KOLHAN UNIVERSITY, CHAIBASA
DEPARTMENT OF MATHEMATICS
(For CBCS syllabus B. Sc.)
COMPOSITION OF BOARD OF STUDIES

1. Chairman : Dr. T. C. K. Raman
   Head, University Department of Mathematics
   Kolhan University, Chaibasa, Mob. No.-9431758090

2. Dr.M.K.Singh (External Expert)
   Professor, Department of Mathematics,
   Ranchi University, RANCHI, Mob. No.-9835347289

3. Dr. D. R. Kuiry (Member)
   Associate Professor,
   University Department of Mathematics
   Kolhan University, Chaibasa. Mob.-9939372565

4. Dr. B. N. Prasad(Member)
   Associate Professor & Head, Department of Mathematics,
   Jamshedpur Co-operative College, Jamshedpur,. Mob.-9430745882

5. Dr. M. A. Khan(Member)
   C. V. C. Kolhan University,Chaibasa.Mob.No.-9234776209

6 . Dr. K.N.Pradhan(Member)
   Head, Department of Mathematics,
   Tata College, Chaibasa, MobNo.- 7209860187

(Dr.T.C.K.Raman)
Associate Professor & Head, Department of Mathematics
KOLHAN UNIVERSITY ,CHAIBASA.

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External Expert

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Dr. M. A. Khan
Member

9. CREDIT SCHEME FOR CBCS IN B.SC. HONOURS

Course	Credits	
	Theory+ Practical	Theory + Tutorial
I. Core Course (14 Papers)	14x4= 56	14x5=70
Core Course Practical / Tutorial (14 Papers)	14x2=28	14x1=14
II. Elective Course (8 Papers)		
A.1. Discipline Specific Elective (4 Papers)	4x4=16	4x5=20
A.2. Discipline Specific Elective Practical/ Tutorial (4 Papers)	4x2=8	4x1=4
B.1. Generic Elective/ Interdisciplinary (4 Papers)	4x4=16	4x5=20
B.2. Generic Elective Practical/ Tutorial (4 Papers)	4x2=8	4x1=4
III. Ability Enhancement Courses		
1. Ability Enhancement Compulsory Courses (AECC) (2 Papers of 2 credit each) Environmental Science English/MIL Communication	2x2=4	2x2=4
2. Skill Enhancement Courses (SEC) (Minimum 2) (2 Papers of 2 credit each)	2x2=4	2x2=4
	Total credit = 140	**Total credit = 140**

*Institute should evolve a system/policy about General interest/Hobby/Sports/NCC/NSS/related courses on its own.

*Optional Dissertation or project work in place of one Discipline Specific Electivepaper (6 credits) in 6th Semester may be opted by the learner.

*Wherever there is a practical there may not be tutorial and vice-versa.

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Member

Dr. M. A. Khan
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9.1 SCHEME FOR CBCS IN B. SC. HONOURS

Semester	Core Course (14 Papers)	AbilityEnhancement Compulsory Course (AECC) (2 Papers)	Skill Enhancement Course (SEC) (2 Papers)	Elective: Discipline Specific Elective (DSE) (4 Papers)	Elective: Generic Elective (GE) (4 Papers)
I	C 1	AECC 1 MIL COMMUNICATION			GE 1 Basic Mathematics
	C 2				
II	C 3	AECC 2 Environmental Science			GE 2 Computer Application
	C 4				
III	C 5		SEC 1 Communicative English		GE 3 History & Culture of Jharkhand
	C 6				
	C 7				
IV	C 8		SEC 2 Personality Development		GE 4 Economics
	C 9				
	C 10				
V	C 11			DSE 1	
	C 12			DSE 2	
VI	C 13			DSE 3	
	C 14			DSE 4 Project Work	

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Member

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11. CREDIT SCHEME FOR CBCS IN UNDERGRADUATE B.SC. PROGRAMME

Course	Credits	
	Theory + Practical	Theory + Tutorials
I. Core Course (12 Papers) 04 Courses from each of the 03 disciplines of choice	12x4= 48	12x5=60
Core Course Practical / Tutorial Practical/ Tutorials) 04 Courses from each of the 03 Disciplines of choice	12x2=24	12x1=12
II. Elective Course (6 Papers) Two papers from each discipline of choice including paper of interdisciplinary nature.	6x4=24	6x5=30
Elective Course Practical / Tutorials (6 Practical / Tutorials*) Two Papers from each discipline of choice including paper of interdisciplinary nature	6x2=12	6x1=6
III. Ability Enhancement Courses 1. Ability Enhancement Compulsory Courses (AECC) (2 Papers of 2 credits each) Environmental Science English/MIL Communication	2x2=4	2x2=4
2. Skill Enhancement Courses (SEC) (4 Papers of 2 credits each)	4x2=8	4x2=8
	Total credit = 120	**Total credit = 120**

*Institute should evolve a system/policy about General interest/Hobby/Sports/NCC/NSS/related courses on its own.

*Optional Dissertation or project work in place of one Discipline elective paper (6credits) in 6th Semester may be opted by the learner.

*Wherever there is practical there will be no tutorials and vice –versa.

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External Expert

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Member

Dr. B. N. Prasad
Member

Dr. M. A. Khan
Member

11.1 SCHEME FOR CBCS IN UNDERGRADUATE B.SC. PROGRAMME

Semester	Core Course (12 Paper)	Ability Enhancement Compulsory Course (AECC) (2 Papers)	Skill Enhancement Course (SEC) (4 Papers)	Discipline Specific Elective (DSE) (6 Papers)
I	DSC 1 A DSC 2 A DSC 3 A	AECC 1 MIL COMMUNICATION		
II	DSC 1 B DSC 2 B DSC 3 B	AECC 2 Environmental Science.		
III	DSC 1 C DSC 2 C DSC 3 C		SEC 1 Communicative English	
IV	DSC 1 D DSC 2 D DSC 3 D		SEC 2 Personality Development	
V			✯ SEC 3 History & Culture of Jharkhand	DSE 1 A Theory DSE 2 A Theory DSE 3 A Practical ✓ (100)
VI			✯ SEC 4 Computer Application	DSE 1 B Theory ✓ DSE 2 B Theory ✓ DSE 3 B Practical ✓ (70+30)

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Dr. M. A. Khan
Member

Course Content of Mathematics
Under Choice Based Credit System (CBCS)

Subject: Mathematics

Syllabus Scheme for CBCS in Undergraduate B.A./B.Sc. Honours Program.

There will be two Semesters in each year. In fifth & sixth semesters there are four Discipline Specific Elective (DSE) papers altogether. Among DSEMATH501A & DSEMATH501B only one is to be opted; similarly among DSEMATH502A and DSEMATH502B only one is to be opted & finally among DSEMATH603A & DSEMATH603B only one is to be opted. DSE 4 is concerned with project work.

1st Semester

CCMATH101 100 marks
Real Analysis & Matrices.

CCMATH102 100 marks
Differential Calculus & Analytical Geometry of Two dimensions.

2nd Semester

CCMATH203 100 marks
Integral Calculus & Analytical Geometry of three dimensions.

CCMATH204 100 marks
Linear Programming & Statistics.

3rd Semester

CCMATH305 100 marks
Analysis I & Differential Equation.

CCMATH306 100 marks
Higher Arithmetic & Group Theory.

CCMATH307 100 marks
Discrete mathematics & Metric Spaces.

4th Semester

CCMATH408 100 marks
Complex Analysis & Mechanics.

CCMATH409 100 marks
Analysis II & Abstract Algebra.

CCMATH410 100 marks
Programming in C & Numerical Analysis.

5th Semester

CCMATH511 100 marks
Statics & Dynamics.

CCMATH512 100 marks
Fluid Mechanics & Special Functions.

DSEMATH501A
Linear Algebra & Linear Difference Equation. 100 marks

or

DSEMATH501B
Trigonometry, Vector Algebra & Vector Differentiation. 100 marks

DSEMATH502A
Theory of Equation & Set Theory.

or

DSEMATH502B
Mathematical Modeling & Topology

6th Semester

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CCMATH613 100 marks
Tensor & Fourier Transform.
CCMATH614 100 marks
Differential Equation.
DSEMATH603A
Number Theory & Probability. 100 marks
Or
DSEMATH603B
Life History & Contributions of Eminent Mathematicians.
DSEMATH604
Project work related to elective papers. 100 marks

Subject : Mathematics

Syllabus Scheme for CBCS in Undergraduate B.A./B.Sc. Program.

There will be two Semesters in each year. In fifth & sixth semesters there are two Discipline Specific Elective (DSE) papers altogether. Among DSE 1A(i) & 1A(ii) only one is to be opted; similarly among DSE 1B(i) and 1B(ii) only one is to be opted.

1st Semester
DSCMATH101A 100 marks
Real Analysis & Differential Calculus.
2nd Semester
DSCMATH201B 100 marks
Integral Calculus & Vector Analysis.
3rd Semester
DSCMATH301C 100 marks
Differential Equation, Group Theory & Analysis II.
4th Semester
DSCMATH401D 100 marks
Matrices & Abstract Algebra.
5th Semester
DSEMATH501A(i) 100 marks
Complex Analysis & Numerical Analysis.
DSEMATH501A(ii) 100 marks
Set Theory & Analytical Geometry of Two dimensions.

6th Semester
DSEMATH601B(i) 100 marks
Mechanics & Metric Space.
DSEMATH601B(ii) 100 marks
Life History & Contributions of Eminent Mathematicians.

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Member

Dr. M. A. Khan
Member

KOLHAN UNIVERSITY, CHAIBASA

Syllabus : Mathematics for B.A./B.Sc. Hons, Programme
(End-Semester Examination ESE)

Mathematics (Hons.) – Semester I

Time – 3 hrs **Paper I** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

CCMATH101

UNIT I : Real analysis I **Lecture – 24** **Questions-6**

A.1 : Axioms for R

A.2 : Limit of a sequence, monotonic sequences and their convergence, lim sup & lim inf, sub-sequence, algebraic operations of limit. Cauchy sequence, General Principle of convergence. Cauchy's 1st theorem on limits, Bolzano Weierstrass theorem.

A.3 : Notion of convergent and divergent series of real terms, Pringsheim's theorem, Comparison tests, Cauchy's root test.

A.4 : D' Alembert's ratio test. Alternating series and Leibnitz test, De-Morgan and Bertrand test, Cauchy condensation test. Gauss ratio test, integral test, absolutely convergent series.

UNIT II : Matrices **Lecture – 24** **Questions-6**

B.1 : Mappings, Equivalence Relations and partitions. Congruence Modulo n.

B.2 : Symmetric, Skew Symmetric, Hermitian and Skew Hermitian Matrices. Elementary operations on matrices. Inverse of a Matrix. Linear independence of row and column matrices.

B.3 : Row rank, column rank and rank of a matrix. Equivalence of column and row ranks. Eigenvalues, eigenvectors and the characteristics equation of a matrix. Cayley Hamiton theorem and its use in finding inverse of a matrix. Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations.

Books Recommended :

1. Real Analysis : Dasgupta & Prasad / Lalji Prasad / K.K. Jha
2. Matrices : A.R. Vashishta / Shanti Narayan

Time – 3 hrs **Paper II** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

CCMATH102

UNIT I : Differential Calculus **Lecture – 28** **Questions-7**

A.1 : Successive differentiation, Leibnitz theorem.

A.2 : Expansion, Partial Differentiation, Taylor's Theorem for functions of two Variables, Jacobian.

A.3 : Tangent and Normal, Curvature.

A.4 : Asymptotes, maxima and Minima of functions of two variables, Lagrange's multipliers.

UNIT II : Analytical Geometry of two dimensions **Lecture – 24** **Questions-6**

B.1 : Change of rectangular axis, Conditions for the general equation of second degree to represent Parabola, Ellipse and Hyperbola and reduction into standard forms.

B.2 : Equations of tangents and normals (using calculus), Chord of contact, polar and pair of tangents.

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B.3 : Axes, Centre director circle in reference to general equation of conic.
B.4 : Polar equation.
Books Recommended :
1. Differential Calculus : Das & Mukherjee / Dasgupta / Lalji Prasad
2. Analytical Geometry of two Dimensions : J. Jha / Dasgupta & Prasad / Lalji Prasad

Mathematics (Hons.) – Semester II

Time – 3 hrs **Paper III** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

CCMATH203

UNIT I : Integral Calculus **Lecture – 32** **Questions-8**

A.1 : Integration of rational and irrational functions, Evaluation of Definite integral, Reduction formula, Differentiation and Integration under the sign of integration.
A.2 : Evaluation of double and triple Integrals
A.3 : Point of Inflexion, double point, Curve tracing Length and area.
A.4 : Volumes and Surface area of solids of revolution.

UNIT II : Analytical Geometry of three dimensions **Lecture – 16** **Questions-4**

B.1 : Review of Equation of Planes and Straight lines
B.2 : Shortest distance between lines, spheres, Cone, Cylinder
Books Recommended :
1. Integral Calculus : Das & Mukherjee / Dasgupta & Prasad / Lalji Prasad
2. Analytical Geometry of three dimension : Shanti Narayan / Dasgupta / Lalji Prasad

Time – 3 hrs **Paper IV** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

CCMATH204

UNIT I : Linear Programming **Lecture – 24** **Questions-6**

A.1 : Convex sets in R2 and their properties, L.P.P., problem formulation, Graphical Method.
A.2 : Simplex method including Big M-method, Duality : Dual Simplex method.
A.3 : Transportation and Assignment.
A.4 : Deterministic replacement models, sequencing problems on two machines and n jobs.

UNIT II : Statistics **Lecture – 24** **Questions-6**

B.1 : Measures of Skewness and Kurtosis
B.2 : Curve fitting and method of least square.
B.3 : Correlation and regression & their expectations and variance.
Books Recommended :
1. Linear Programming Problem : R.K. Gupta / Lalji Prasad
2. Mathematical Statistics : Kapur & Saxena

Mathematics (Hons.) – Semester III

Time – 3 hrs **Paper V** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

CCMATH305

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UNIT I : Analysis I **Lecture – 24** **Questions-6**

A.1 : Limit and Continuity : Limit, Continuity, Discontinuities, uniform continuity, properties of functions continuous in closed intervals, Functions of bounded variation.

A.2 : Derivability, Relationship with continuity, Roll's theorem, Lagrange's and Cauchy Mean Value theorem, Taylor's theorem, Maclaurin's theorem, remainder after n terms, Power series expansion of $(1+x)^n$, sinx, cosx and log (1+x) using suitable remainder after n terms.

A.3 : Riemann Integration Definition, Darboux's theorem I & II.

A.4 : Integrability condition, particular classes of bounded integerable function primitive, fundamental theorem, first and second Mean.

UNIT II : Differential Equation **Lecture – 24** **Questions-6**

B.1 : First order higher degree Clairaut's form, singular solution orthogonal trajectories.

B.2 : Linear Equation with constant coefficient.

B.3 : Second order linear equations : solution by changing independent variable and by variation of parameters.

B.4 : Simultaneous equation dx/P = dy/Q = dz/R and Total differential equation pdx+Qdy+ Rdz = 0 together with their geometrical significance.

Books Recommended :

1. Real Analysis : A.R. Vasistha / Lalji Prasad / Shanti Narayan
2. Differential Equation : J.N. Sharma / B.N. Prasad

Time – 3 hrs **Paper VI** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

CCMATH306

UNIT I : Higher Arithmetic **Lecture – 20** **Questions-4**

A.1 : Divisibility, H.C.F. Primes & Unique factorization in N & Z the Diophantine equation ax+by=c.

A.2 : Residue class, complete and reduced residue system, congruences and their properties, Fermat's theorem, Euler's theorem and Wilson's theorem.

A.3 : Algebraic congruences, Solution by inspection. Solution of ax=b (mod m), Chinese remainder theorem, non-linear algebraic congruency with respect to the modulus.

UNIT II : Group Theory **Lecture – 32** **Questions-8**

B.1 : Definition of a group with examples and simple properties. Subgroups, Generation of groups.

B.2: Cyclic groups, Coset decomposition, Lagrange's theorem, Homomorphism and isomorphism. Normal subgroups. Quotient groups. The fundamental theorem of Homomorphism. Permutation groups. Even and Odd permutations. The alternating group & Cayley's theorem.

Books Recommended :

1. Basic Number Theory : S.B. Mallick
2. Number Theory : Hari Kishan / B.N. Prasad
3. Introduction to Number Theory : Niven & Zukerman
4. Modern Algebra : Surjeet Singh & Quazi Zameerudin / A.R. Vasistha

Time – 3 hrs **Paper VII** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

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CCMATH307

UNIT I : Discrete Mathematics **Lecture – 24** **Questions-6**

A.1 : Sets and Propositions-Cardinality. Mathematical Induction. Principle of Inclusion and exclusion.

A.2 : Relations and Functions – Binary Relations. Equivalence Relations and partitions. Partial Order Relations and Lattices, chains and Antichains. Pigeon Hole Principle.

A.3 : Graphs and Planar Graph, basic terminology. Multigraphs. Weighted Graphs. Paths and Circuits. Shortest paths. Eurelian Paths and Circuits. Travelling Salesman Problem. Planer Graphs.

A.4 : Boolean Algebras – Lattices and algebraic structures. Duality. Distributive and complemented Lattices. Boolean lattices and Algebras. Boolean Functions and Expression.

UNIT II : Metric Space **Lecture – 24** **Questions-6**

B.1 : Definition and example of metric spaces, Open sets, Interior closed Sets closure.

B.2 : Convergence, completeness, Bair's theorem, Cantor's Intersection theorem.

B.3 : Continuous maps, Uniform Continuity and related extensions.

Books Recommended :

1. Discrete Mathematics : C.L. Lieu, Elements of Discrete Mathematics : McGraw Hill International Ed.(12) Volumes 1 to 4 Published as Modulus in Applied Mathematics. Springer-Verlag 1982.
2. Topology : K.K. Jha / J.N. Sharma
3. Mathematical Analysis : Shanti Narayan / Mallick Arora
4.

5. Mathematics (Hons.) – Semester IV

Time – 3 hrs **Paper VIII** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

CCMATH408

UNIT I : Complex Analysis **Lecture – 24** **Questions-6**

A.1 : Real Functions for two variables. Simultaneous and iterated limits; continuity, partial derivatives, differentiability and related necessary and sufficient conditions.

A.2 : Functions of a complex variables : Limit, continuity, derivative Cauchy Riemann Equations analytic function, harmonic function, construction of analytic function Miln Thompson Method.

A.3 : Geometric Importance of some standard transformations e.g. w=z+c w=cz w=1/z. W=(az+b) / (cz+d) (bilinear).

A.4 : Conformal transformation as transformation effected by analytic functions special conformal transformations $w=z^z$, $w=e^z$, w=sinz

UNIT II : Mechanics **Lecture – 24** **Questions-6**

B.1 : Reduction of system of coplanar forces, equation of resultant. Condition for equilibrium, astatic centre.

B.2 : Laws, Angles and cone of friction, equilibrium on a rough inclined plane, particle constrained to move on a rough curve under any given forces.

B.3 : Kinematics in two dimensions : tangential, normal, radial, transverse velocities and acceleration. Angular Velocity and acceleration. Rectilinear motion and simple pendulum : S.H.M., compounding of two S.H.M., Repulsive motion, motion under inverse square law.

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B.4 : Rectilinear Motion (Kinetics) : Newton's Law, work, KE, work Energy principle, impulse, Torque and angular momentum, conservation of energy, momentum and angular momentum, Hooke's law. Extension of an elastic string : horizontal & vertical case.

Books Recommended :

1. Mechanics : Singh & Sen
2. Complex Analysis : J.N. Sharma / Lalji Prasad

Time – 3 hrs **Paper IX** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

CCMATH409

UNIT I : Analysis II **Lecture – 24** **Questions-6**

A.1 : Convergence of improper integrals, Comparison Tests, Absolute convergence, Able's and Dirichlets Tests. Frullani's Integrals, Def. Duplication formula, inter-relation.

A.2 : Multiple Integrals via Dirichlet's Theorem Liouville's extension. Change of order of integration and change of variables.

A.3 : Vector Integration : Line Integral, Surface Integral, Green's theorem in R2, stoke,s theorem, Gauss divergence theorem.

UNIT II : Abstract Algebra **Lecture – 24** **Questions-6**

B.1 : Rings, Preliminary Results, Special Kinds, subrings and Ideals.

B.2 : Quotient rings : Fields and Homomorphism.

B.3 : Field for quotient and embedding theorem, polynomial rings, Euclidian ring & Unique factorization in it.

Books Recommended :

1. Mathematical Analysis : Shanti Narayan / Mallick Arora
2. Integral Calculus : Williamson
3. Vector Calculus : Shanti Narayan

Time – 3 hrs **Paper X** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

CCMATH410

UNIT I : Programming in C **Lecture – 24** **Questions-6 (Including Lab)**

A.1 : Programmer's model of a computer. Algorithms. Flow Charts. Data Types. Arithmetic and input/output instructions.

A.2 : Decision control structures. Decisions statements.

A.3 : Logical and Conditional operators. Loop. Case control structures.

A.4 : Functions, Recursions, Preprocessors.

A.5 : Arrays, Puppeting of string. Structures. Pointers. File formatting.

UNIT II : Numerical Analysis **Lecture – 24** **Questions-6**

(CALCULATOR IS ALLOWED IN THIS PAPER)

B.1 : Solution of Equations : Bisection, regula-falsi, Newton's method, Root of Polynomials.

B.2 : Interpolation : Lagrange and Hermite Interpolation, divided differences Schemes, Interpolation Formula using Differences.

B.3 : Numerical Differentiation : Numerical formulas.

B.4 : Numerical Integration : Quadrature Formula Simpsons and Trapezoidal Rule.

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B.5 : Linear Equations : Direct methods for solving systems of linear equations (Gauss Elimination).
B.6 : Ordinary Differential equation : Euler Method, Single-step Method, Runge-Kutta's Method.

Books Recommended :
1. Programming in ANCI in C.E. Balaguru Swamy.
2. Numerical Analysis : J.B. Scarborough
3. Introduction to Numerical Analysis : A. Gupta & S.C. Bose

4. Mathematics (Hons.) – Semester V

Time – 3 hrs **Paper XI** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

CCMATH511

UNIT I : Statics **Lecture – 24** **Questions-6**

A.1 : Conditions for equilibrium of forces in three dimension.
A.2 : Wrench pitch, Null Lines.
A.3 : Principle of Virtual work and its application in two dimensional cases.
A.4 : Common Catenary
A.5 : Stable equilibrium, energy test of stability (problems involving one variable only).

UNIT II : Dynamics **Lecture – 24** **Questions-6**

B.1 : Motion of a particle under a central force, Differential equation of a central orbit in both polar and pedal co-ordinates.
B.2 : Newton's law of gravitation, planetary orbits, Kepler's laws of motion.
B.3 : Motion of projectile under gravity in a non-resisting medium.
B.4 : Motion of the mass centre and motion relative to the mass centre D'Alembert's principle.
B.5 : Two dimensional motion of a rigid body rotating about a fixed axis, compound pendulum.

Books Recommended :
1. Statics : Loney
2. Dynamics : Loney / A.R. Vasishtha

Time – 3 hrs **Paper XII** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

CCMATH512

UNIT I : Fluid Mechanics **Lecture – 24** **Questions-6**

A.1 : Nature and Properties of Fluid pressure, pressure of heavy liquids.
A.2 : Equilibrium of fluids under given system of forces.
A.3 : Centre of pressure.
A.4 : Thrust on plane and curved surfaces.
A.5 : Lagarangian and Eulerian methods, Equation of continuity.
A.6 : Euler's equation of motion for perfect fluid, Bernoulli's Theorem.

UNIT II : Special Functions **Lecture – 24** **Questions-6**

B.1 : Series solution : Ordinary point, singular point (regular), General Methods and forms of series solution (Indicial equation-frobenius method).

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[N.B. result of analysis regarding validity of series. Solution are to be taken for granted]

B.2 : Bessel's equation : Solution Recurrence formula for $J_n(x)$; generating function for $J_n(x)$, equations reducible to Bessel equation, Orthogonality of Bessel's functions.

B.3 : Legendre equation : Solution, Rodrigue's formula, Legendre polynomials, generating function for $P_n(x)$, Orthogonality of Legendre polynomials.

B.4 : Hypergeometric functions, special cases, Integral representation. Summation theorem.

Books Recommended :

1. Hydrostatics : J.P. Sinha
2. Hydrodynamics : Ramsey / M.D. Raisingania
3. Advance differential equation : M. D. Raisinghania

Time – 3 hrs **Paper DSE 1A** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

DSEMATH501A

UNIT I : Linear Algebra **Lecture – 24** **Questions-6**

A.1 : Vector Space : Def. & properties, subspaces, linear dependence, dimension and basis of a finite dimensional vector space, Quotient space, Direct sums and complements matrices and change of basis.

A.2 : Inner product & norm in a I. S., properties of inner product, Schwartz inequality, orthogonal set, orthogonal basis and Gram-schmidt construction for finite dimensional inner product space.

A.3 : Linear transformation : Def, Sylvester Law of nullity, algebra of linear transformations, Dual spaces, principal of duality.

A.4 : Matrices and linear transformation, similar matrices, even matrices, diagonalisation Eigen root (Algebraic geometric and multiplicity).

UNIT II : Linear Difference Equation **Lecture – 24** **Questions-6**

B1: Difference Equation Order, Solution of Difference Equation, Existence & Uniquencess theorem, solution of the form $Y_{n+1} = Ay_n+C$.

B2: Linear Difference Equation with constant coefficient : Basic Definition. Combination of solution, Fundamental set of solution, Homogeneous Difference Equation & their solution (General & Particular), Special operator, variation of parameters.

Books Recommended :

1. Modern Algebra : Surjeet Singh & Quazi Zameeruddin (Ch. 11 & 12)
2. Linear Difference Equation : R.K. Gupta & D.C. Agarwal.

Time – 3 hrs **Paper DSE 1B** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

DSEMATH501B

UNIT I: Trigonometry **Lecture – 24** **Questions-6**

A.1 : De-Moivre's theorem and its applications. Direct and inverse circular and hyperbolic functions.

A.2 : Logarithm of a complex quantity. Expansion of trigonometric functions.

A.3 : Gregory's series.

A.4 : Summation of series

A.4 : Factorization.

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UNIT II : Vector Algebra **Lecture – 12** **Questions-3**

B.1: Scalar and Vector product of three vectors. Product of four vectors. Reciprocal Vectors.

UNIT III : Vector Differentiation **Lecture – 12** **Questions-3**

C.1 : Point function, Differentiation of a vector function of a scalar variable, Gradient, Divergence and Curl and second order operators in Cartesian Co-ordinate system.

Books Recommended:

1 Higher Trigonometry by Lalji Prasad/Das Gupta

2 Vector Analysis by Lalji Prasad/ Shanti Narayan

Time – 3 hrs **Paper DSE 2A** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

DSEMATH502A

UNIT I (Set Theory) **lectures-20** **Question-5**

A-1: Index family of sets, Generalised set operations & De-Morgan Laws, set mappings.

A-2: Bijection: Countable and Uncountable sets, Equivalence relation and related fundamental theorem on partition.

A-3: Partial order relation & related concepts of u. b., l. b., inf., sup., maximal element, minimal element & lattice (definition and examples only), statement of Zorn's lemma.

UNIT II (Theory of Equation) **lectures-28** **Question-7**

B-1: Relations of root and their symmetric functions with coefficients.

B-2: Transformation of equations, Descarte's rule of signs.

B-3: Cardon's solution of a cubic equation.

B-4: Descarte's solution of a bi-quadratic equation.

B-5: Discriminant and nature of roots.

Books recommended

1 Theory of Equation – Burnside & Penton/ Lalji Prasad

2 Set theory (Degree level) – K. K. Jha.

Time – 3 hrs **Paper DSE 2B** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

DSEMATH502B

UNIT I Mathematical Modeling **Lecture 28** **Question-7**

A1: Difference & differential equation growth models: Single species population models, Population growth and age structure models

A2: Higher order linear models: A model for the detection of diabetes

A3: Non linear population growth models: Pray predator models, epidemic growth models

A4: An application in environment: Urban waste water management planning models

A5: Models from political sciences: Proportional representation(Cumulative & comparison voting) models

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UNIT II Topology **Lecture 20** **Question-5**

B-1: Definition and examples of topological spaces. Open sets, interior. Closed sets closure, frontier

B-2: Convergence & Cauchy's sequences in topological spaces

B-3: Continuous maps, Uniform continuity and related extensions.

Books Recommended:

1 Mathematical Modelling by J N Kapoor
2 Topology by M L Khanna
3 Topology by K K Jha

Mathematics (Hons.) – Semester VI

Time – 3 hrs **Paper XII** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

CCMATH613

(A) Tensor **Lecture – 22** **Questions-7**

Tensor Algebra : Transformation of co-ordinates, Contravarient & co-variant vector, Kronecker delta, Tensor of higher orders, Inner Product, conjugate tensor, Tensor field.

Convariant Differentiation : Christoffells three index symbols, Transformation of symbol, covariant derivatives of scalar, Ricci theorem, Divergence, curl, Laplace operator.

(B) Fourier Transformation **Lecture – 28** **Questions-8**

B.1 : Infinite Fourier Transform : Infinite Fourier sine transform, Infinite Fourier cosine transform, Relation between Fourier & Laplace transform.

B.2 : The Finite Fourier Transform & Integral : Finite Fourier sine transform, Finite Fourier cosine transform, Fourier Integral.

Books Recommended :

1. D.C. Agrawal, Tensor Calculus & Riemannian Geometry
2. Goel & Gupta, Laplace & Fourier Transform

Time – 3 hrs **Paper XIV** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

CCMATH614

UNIT I : Differential Equation **Lecture – 40** **Questions-12**

A.1 : Partial differential equation, formation, linear p.d.e. of order 1-Lagrange's method.

A.2 : Non linear equation of order 1, four forms Charpits method, Jacobi Method.

A.3 : Homogeneous linear equation with constant co-efficient Rules of C.F. and P.I.

A.4 : Non-linear equations of second order, Monge's method.

A.5 : Boundary Value Problem : Derivation and solution of one dimensional wave equation and one dimensional heat equation.

A.6 : Laplace transform : Def, transformation of elementary functions, properties, inverse transform, transform derivatives and integrals, multiplication by t^n, division by t. Convolution theorem and application to differential equation.

Books Recommended :

1. Advanced Differential Equation : M.D. Raisingania
2. Differential equation : J.N. Sharma

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Dr. K. N. Pradhan, Member
Dr. B. N. Prasad, Member
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Time – 3 hrs **Paper DSE 3A** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

DSEMATH603A

UNIT I: Number Theory **Lecture – 24** **Questions-6**

A 1: Perfect Numbers, Fermat Numbers, Abundant Deficient Numbers, F-number, Mersenne Number, Super perfect or transcendental numbers, Amicable numbers, Necessary & Sufficient condition for a positive integer to be an even perfect number(Euler's Theorem)

A 2: Sum of squares of integers, Introduction, Sum of two square & related theorem, Expression of a prime number as the sum of two squares, Sum of more than two squares, Difference of two squares, Waring problem, The condition for an odd prime to be expressible as a sum of two squares.

A 3: Arithmetical functions $\tau(n)$ & $\mu(n)$ and related theorems.

UNIT II: Probability **Lecture – 24** **Questions-6**

B 1: Random experiment, Sample Space, Algebra of events, Probability of an event, Mutually exclusive events, addition theorem, Conditional probability, independent events, multiplication theorem,

B 2: Total probability, Baye's theorem,

B 3: Random Variables and Distribution Functions, Introduction, Distribution Functions of Discrete Variables, Distribution Functions of Continuous Variables, Mathematical Expectations,

B 4: Binomial Distribution, Poisson's Distribution, Hypergeometric distribution, Normal & Negative binomial distribution,

Books Recommended :

1. Basic Number Theory : S.B. Mallick
2. Number Theory : Hari Kishan / B.N. Prasad
3. Theory of Numbers: Pundir & Pundir
4. Fundamental of Mathematical Statistics : Gupta & Kapoor

Time – 3 hrs **Paper DSE 3B** **Full Marks – 70**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

DSEMATH603B:

Life History & Contributions of Eminent Mathematicians:

1: Aryabhatt
2: Archimedese
3: Srinivasa Ramanujam
4: G H Hardy
5: Euclid of Alexandria
6: Baron Augustin-Louis Cauchy
7: Pierre-Simon Laplace
8: Bertrand Russell
9: Pierre de Fermat
10: Leonhard Euler
11: Joseph Fourier
12: Karl Friedrich Gauss
13: Bernhard Riemann
14: G W Liebnitz
15: Sir Issac Newton

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16: Albert Einstein
Resource: Internet & Associated Contexts

Paper DSE 4

DSEMATH604
Project work of 100 Marks related to elective papers

Continuous Internal Assessment (CIA)- 30 Marks

The CIA must be conducted for every core paper as well as every DSE paper by the respective Department in the following manner.

1. Mid-Term test(Subjective/Objective Type)- - - 15 Marks
2. Assignment/Project/Poster/Quiz/Seminar- 10 Marks
3. Classroom attendance and active participation with leadership quality, good manners and articulation in Routine class instructional deliveries(Case studies/seminars/presentation- - - - 05 Marks

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KOLHAN UNIVERSITY, CHAIBASA

Syllabus : Mathematics for B.A./B.Sc. Programme.
(End-Semester Examination ESE)

Mathematics - Semester I
Semester I

Time – 3 hrs **Paper I** **Full Marks – 100**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

DSCMATH101A

UNIT I : Real Analysis **Lecture – 24** **Questions-6**

Limit of a sequence, monotonic sequences and their convergence, lim sup & lim inf, sub sequence, algebraic operations of limit. Cauchy sequence, General Principle of convergence.
Notion of convergent and divergent series of real terms, Comparison tests, Cauchy's root test.
D'Alembert's ratio test. Alternating series and Leibnitz test, De-Morgan and Bertrand test, Cauchy condensation test.

UNIT I : Differential Calculus **Lecture – 24** **Questions-6**

Successive differentiation, Leibnitz theorem, Expansion, Partial Differentiation, Taylor's Theorem for functions of two Variables, Jacobian. Tangent and Normal, Curvature. Asymptotes, maxima and Minima of functions of two variables.

Books Recommended :

1. Real Analysis : Dasgupta & Prasad / Lalji Prasad / K.K. Jha
2. Differential Calculus : Das & Mukherjee / Dasgupta / Lalji Prasad

Semester II

Time – 3 hrs **Paper II** **Full Marks – 100**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

DSCMATH201B

UNIT I : Integral Calculus **Lecture – 28** **Questions-7**

Integration of rational and irrational functions, Evaluation of definite integral Reduction formula, Evaluation of double and triple Integrals. Curve tracing Length and area, Volumes.

UNIT II : Vector Analysis. **Lecture – 20**
Questions-5

Scalar and Vector product of three vectors. Product of four vectors. Reciprocal Vectors. Point function, differentiation of a vector function of a scalar variable, Gradient, Divergence and curl and second order operators in Cartesian Co-ordinate system.

Books Recommended :

1. Vector Calculus : Lalji Prasad / Shanti Narayan
2. Integral Calculus : Das & Mukherjee / Dasgupta & Prasad / Lalji Prasad

Semester III

Time – 3 hrs **Paper III** **Full Marks – 100**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have

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to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

DSCMATH301c

UNIT I : Differential Equation **Lecture – 16** **Questions-4**

First order higher degree Clairaut's from, Singular solution orthogonal trajectories. Linear Equation with constant coefficients. Homogenous Linear Equation with variable coefficients Simultaneous equation dx/P=dy/Q=dz/R and Total diff. eqn. Pdx + Qdy + Rdz=0 together with their geometrical significance.

UNIT II : Group Theory **Lecture – 12** **Questions-3**

Definition of a group with examples and simple properties. Subgroups. Generation of groups. Cyclic groups. Coset decomposition. Lagrange's theorem.

UNIT III : Analysis II **Lecture – 20** **Questions-5**

Limit and Continuity: Limit, Continuity, discontinuities uniform continuity, properties of functions continuous in closed intervals.

Derivability, Relationship with continuity, Roll's theorem, Lagrange's and Cauchy Mean Value theorem, Taylor's theorem, Maclaurin's theorem, remainder after n terms.

Riemann Integration Definition, Oscillatory sum and integrable conditions. Intergrability of monotonic and continuous functions. Fundamental Theorem of integral calculus.

Books Recommended :

1. Modern Algebra : A.R. Vasistha
2. Differential Equation : Lalji Prasad / Dasgupta & Prasad
3. Real Analysis : Dasgupta & Prasad / Lalji Prasad

Semester IV

Time – 3 hrs **Paper IV** **Full Marks – 100**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

DSCMATH401D

UNIT I : Matrices **Lecture – 24** **Questions-6**

Symmetric, Skew Symmetric. Hermitian and Skew Hermitian metrices. Elementary Operations on matrices. Inverse of a Matrix. Rank of a matrix, solution of system of linear equations, characteristics equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix.

UNIT II : Abstract Algebra **Lecture – 24** **Questions-6**

Normal subgroup, Factor group, Fundamental Theorem of homomorphism, Rings, Preliminary Results, Special Kinds, subrings and Ideals. Integral domain and Fields. Ring Homomorphism and isomorphism.

Books Recommended :

1. Matrices : A.R. Vasistha
2. Modern Algebra : A.R. Vasistha

Semester V

Time – 3 hrs **DSE** **Full Marks – 100**

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

DSEMATH501A(i)

UNIT I : Complex Analysis **Lecture – 24** **Questions-6**

Real Functions of two variables. Simultaneous and iterated limits, continuity, partial derivatives, differentiability and related necessary and sufficient conditions. Functions of a

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Member	Member	Member

complex variables : Limit, continuity, derivative Cauchy-Riemann Equations Analytic function, harmonic function, construction of analytic function Milne Thompson Method, Geometric Some standard transformations e.g. w=z+c. w=cz, w=1/z. w=(az+b)/(cz+d) (bilinear). Conformal transformation as transformation effected by analytic functions.

UNIT II : Numerical Analysis Lecture – 24 Questions-6

Solution of Equations : Bisection, regula-falsi, Newton's method, Root of Polynomials. Interpolation : Lagrange, divided differences Schemes, Interpolatin Formula using Differences. Numerical Differentiation : Numerical Quadrature formulas. Numerical Integration : Simpsons and Trapezoidal Rule.

Books Recommended :

1. Complex analysis : J.N. Sharma / Lalji Prasad
2. Introduction to Numerical Analysis : A. Gupta & S.C. Bose

DSEMATH501A(ii)

UNIT I: Analytical Geometry of two dimensions Lecture – 24 Questions-6

Change of rectangular axis, conditions for the general equation of second degree to represent parabola, Ellipse and Hyperbola and reduction into standard forms. Equations of tangents and normal (using calculus), Polar equation.

UNIT II : Set Theory Lecture – 24 Questions-6

Mappings, Equivalence Relations and partitions. Congruence modulo n, Generalized Union, Intersection, Complementation, countable and uncountable set, Schroeder and Bernstien theorem, concept of cardinal number.

Semester VI

Time – 3 hrs DSE Full Marks – 100

There will be three groups A, B & C. Group A is compulsory comprising of 10 objective type question for 2 marks each. Group B contains 8 short answer type questions of which 4 have to be answered for 5 marks each. Group C contains 4 questions of long answer type of which 2 have to be answered for 15 marks each.

DSEMATH601B(i)

UNIT I : Mechanics Lecture – 24 Questions-6

Reduction of system of coplanar forces, equation of resultant. Condition for equilibrium, static centre. Laws, Angles and cone of friction, equilibrium on a rough inclined plane, particle constrained to move on a rough curve under any given forces.

Kinematics in two dimensions : tangential, normal, radial, transverse velocities and acceleration. Angular Velocity and acceleration.

Rectilinear motion and simple pendulum : S.H.M., compounding of two S.H.M., Repulsive motion, motion under inverse square law.

Rectilinear Motion (kinetics) : Newton's Law, work, K,E, work Energy principle, impulse, Torque and angular momentum, conservation of energy, momentum and angular momentum, Hooke's law.

UNIT II : Metric Space Lecture – 24 Questions-6

B.1 : Definition and example of metric spaces, Open sets, Interior Closed Sets closure.

B.2 : Convergence, completeness, Bair's theorem, Cantor's Intersection theorem.

B.3 : Continuous maps, Uniform Continuity and related extensions.

Books Recommended :

1. Mechanics : Singh & Sen
2. Metric Space : Lalji Prasad

DSEMATH601B(ii)

Life History & Contributions of Eminent Mathematicians:

1: Aryabhatt
2: Archimedese
3: Srinivasa Ramanujam
4: G H Hardy

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5: Euclid of Alexandria
6: Baron Augustin-Louis Cauchy
7: Pierre-Simon Laplace
8: Bertrand Russell
9: Pierre de Fermat
10: Leonhard Euler
11: Joseph Fourier
12: Karl Friedrich Gauss
13: Bernhard Riemann
14: G W Liebnitz
15: Sir Issac Newton
16: Albert Einstein

Resource: Internet & Associated Contexts

Continuous Internal Assessment (CIA)- 30 Marks

The CIA must be conducted for every DSC paper as well as every DSE paper by the respective Department in the following manner.

1. Mid-Term test(Subjective/Objective Type)- - - 15 Marks
2. Assignment/Project/Poster/Quiz/Seminar- 10 Marks
3. Classroom attendance and active participation with leadership quality, good manners and articulation in Routine class instructional deliveries(Case studies/seminars/presentation- - - - 05 Marks

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Dr. K. N. Pradhan Member	Dr. B. N. Prasad Member	Dr. M. A. Khan Member