Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation.

Unit – II

Moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, continuous distributions: uniform, normal, exponential.

Unit – III

Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions.

Unit – IV

Expectation of function of two random variables, conditional expectations, independent random variables.

Suggested Readings:

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, *Introduction to Mathematical Statistics*, Pearson Education, Asia, 2007.
2. Irwin Miller and Marylees Miller, John E. Freund, *Mathematical Statistics with Application*, 7th Ed., Pearson Education, Asia, 2006.
3. Sheldon Ross, *Introduction to Probability Model*, 9th Ed., Academic Press, Indian Reprint, 2007.



20USECM404
Vedic Arithmetic

Maximum Marks-100
External Examination-80
Internal Assessment-20
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Unit – I

Multiplication: Ekadhikena Purvena method (multiplication of two numbers of two digits), Ekadhikena Purvena (multiplication of two numbers of three digits), Urdhvatiryakbhyam (multiplication of two numbers of three digits), Nikhilam Navtashcarman Dashtaha (multiplication of two numbers of three digits), Combined Operations.

Unit – II

Division: Nikhilam Navtashcarman Dashtaha (two digits divisor), Paravartya Yojayati-Sutra (three digits divisor). Divisibility: Ekadhikena Purvena method (two digits divisor), Ekadhikena Purvena (two digits divisor).

Unit – III

LCM and HCF in arithmetic and Algebra.

Unit – IV

Power: Square (four digits numbers), Cube(two digits numbers). Root: Square root (four digits numbers), Cube root(six digits numbers).

Suggested Readings:

1. Vedic Mathematics, Motilal Banarsi Das, New Delhi.
2. Vedic Ganita: Vihangama Drishti-1, Siksha Sanskriti Uthana Nyasa, New Delhi.
3. Vedic Ganita Praneta, Siksha Sanskriti Uthana Nyasa, New Delhi.
4. Vedic Mathematics: Past, Present and Future, Siksha Sanskriti Uthana Nyasa, New Delhi.
5. Leekavati, Chokhambba Vidya Bhawan, Varansi.
6. Bharatiya Mathematicians, Sharda Sanskriti Sansthan, Varanasi.

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**Scheme of Examination and Syllabi of SEC for B.Sc. (Non-Medical
& Computer Science)/ B. A. Mathematics
(w.e.f. 2020-21)
SEMESTER-V**

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
Choose One out of following four papers:					
20USECM501	Integral Calculus	Skill Enhancement	3	3	80+20=100
20USECM502	Theory of Equations				
20USECM503	Discrete Mathematics				
20USECM504	Vedic Algebra				

20USECM501

Integral Calculus

Maximum Marks-100
External Examination-80
Internal Assessment-20
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Unit – I

Integration by Partial fractions, integration of rational and irrational functions. Properties of definite integrals.

Unit – II

Reduction formulae for integrals of rational, trigonometric, exponential and logarithmic functions and of their combinations.

Unit – III

Areas and lengths of curves in the plane, volumes and surfaces of solids of revolution.

Unit – IV

Double and Triple integrals.

Suggested Readings:

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd., 2002.

20USECM502
Theory of Equations

Maximum Marks-100
External Examination-80
Internal Assessment-20
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Unit – I

General properties of polynomials, Graphical representation of a polynomials, maximum and minimum values of a polynomials.

Unit – II

General properties of equations, Descarte's rule of signs positive and negative rule, Relation between the roots and the coefficients of equations.

Unit – III

Symmetric functions, Applications symmetric function of the roots, Transformation of equations.

Unit – IV

Solutions of reciprocal and binomial equations. Algebraic solutions of the cubic and biquadratic. Properties of the derived functions.

Suggested Readings:

1. W.S. Burnside and A.W. Panton, *The Theory of Equations*, Dublin University Press, 1954.
2. C. C. MacDuffee, *Theory of Equations*, John Wiley & Sons Inc., 1954.

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20USECM503

Discrete Mathematics

Maximum Marks-100
External Examination-80
Internal Assessment-20
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Unit – I

Sets, principle of inclusion and exclusion, relations, equivalence relations and partition, denumerable sets, partial order relations, Mathematical Induction, Pigeon Hole Principle and its applications.

Unit – II

Propositions, logical operations, logical equivalence, conditional propositions, Tautologies and contradictions. Quantifier, Predicates and Validity.

Unit – III

Permutations and combinations, probability, basic theory of Graphs and rings.

Unit – IV

Discrete numeric functions, Generating functions, recurrence relations with constant coefficients. Homogeneous solution, particular relations, total rotation, Solution of recurrence relation by the method Generating function.

Suggested Readings:

1. J.P. Tremblay & R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 1997.
2. J.L. Gersting, Mathematical Structures for Computer Science, (3rd edition), Computer Science Press, New York.2014.
3. Seymour Lipschutz, Finite Mathematics (International edition 1983), McGraw-Hill Book Company, New York.1983.
4. C.L. Liu, Elements of Discrete Mathematics, McGraw- Hill Book Co.1998.



20USECM504
Vedic Algebra

Maximum Marks-100
External Examination-80
Internal Assessment-20
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Unit – I

Multiplication: Urdhvatiragbhyam Method, Combined Operations.

Unit – II

Division (Divisor: Linear Expression of Single Variable), Factorization (Quadratic Expression of single variable).

Unit – III

LCM and HCF

Unit – IV

Solutions of linear simultaneous equations.

Suggested Readings:

1. Vedic Mathematics, Motilal Banarsi Das, New Delhi.
2. Vedic Ganita: Vihangama Drishti-1, Siksha Sanskriti Uthana Nyasa, New Delhi.
3. Vedic Ganita Praneta, Siksha Sanskriti Uthana Nyasa, New Delhi.
4. Vedic Mathematics: Past, Present and Future, Siksha Sanskriti Uthana Nyasa, New Delhi.
5. Beejganitam, Chokhambba Vidya Bhawan, Varansi.
6. Bharatiya Mathematicians, Sharda Sanskriti Sansthan, Varanasi.

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**Scheme of Examination and Syllabi of SEC for B.Sc. (Non-Medical
& Computer Science)/ B. A. Mathematics
(w.e.f. 2020-21)
SEMESTER-VI**

Paper Code	Paper Name	Type of Course	Credits (Theory/ Practical)	Contact Hours (Theory/ Practical)	Marks (External + Internal)
Choose One out of following four papers:					
20USECM601	Boolean Algebra	Skill Enhancement	3	3	80+20=100
20USECM602	Transportation and Game Theory				
20USECM603	Mathematical Finance				
20USECM604	Vedic Geometry				

**20USECM601
Boolean Algebra**

Maximum Marks-100
External Examination-80
Internal Assessment-20
Max. Time- 3 hrs.

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Unit – I

Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle, maximal and minimal elements.

Unit – II

Lattices as ordered sets, complete lattices, lattices as algebraic structures, sub-lattices, products and homomorphism.

Unit – III

Definition, examples and properties of modular and distributive lattices, Boolean algebras, Boolean polynomials, minimal forms of Boolean polynomials.

Unit – IV

Quinn-McCluskey method, Karnaugh diagrams, switching circuits and applications of switching circuits.

Suggested Readings:

1. B A. Davey and H. A. Priestley, *Introduction to Lattices and Order*, Cambridge University Press, Cambridge, 1990.
2. Rudolf Lidl and Günter Pilz, *Applied Abstract Algebra*, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

20USECM602

Transportation & Game Theory

Maximum Marks-100
External Examination-80
Internal Assessment-20
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Unit – I

Transportation problem and its mathematical formulation, northwest-corner method, least cost Method.

Unit – II

Vogel approximation method for determination of starting basic solution.

Unit – III

Algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.

Unit – IV

Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure.

Suggested Readings :

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, *Linear Programming and Network Flows*, 2nd Ed., John Wiley and Sons, India, 2004.
2. F. S. Hillier and G. J. Lieberman, *Introduction to Operations Research*, 9th Ed., Tata McGraw Hill, Singapore, 2009.
3. Hamdy A. Taha, *Operations Research, An Introduction*, 8th Ed., Prentice-Hall India, 2006.

20USECM603
Mathematical Finance

Maximum Marks-100
External Examination-80
Internal Assessment-20
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Unit – I

Basic principles: Comparison, arbitrage and risk aversion, Interest (simple and compound, discrete and continuous), time value of money, inflation.

Unit – II

Net present value, internal rate of return (calculation by bisection and Newton-Raphson methods), comparison of NPV and IRR. Bonds, bond prices and yields. Floating-rate bonds, immunization.

Unit – III

Asset return, short selling, portfolio return, (brief introduction to expectation, variance, covariance and correlation), random returns, portfolio mean return and variance.

Unit – IV

Diversification, portfolio diagram, feasible set, Markowitz model (review of Lagrange multipliers for 1 and 2 constraints).

Suggested Readings:

1. David G. Luenberger, *Investment Science*, Oxford University Press, Delhi, 1998.
2. John C. Hull, *Options, Futures and Other Derivatives*, 6th Ed., Prentice-Hall India, Indian reprint, 2006.
3. Sheldon Ross, *An Elementary Introduction to Mathematical Finance*, 2nd Ed., Cambridge University Press, USA, 2003.



20USECM604
Vedic Geometry

Maximum Marks-100
External Examination-80
Internal Assessment-20
Max. Time- 3 hrs.

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Unit – I

Concept of Bhaudhayana Number (BN): BN of an angle, Multiplication of a constant in a BN, BN of complimentary angles, BN of sum and difference of an angle, BN of half angle.

Unit – II

Trigonometry: Definition of trigonometric ratios, Trigonometric identities.

Unit – III

Co-ordinate Geometry: Different forms of straight lines.

Unit – IV

Complex Numbers: Multiplication, division and square root.

Suggested Readings:

1. Vedic Mathematics, Motilal Banarsi Das, New Delhi.
2. Vedic Ganita: Vihangama Drishti-1, Siksha Sanskriti Uthana Nyasa, New Delhi.
3. Vedic Ganita Praneta, Siksha Sanskriti Uthana Nyasa, New Delhi.
4. Vedic Mathematics: Past, Present and Future, Siksha Sanskriti Uthana Nyasa, New Delhi.
5. Beejganitam, Chokhambba Vidya Bhawan, Varanasi.
6. Bharatiya Mathematicians, Sharda Sanskriti Sansthan, Varanasi.