

# KOLHAN UNIVERSITY

CHAIBASA



UNIVERSITY DEPARTMENT OF MATHEMATICS

Course Content of Mathematics

Under Choice Based Credit System (CBCS)

Syllabus Scheme for CBCS in B. Sc.

Effective from Academic Session 2020-2022.

**UNIVERSITY DEPARTMENT OF MAHEMATICS**  
**Kolhan University, Chaibasa**

(For CBCS syllabus B. Sc.)

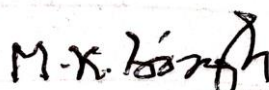
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Head, University Department of Mathematics  
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Professor, Department of Mathematics,  
Magadh University, Bodh Gaya, Mob. No.-9430239080
3. **Dr. Sanjay Tiwari (External expert)**  
Associate Professor,  
University Department of Mathematics,  
Magadh University, Bodh Gaya. Mob. No.-6207805152
4. **Dr. K. N. Pradhan (Member)**  
C.C.D.C. Kolhan University, Chaibasa  
& Associate Professor, Head, Department of Mathematics  
Mahila College, Chaibasa. Mobile number: 7209860187
5. **Dr. Md. Moiz Ashraf (Member Secretary)**  
Head, P. G. Department of Mathematics,  
Karim City College, Jamshedpur. Mob. No.- 9431167113

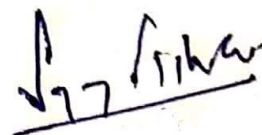
(Dr. T. C. K. Raman)  
Chairman & Head, Department of Mathematics  
KOLHAN UNIVERSITY, CHAIBASA.



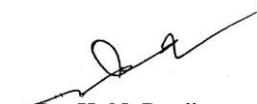
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## 9. CREDIT SCHEME FOR CBCS IN B. SC. HONOURS

Course	Credits	
	<u>Theory + Practical</u>	<u>Theory + Tutorial</u>
I. Core Course (14 Papers)	$14 \times 4 = 56$	$14 \times 5 = 70$
Core Course Practical/Tutorials (14 Papers)	$7 \times 4 = 28$	$14 \times 1 = 14$
II. Elective Course (8 Papers)		
A.1. Discipline Specific Elective (4 Papers)	$4 \times 4 = 16$	$4 \times 5 = 20$
A.2. Discipline Specific Elective Practical/Tutorial (4 Papers)	$4 \times 2 = 8$	$4 \times 1 = 4$
B.1. Generic Elective/ Interdisciplinary (4 Paper)	$4 \times 4 = 16$	$4 \times 5 = 20$
B.2. Generic Elective Practical/Tutorial (4 Papers)	$4 \times 2 = 8$	$4 \times 1 = 4$
III. Ability Enhancement Courses		
1. Ability Enhancement Compulsory Course (AECC) (2 Papers of 2 credits each) Environmental Science/ MIL Communication	$2 \times 2 = 4$	$2 \times 2 = 4$
2. Skill Enhancement Courses (SEC) (Minimum 2) (2 Papers of 2 credits each)	$2 \times 2 = 4$	$2 \times 2 = 4$
	<b>Total Credit=140</b>	<b>Total Credit=140</b>

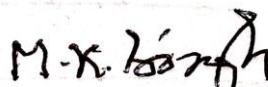
\*Institute should evolve a system/policy about General interest/Hobby/Sports/NCC/NSS/related on its own.

\*Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6<sup>th</sup> Semester may be opted by the learner.

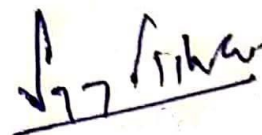
\*Wherever there is a practical there may not be tutorial and vice-versa.



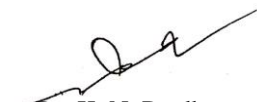
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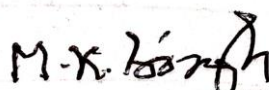
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**9.1 SCHEME FOR CBCS IN B. SC. HONOURS**

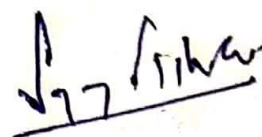
Semester	Core Course (14 Papers)	Ability Enhancement Compulsory Course (AECC) (2 Papers)	Skill Enhancement Course (SEC) (2 Papers)	Elective: Discipline Specific Elective (DSE) (4 Papers)	Elective: Generic Elective (GE) (4 Papers)
I	C 1	AECC 1			GE 1
	C 2	English/ MIL(Hindi) Communication			
II	C 3	AECC 2			GE 2
	C 4	Environmental Science			
III	C 5		SEC 1		GE 3
	C 6				
	C 7				
IV	C 8		SEC 2		GE 4
	C 9				
	C 10				
V	C 11			DSE 1	
	C 12			DSE 2	
VI	C 13			DSE 3	
	C 14			DSE 4 Project Work	



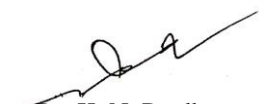
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Member



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

Course	Credits	
	<u>Theory + Practical</u>	<u>Theory + Tutorial</u>
I. Core Course (12 Papers) 04 Courses from each of the 03 disciplines of choice Core Course Practical/Tutorials (12 Practical/Tutorials) 04 Courses from each of the 03 disciplines of choice	$12 \times 4 = 48$	$12 \times 5 = 60$
II. Elective Course (6 Papers) Two papers from each discipline of choice including paper of inter-disciplinary nature. Elective Course Practical/Tutorials (6 Practical/Tutorials*) Two papers from each discipline of choice including paper of inter-disciplinary nature	$6 \times 4 = 24$	$6 \times 5 = 30$
III Ability Enhancement Courses 1. Ability Enhancement Compulsory Courses (AECC) (2 Papers of 2 credits each) Environmental Science/ MIL Communication 2. Skill Enhancement Courses (SEC) (4 Papers of 2 credits each)	$2 \times 2 = 4$	$2 \times 2 = 4$
	<b>Total Credit=120</b>	<b>Total Credit=120</b>

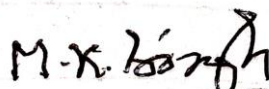
\*Institute should evolve a system/policy about General interest/Hobby/Sports/NCC/NSS/related on its own.

\*Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6<sup>th</sup> Semester may be opted by the learner.

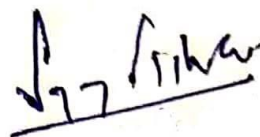
\*Wherever there is a practical there may not be tutorial and vice-versa.



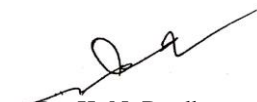
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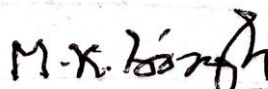
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**11.1 SCHEME FOR CBCS IN UNDERGRADUATE B.SC. PROGRAMME**

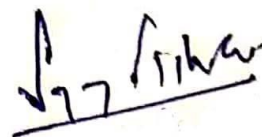
Semester	Core Course (12 Paper)	Ability Enhancement Compulsory Course (AECC) (2 Papers)	Skill Enhancement Course (SEC) (4 Papers)	Discipline Specific Elective (DSE) (6 Papers)
I	DSC 1 A	AECC 1 English/ MIL(Hindi) Communication		
	DSC 2 A			
	DSC 3 A			
II	DSC 1 B	AECC 2 Environmental Science		
	DSC 2 B			
	DSC 3 B			
III	DSC 1 C		SEC 1	
	DSC 2 C			
	DSC 3 C			
IV	DSC 1 D		SEC 2	
	DSC 2 D			
	DSC 3 D			
V			SEC 3	DSE 1 A Theory
				DSE 2 A Theory
				DSE 3 A Practical
VI			SEC 4	DSE 1 B Theory
				DSE 2 B Theory
				DSE 3 B Practical



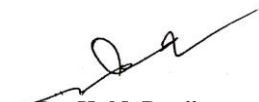
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External Expert, Member



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Member



Dr. Md. Moiz Ashraf  
Member Secretary

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

### Subject: Mathematics

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

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. DSEMATH604 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  
Trigonometry, Vector Algebra & Vector Differentiation.

#### 3rd Semester

**CCMATH305** 100 marks  
Analysis I & Differential Equation.

**CCMATH306** 100 marks  
Complex Analysis & Mechanics.

**CCMATH307** 100 marks  
Theory of Equation & Set Theory.

#### 4th Semester

**CCMATH408** 100 marks  
Higher Arithmetic & Group Theory.

**CCMATH409** 100 marks  
Fluid Mechanics & Special Functions.

**CCMATH410** 100 marks  
Linear Programming & Statistics.

#### 5th Semester

**CCMATH511** 100 marks  
Statics & Dynamics.

**CCMATH512** 100 marks  
Analysis II & Abstract Algebra.

**DSEMATH501A** 100 marks  
Discrete mathematics & Metric Spaces.

or

**DSEMATH501B** 100 marks  
Programming in C & Numerical Analysis.

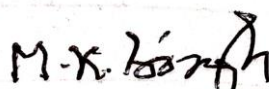
**DSEMATH502A** 100 marks  
Tensor & Fourier Transform.

or

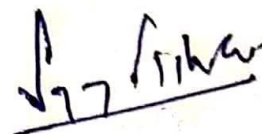
**DSEMATH502B** 100 marks  
Mathematical Modeling & Topology



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**6th Semester**

<b>CCMATH613</b> Linear Algebra & Linear Difference Equation.	100 marks
<b>CCMATH614</b> Differential Equation.	100 marks
<b>DSEMATH603A</b> Number Theory & Probability.	100 marks
<b>Or</b>	
<b>DSEMATH603B</b> Life History & Contributions of Eminent Mathematicians.	100 marks
<b>DSEMATH604</b> Project work related to elective papers.	100 marks

**Subject: Mathematics**

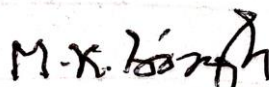
**Syllabus Scheme for CBCS in Undergraduate B.A./B.Sc. Program.**

There will be two Semesters in each year. In fifth & sixth semesters there are two Discipline Specific Elective (DSE) papers altogether. Among DSEMATH501A(i) & DSEMATH501A(ii) only one is to be opted; similarly, among DSEMATH601B(i) and DSEMATH601B(ii) only one is to be opted.

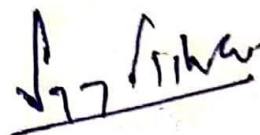
	<b>1st Semester</b>	
<b>DSCMATH101A</b> Real Analysis & Differential Calculus.		100 marks
	<b>2nd Semester</b>	
<b>DSCMATH201B</b> Integral Calculus & Vector Analysis.		100 marks
	<b>3rd Semester</b>	
<b>DSCMATH301C</b> Differential Equation, Group Theory & Analysis II.		100 marks
	<b>4th Semester</b>	
<b>DSCMATH401D</b> Matrices & Abstract Algebra.		100 marks
	<b>5th Semester</b>	
<b>DSEMATH501A(i)</b> Complex Analysis & Numerical Analysis.		100 marks
<b>Or</b>		
<b>DSEMATH501A(ii)</b> Set Theory & Analytical Geometry of Two dimensions.		100 marks
	<b>6th Semester</b>	
<b>DSEMATH601B(i)</b> Mechanics & Metric Space.		100 marks
<b>Or</b>		
<b>DSEMATH601B(ii)</b> Life History & Contributions of Eminent Mathematicians.		100 marks



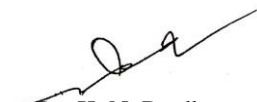
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Member Secretary



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

**Mathematics (Hons.) – Semester I**

**Time - 3 Hours**

**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**

**Lecture – 24**

**Questions-6**

- A.1: Axioms for R  
A.2: Limit of a sequence, monotonic sequences and their convergence,  $\limsup$  &  $\liminf$ , 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**

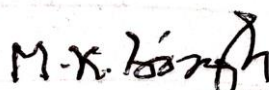
- B.1: Addition, Multiplication with scalar, Multiplication of matrices, Adjoint, inverse of matrices and related theorems.  
B.2: Symmetric, Skew Symmetric, Hermitian and Skew Hermitian Matrices. Elementary operations on matrices. Inverse of a Matrix. Linear independence of row and column matrices.  
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 Hamilton 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:

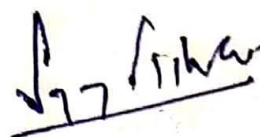
1. Real Analysis: Dasgupta & Prasad / Lalji Prasad / K.K. Jha
2. Matrices: A.R. Vashishta / Shanti Narayan



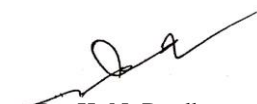
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Member



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Member Secretary

**Time - 3 Hours**

**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.

B.3: Axes, Centre director circle in reference to general equation of conic.

B.4: Polar equation.

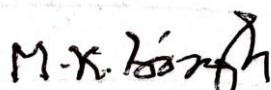
Books Recommended:

1. Differential Calculus: Das & Mukherjee / Dasgupta / Lalji Prasad

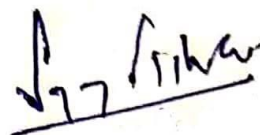
2. Analytical Geometry of two Dimensions: J. Jha / Dasgupta & Prasad / Lalji Prasad



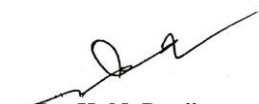
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**Mathematics (Hons.) – Semester II**

**Time - 3 Hours**

**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

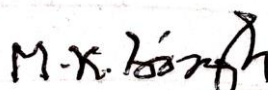
Books Recommended:

1. Integral Calculus: Das & Mukherjee / Dasgupta & Prasad / Lalji Prasad

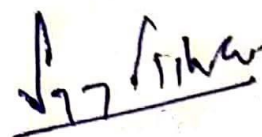
2. Analytical Geometry of three dimension: Shanti Narayan / Dasgupta / Lalji Prasad



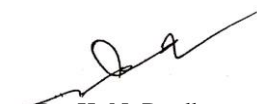
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External Expert, Member



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Member



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Member Secretary

**Time - 3 Hours**

**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: 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.5: Factorization.

**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**

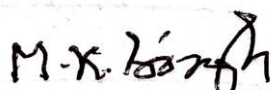
- C.1: Point function, Differentiation of a vector function of a scalar variable, Gradient, Divergence and Curl and second order operators in Cartesian Co-ordinate system.

Books Recommended:

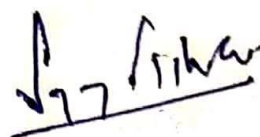
- 1 Higher Trigonometry by Lalji Prasad/Das Gupta
- 2 Vector Analysis by Lalji Prasad/ Shanti Narayan



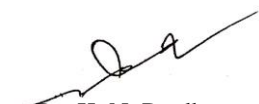
Dr. T. C. K. Raman  
Head & Chairman



Dr. M. K. Singh  
External Expert, Member



Dr. Sanjay . Tiwari  
External Expert, Member



Dr. K. N. Pradhan  
Member



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Member Secretary

**Mathematics (Hons.) – Semester III**

**Time - 3 Hours**

**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**

**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  $(1+x)^n$ ,  $\sin x$ ,  $\cos x$  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 integrable function primitive, fundamental theorem, first and second Mean.

**UNIT II: Differential Equation**

**Lecture – 24**

**Questions-6**

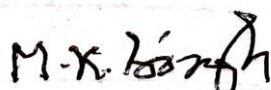
- B.1: First order higher degree Clairaut's form, singular solution orthogonal trajectories.
- B.2: Linear Equation with constant coefficient.
- B.3: Second order linear equations: solution by changing independent variable and by variation of parameters.
- B.4: Simultaneous equation  $dx/P = dy/Q = dz/R$  and Total differential equation  $pdx+Qdy+Rdz = 0$  together with their geometrical significance.

Books Recommended:

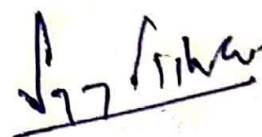
1. Real Analysis: A.R. Vasistha / Lalji Prasad / Shanti Narayan
2. Differential Equation: J.N. Sharma / B.N. Prasad



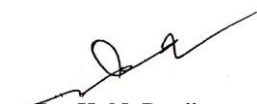
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External Expert, Member



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Member



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Member Secretary

**Time - 3 Hours**

**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: 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  $w=z^2$ ,  $w=e^z$ ,  $w=\sin z$

**UNIT II: Mechanics**

**Lecture – 24**

**Questions-6**

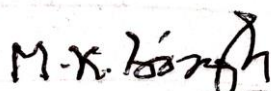
- B.1: Reduction of system of coplanar forces, equation of resultant. Condition for equilibrium, astatic centre.
- B.2: Laws, Angles and cone of friction, equilibrium on a rough inclined plane, particle constrained to move on a rough curve under any given forces.
- B.3: Kinematics in two dimensions: 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. P
- 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:

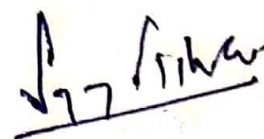
1. Mechanics: Singh & Sen
2. Complex Analysis: J.N. Sharma / Lalji Prasad



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**Time - 3 Hours**

**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.

**CCMATH307**

**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.

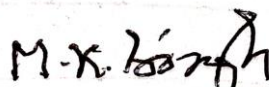
B-5: Discriminant and nature of roots.

**Books recommended**

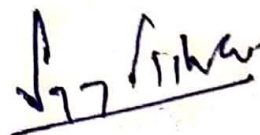
- 1 Theory of Equation – Burnside & Penton/ Lalji Prasad
- 2 Set theory (Degree level) – K. K. Jha.



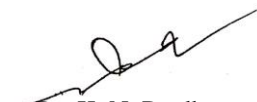
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External Expert, Member



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Member



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**Mathematics (Hons.) – Semester IV**

**Time - 3 Hours**

**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: Higher Arithmetic**

**Lecture – 20**

**Questions-4**

- A.1: Divisibility, H.C.F. Primes & Unique factorization in  $\mathbb{N}$  &  $\mathbb{Z}$  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  $ax=b \pmod{m}$ , Chinese remainder theorem, non-linear algebraic congruency with respect to the modulus.

**UNIT II: Group Theory**

**Lecture – 32**

**Questions-8**

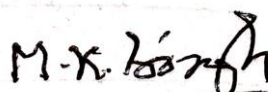
- B.1: Definition of a group with examples and simple properties. Subgroups, Generation of groups.
- B.2: Cyclic groups, Coset decomposition, Lagrange's theorem, Homomorphism and isomorphism. Normal subgroups. Quotient groups. The fundamental theorem of Homomorphism. Permutation groups. Even and Odd permutations. The alternating group & Cayley's theorem.

Books Recommended:

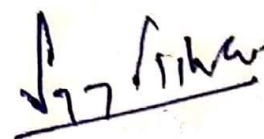
1. Basic Number Theory: S.B. Mallick
2. Number Theory: Hari Kishan / B.N. Prasad
3. Introduction to Number Theory: Niven & Zukerman
4. Modern Algebra: Surjeet Singh & Quazi Zameerudin / A.R. Vasistha



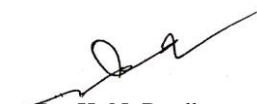
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External Expert, Member



Dr. Sanjay . Tiwari  
External Expert, Member



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Member



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Member Secretary

**Time - 3 Hours**

**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: 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: Lagrangian 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**

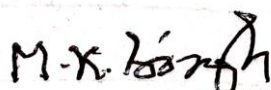
- B.1: Series solution: Ordinary point, singular point (regular), General Methods and forms of series solution (Indicial equation-frobenius method).  
[N.B. result of analysis regarding validity of series. Solution are to be taken for granted]
- B.2: Bessel's equation: Solution Recurrence formula for  $J_n(x)$ ; 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:

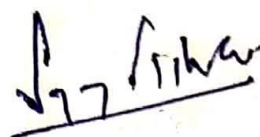
- 1. Hydrostatics: J.P. Sinha
- 2. Hydrodynamics: Ramsey / M.D. Raisingania
- 3. Advance differential equation: M. D. Raisingania



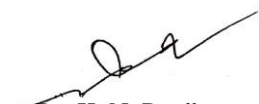
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**Time - 3 Hours**

**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: Linear Programming**

**Lecture – 24**

**Questions-6**

- A.1: Convex sets in  $R^2$  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**

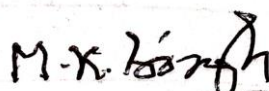
- B.1: Measures of Skewness and Kurtosis.  
B.2: Random variables. Mathematical Expectation and related theorems.  
B.3: Curve fitting and method of least square.  
B.4: Correlation and regression & their expectations and variance.

Books Recommended:

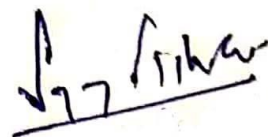
1. Linear Programming Problem: R.K. Gupta / Lalji Prasad
2. Mathematical Statistics: Kapur & Saxena



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**Mathematics (Hons.) – Semester V**

**Time - 3 Hours**

**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 dimensions.
- 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**

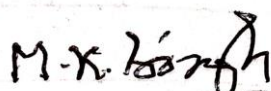
- B.1: Motion of a particle under a central force, Differential equation of a central orbit in both polar and pedal co-ordinates.
- B.2: Newton's law of gravitation, planetary orbits, Kepler's laws of motion.
- B.3: Motion of projectile under gravity in a non-resisting medium.
- B.4: Motion of the mass 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:

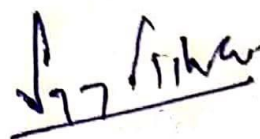
- 1. Statics: Loney
- 2. Dynamics: Loney / A.R. Vasishtha



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**Time - 3 Hours**

**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: Analysis II**

**Lecture – 24**

**Questions-6**

- A.1: Convergence of improper integrals, Comparison Tests, Absolute convergence, Able's and Dirichlet's 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  $R^2$ , Stoke's theorem, Gauss divergence theorem.

**UNIT II: Abstract Algebra**

**Lecture – 24**

**Questions-6**

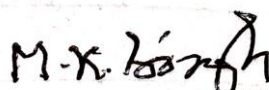
- B.1: Rings, Preliminary Results, Special Kinds, subrings and Ideals.
- B.2: Quotient rings: Fields and Homomorphism.
- B.3: Field for quotient and embedding theorem, polynomial rings, Euclidian ring & Unique factorization in it.

Books Recommended:

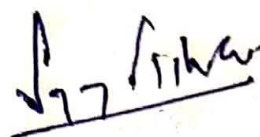
1. Mathematical Analysis: Shanti Narayan / Mallick Arora
2. Integral Calculus: Williamson
3. Vector Calculus: Shanti Narayan



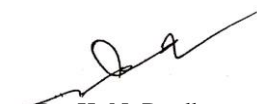
Dr. T. C. K. Raman  
Head & Chairman



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External Expert, Member



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External Expert, Member



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Member



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**Time - 3 Hours**

**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: 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. Eulerian 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**

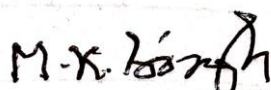
- B.1: Definition and example of metric spaces, Open sets, Interior closed Sets closure.
- B.2: Convergence, completeness, Bair's theorem, Cantor's Intersection theorem.
- B.3: Continuous maps, Uniform Continuity and related extensions.

Books Recommended:

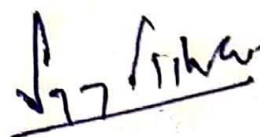
1. Discrete Mathematics: C.L. Lieu, Elements of Discrete Mathematics: McGraw Hill International Ed. (12) Volumes 1 to 4 Published as Modulus in Applied Mathematics. Springer-Verlag 1982.
2. Topology: K.K. Jha / J.N. Sharma
3. Mathematical Analysis: Shanti Narayan / Mallick Arora



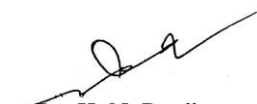
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Or

**Time - 3 Hours**

**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: 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.

**Note:** All these chapters must be taught through the application of Computer. There will be no practical examination.

**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.

B.5: Linear Equations: Direct methods for solving systems of linear equations (Gauss Elimination).

B.6: Ordinary Differential equation: Euler Method, Single-step Method.

Books Recommended:

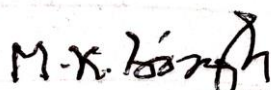
1. Programming in ANCI in C.E. Balaguru Swamy.

2. Numerical Analysis: J.B. Scarborough

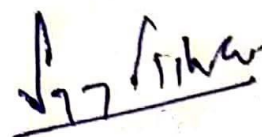
3. Introduction to Numerical Analysis: A. Gupta & S.C. Bose



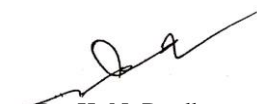
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**Time - 3 Hours**

**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**

**(A) Tensor**

**Lecture – 22**

**Questions-7**

- A.1: Tensor Algebra: Transformation of co-ordinates, Contravariant & co-variant vector, Kronecker delta, Tensor of higher orders, Inner Product, conjugate tensor, Tensor field.  
A.2: Covariant Differentiation: Christoffels three index symbols, Transformation of symbol, covariant derivatives of scalar, Ricci theorem, Divergence, curl, Laplace operator.

**(B) Fourier Transformation**

**Lecture – 28**

**Questions-8**

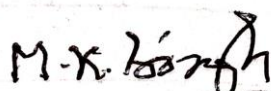
- B.1: Infinite Fourier Transform: Infinite Fourier sine transform, Infinite Fourier cosine transform, Relation between Fourier & Laplace transform.  
B.2: The Finite Fourier Transform & Integral: Finite Fourier sine transform, Finite Fourier cosine transform, Fourier Integral.

Books Recommended:

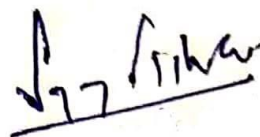
1. D.C. Agrawal, Tensor Calculus & Riemannian Geometry
2. Goel & Gupta, Laplace & Fourier Transform



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Head & Chairman



Dr. M. K. Singh  
External Expert, Member



Dr. Sanjay . Tiwari  
External Expert, Member



Dr. K. N. Pradhan  
Member



Dr. Md. Moiz Ashraf  
Member Secretary

Or

**Time - 3 Hours**

**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: Prey 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

**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

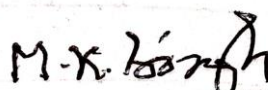
B-3: Continuous maps, Uniform continuity and related extensions.

Books Recommended:

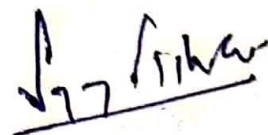
- 1 Mathematical Modelling by J N Kapoor
- 2 Topology by M L Khanna
- 3 Topology by K K Jha



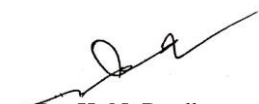
Dr. T. C. K. Raman  
Head & Chairman



Dr. M. K. Singh  
External Expert, Member



Dr. Sanjay . Tiwari  
External Expert, Member



Dr. K. N. Pradhan  
Member



Dr. Md. Moiz Ashraf  
Member Secretary

**Mathematics (Hons.) – Semester VI**

**Time - 3 Hours**

**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**

**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**

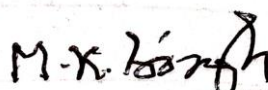
- B1: Difference Equation Order, Solution of Difference Equation, Existence & Uniqueness theorem, solution of the form  $Y_{n+1} = Ay_n + C$ .
- B2: Linear Difference Equation with constant coefficient: Basic Definition. Combination of solution, Fundamental set of solution, Homogeneous Difference Equation & their solution (General & Particular), Special operator, variation of parameters.

Books Recommended:

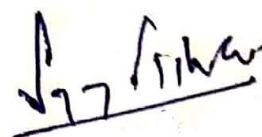
1. Modern Algebra: Surjeet Singh & Quazi Zameeruddin (Ch. 11 & 12)
2. Linear Difference Equation: R.K. Gupta & D.C. Agarwal.



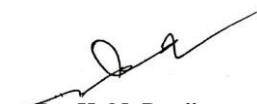
Dr. T. C. K. Raman  
Head & Chairman



Dr. M. K. Singh  
External Expert, Member



Dr. Sanjay . Tiwari  
External Expert, Member



Dr. K. N. Pradhan  
Member



Dr. Md. Moiz Ashraf  
Member Secretary

**Time - 3 Hours**

**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**

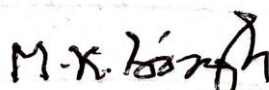
- A.1: Partial differential equation, formation, linear p.d.e. of order 1-Lagrange's method.  
A.2: Non linear equation of order 1, four forms Charpits method, Jacobi Method.  
A.3: Homogeneous linear equation with constant co-efficient Rules of C.F. and P.I.  
A.4: Non-linear equations of second order, 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:

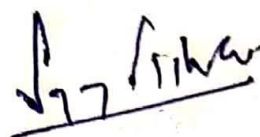
1. Advanced Differential Equation: M.D. Raisingania
2. Differential equation: J.N. Sharma



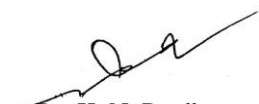
Dr. T. C. K. Raman  
Head & Chairman



Dr. M. K. Singh  
External Expert, Member



Dr. Sanjay . Tiwari  
External Expert, Member



Dr. K. N. Pradhan  
Member



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Member Secretary

**Time - 3 Hours**

**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**

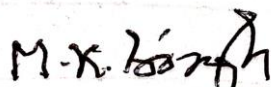
- B 1: Random experiment, Sample Space, Algebra of events, Probability of an event, Mutually exclusive events, addition theorem, Conditional probability, independent events, multiplication theorem,
- B 2: Total probability, Baye's theorem,
- B 3: Random Variables and Distribution Functions, Introduction, 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:

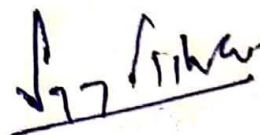
1. Basic Number Theory: S.B. Mallick
2. Number Theory: Hari Kishan / B.N. Prasad
3. Theory of Numbers: Pundir & Pundir
4. Fundamental of Mathematical Statistics: Gupta & Kapoor



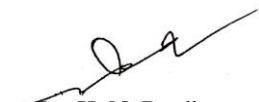
Dr. T. C. K. Raman  
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External Expert, Member



Dr. K. N. Pradhan  
Member



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Member Secretary

Or

**Time - 3 Hours**

**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:**

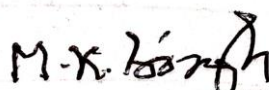
**Life History & Contributions of Eminent Mathematicians:**

- 1: Aryabhata
- 2: Srinivasa Ramanujam
- 3: Vashishtha Narayan Singh
- 4: Bertrand Russell
- 5: Pierre de Fermat
- 6: Joseph Fourier
- 7: Bernhard Riemann
- 8: G W Liebnitz
- 9: Sir Issac Newton
- 10: Albert Einstein

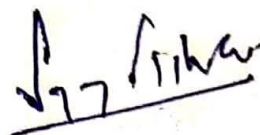
Resource: Internet & Associated Contexts



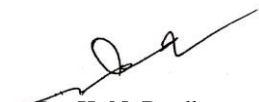
Dr. T. C. K. Raman  
Head & Chairman



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External Expert, Member



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External Expert, Member



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Member



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**Paper DSE 4**

**DSEMATH604**

**Project work of 100 Marks related to elective papers:**

Project courses will be of 100 marks and there shall be no internal written examinations. The total hundred marks will have the following three components:

1. The written component of the project i.e. project report **– 70 marks.**
- &
2. Viva voce examination jointly conducted by an external examiner by the university & the internal supervisor/guide **– 30 marks.**

Project Work of 100 marks should be related to any topic of the Elective Papers in semester 5 & 6. The project work must be submitted in the form of spiral/hard bound dissertation, typed on one side of the paper containing at least 50 (Fifty) pages and not more than 70 (Seventy) pages.

A candidate has to obtain at least 45% marks in a totality of 70(Dissertation)+30(Viva)=100 marks, to clear the paper.

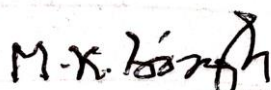
**Continuous Internal Assessment (CIA)- 30 Marks**

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

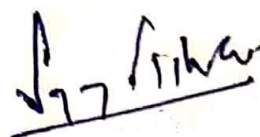
1. Mid-Term test (Subjective/Objective Type)- - - - - 15 Marks
2. Assignment/Project/Poster/Quiz/Seminar- - - - - 10 Marks
3. Classroom attendance and active participation with leadership quality, good manners and articulation in Routine class instructional deliveries (Case studies/seminars/presentation-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



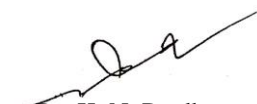
Dr. T. C. K. Raman  
Head & Chairman



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External Expert, Member



Dr. Sanjay . Tiwari  
External Expert, Member



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Member



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Member Secretary



**KOLHAN UNIVERSITY, CHAIBASA**  
**Syllabus: Mathematics for B.A./B.Sc. Programme.**  
**(End-Semester Examination ESE)**

**Mathematics - Semester I**

**Semester I**

**Paper I**

**Full Marks – 100**

**Time - 3 Hours**

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/GEMATH101A**

**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**

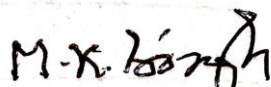
Successive differentiation, Leibnitz theorem, Expansion, Partial Differentiation, Taylor's Theorem for functions of two Variables, Jacobian. Tangent and Normal, Curvature. Asymptotes, maxima and Minima of functions of two variables.

Books Recommended:

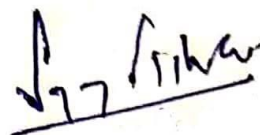
1. Real Analysis: Dasgupta & Prasad / Lalji Prasad / K.K. Jha
2. Differential Calculus: Das & Mukherjee / Dasgupta / Lalji Prasad



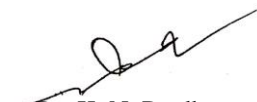
Dr. T. C. K. Raman  
Head & Chairman



Dr. M. K. Singh  
External Expert, Member



Dr. Sanjay . Tiwari  
External Expert, Member



Dr. K. N. Pradhan  
Member



Dr. Md. Moiz Ashraf  
Member Secretary

**Semester II**

**Paper II**

**Full Marks – 100**

**Time - 3 Hours**

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/GEMATH201B**

**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**

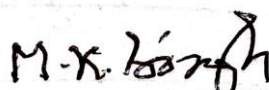
Scalar and Vector product of three vectors. Product of four vectors. Reciprocal Vectors. Point function, differentiation of a vector function of a scalar variable, Gradient, Divergence and curl and second order operators in Cartesian Co-ordinate system.

Books Recommended:

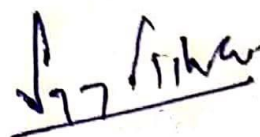
1. Vector Calculus: Lalji Prasad / Shanti Narayan
2. Integral Calculus: Das & Mukherjee / Dasgupta & Prasad / Lalji Prasad



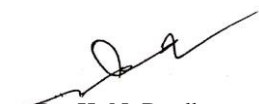
Dr. T. C. K. Raman  
Head & Chairman



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External Expert, Member



Dr. Sanjay . Tiwari  
External Expert, Member



Dr. K. N. Pradhan  
Member



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Member Secretary

**Semester III**

**Time - 3 Hours**

**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 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/GEMATH301C**

**UNIT I: Differential Equation**

**Lecture – 16**

**Questions-4**

First order higher degree Clairaut's form, 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.

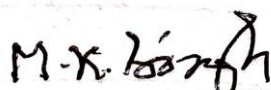
Riemann Integration Definition, Oscillatory sum and integrable conditions. Intergrability of monotonic and continuous functions. Fundamental Theorem of integral calculus.

Books Recommended:

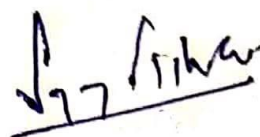
1. Modern Algebra: A.R. Vasistha
2. Differential Equation: Lalji Prasad / Dasgupta & Prasad
3. Real Analysis: Dasgupta & Prasad / Lalji Prasad



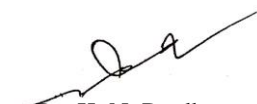
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Head & Chairman



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External Expert, Member



Dr. Sanjay . Tiwari  
External Expert, Member



Dr. K. N. Pradhan  
Member



Dr. Md. Moiz Ashraf  
Member Secretary

**Semester IV**

**Paper IV**

**Full Marks – 100**

**Time - 3 Hours**

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/GEMATH401D**

**UNIT I: Matrices**

**Lecture – 24**

**Questions-6**

Symmetric, Skew Symmetric, Hermitian and Skew Hermitian matrices. 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**

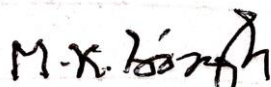
Normal subgroup, Factor group, Fundamental Theorem of homomorphism, Rings, Preliminary Results, Special Kinds, subrings and Ideals. Integral domain and Fields. Ring Homomorphism and isomorphism.

Books Recommended:

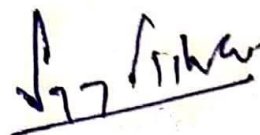
1. Matrices: A.R. Vasistha
2. Modern Algebra: A.R. Vasistha



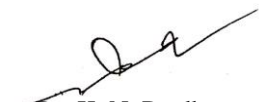
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Head & Chairman



Dr. M. K. Singh  
External Expert, Member



Dr. Sanjay . Tiwari  
External Expert, Member



Dr. K. N. Pradhan  
Member



Dr. Md. Moiz Ashraf  
Member Secretary

**Semester V**

**Time - 3 Hours**

**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 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

**OR**

**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**

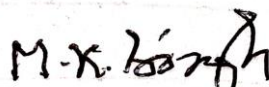
**Lecture – 24**

**Questions-6**

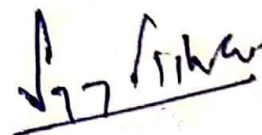
Mappings, Equivalence Relations and partitions. Congruence modulo  $n$ , Generalized Union, Intersection, Complementation, countable and uncountable set, Schroeder and Bernstien theorem, concept of cardinal number.



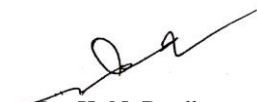
Dr. T. C. K. Raman  
Head & Chairman



Dr. M. K. Singh  
External Expert, Member



Dr. Sanjay . Tiwari  
External Expert, Member



Dr. K. N. Pradhan  
Member



Dr. Md. Moiz Ashraf  
Member Secretary

**Semester VI**

**Time - 3 Hours**

**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

**OR**

**DSEMATH601B(ii)**

**Life History & Contributions of Eminent Mathematicians:**

- 1: Aryabhata
- 2: Vasishtha Narayan Singh
- 3: Srinivasa Ramanujam
- 4: Archimedese
- 5: Euclid of Alexandria
- 6: Sir Issac Newton
- 7: Albert Einstein

Resource: Internet & Associated Contexts

**Continuous Internal Assessment (CIA)- 30 Marks**

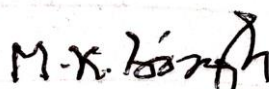
The CIA must be conducted for every DSC paper as well as every DSE paper by the respective Department in the following manner.

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

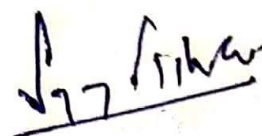
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Dr. Sanjay . Tiwari  
External Expert, Member



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Member



Dr. Md. Moiz Ashraf  
Member Secretary

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**KOLHAN UNIVERSITY, CHAIBASA**  
**Syllabus: GENERAL ELECTIVE (GE) Mathematics for B.A./B.Sc. Hons. Programme.**  
**(End-Semester Examination ESE)**

**Semester I**  
**Paper I**

**Time - 3 Hours**

**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.

**GEMATH101A**

**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.

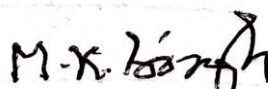
Books Recommended:

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

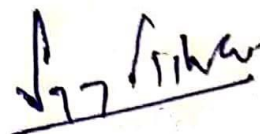
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Head & Chairman



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External Expert, Member



Dr. Sanjay . Tiwari  
External Expert, Member



Dr. K. N. Pradhan  
Member



Dr. Md. Moiz Ashraf  
Member Secretary

**Semester II**

**Paper II**

**Full Marks – 100**

**Time - 3 Hours**

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.

**GEMATH201B**

**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**

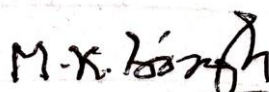
Scalar and Vector product of three vectors. Product of four vectors. Reciprocal Vectors. Point function, differentiation of a vector function of a scalar variable, Gradient, Divergence and curl and second order operators in Cartesian Co-ordinate system.

Books Recommended:

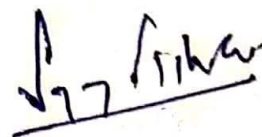
1. Vector Calculus: Lalji Prasad / Shanti Narayan
2. Integral Calculus: Das & Mukherjee / Dasgupta & Prasad / Lalji Prasad



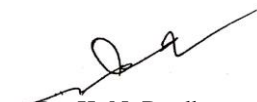
Dr. T. C. K. Raman  
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External Expert, Member



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External Expert, Member



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Member



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Member Secretary



**Semester III**

**Paper III**

**Full Marks – 100**

**Time - 3 Hours**

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.

**GEMATH301C**

**UNIT I: Differential Equation**

**Lecture – 16**

**Questions-4**

First order higher degree Clairaut's form, 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.

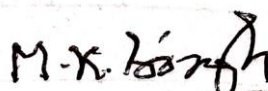
Riemann Integration Definition, Oscillatory sum and integrable conditions. Intergrability of monotonic and continuous functions. Fundamental Theorem of integral calculus.

Books Recommended:

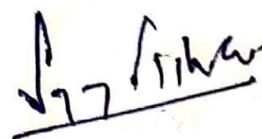
1. Modern Algebra: A.R. Vasistha
2. Differential Equation: Lalji Prasad / Dasgupta & Prasad
3. Real Analysis: Dasgupta & Prasad / Lalji Prasad



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External Expert, Member



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External Expert, Member



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Member



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Member Secretary

**Semester IV**

**Paper IV**

**Full Marks – 100**

**Time - 3 Hours**

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.

**GEMATH401D**

**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

**Continuous Internal Assessment (CIA)- 30 Marks**

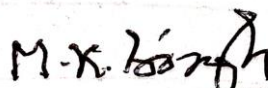
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2. Assignment/Project/Poster/Quiz/Seminar- - - - - 10 Marks
3. Classroom attendance and active participation with leadership quality, good manners and articulation in Routine class instructional deliveries (Case studies/seminars/presentation)- - 05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

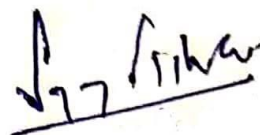
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