ACHHRURAM MEMORIAL COLLEGE JHALDA

DEPARTMENT OF MATHEMATICS

Days	Sem	1	2	3	4	5	6
		10.30-11.30	11.30-12.30	12.30-1.30	1.30-2.30	2.30-3.30	3.30-4.30
MON	H(I)	LG	SGM		PC	LG	
	H(III)	SSD	SSD		LG	PC	
	H(V)	PC	PC	SGM	SSD	SGM	PC
	P(I)						
	P(III)	SGM	LG			SSD	
	P(V)						
	GE-I			LG			
TUE	H(I)	AM			SA	PC	
	H(III)	PC	PC		PC	LG	SGM
	H(V)	SSD	AM	AM	LG	AM	PC
	P(I)						
	P(III)	LG	SA				KM
	P(V)	SA	SSD	LG	SSD		
	GE-I			SA			
WED	H(I)	LG	KM		KM	SA	
	H(III)	PC	AM		SGM		LG
	H(V)	AM	PC	AM	AM	PC	AM
	P(I)	KM	SA		LG	KM	
	P(III)	SGM	SGM		SA	SSD	
	P(V)			SSD			KM
	GE-I			SGM			
THU	H(I)	LG	LG				
	H(III)	AM	PC			PC	
	H(V)	PC	AM	PC	KM	AM	LG
	P(I)						
	P(III)					KM	SA
	P(V)						
	GE-I			KM			
FRI	H(I)	AM	SSD				
	H(III)	SA	SGM		SSD	LG	
	H(V)	KM	AM	AM	AM	PC	PC
	P(I)	SGM	KM				
	P(III)	SSD	SA		KM	SA	
	P(V)						
	GE-I			SGM			
SAT	H(I)	SA	SGM				
	H(III)	KM	KM		AM	AM	
	H(V)	AM	SA	SA	SGM	SA	SSD
	P(I)						
	P(III)				SA	SSD	
	P(V)	SGM	SSD	KM	KM		
	GE-I			SGM			

SSD- Dr. Shibajee Singha Deo SGM- Mr. Santigopal Mukherjee KM- Mrs. Kalyani Mukherjee (Chatterjee)

SA- Mr. Sukanta Addi LG- Mr. Laltu Gorai PC- Mr. Prasanta Choudhury AM- Mr. Arindam Mukherjee

04/12/2019

Dr. Shibajee Singha Deo
Head
Deptt. of Mathematics.
A.M. College Jhalda
Purulia (W.B.)

SYLLABUS DISTRIBUTION FOR MATHEMATICS HONOURS SEMESTER-I

ACHHRURAM MEMORIAL COLLEGE JHALDA

DEPARTMENT OF MATHEMATICS

Syllabus allotted to Dr. Shibajee Singha Deo:

CC-2: Title: Algebra-I

Unit -1: Classical Algebra: Simple Continued fraction and its convergent, representation of real numbers.

Polynomial equation, Fundamental theorem of Algebra (Statement only), Multiple roots, Statement of Rolle's theorem only and its applications, Equation with real coefficients, Complex roots, Descarte's rule of sign, relation between roots and coefficients, transformation of equation, reciprocal equation, binomial equation– special roots of unity, solution of cubic equations–Cardan's method, solution of biquadratic equation– Ferrari's method.

Inequalities involving arithmetic, geometric and harmonic means and their generalizations, Schwarz and Weierstrass's inequalities.

Syllabus allotted to Mr. Santigopal Mukherjee:

CC-1: Title: Calculus & Analytical Geometry (2D)

Unit-2: Integral Calculus:

Reduction formulae, derivations and illustrations of reduction formulae, rectification & quadrature of plane curves, area and volume of surface of revolution.

CC-2: Title: Algebra-I

Unit -1: Classical Algebra:

Complex Numbers: De-Moivre's Theorem and its applications, Direct and inverse circular and hyperbolic functions, Exponential, Sine, Cosine and Logarithm of a complex number, Definition of $(a \neq 0)$, Gregory's Series.

Syllabus allotted to Mrs. Kalyani Mukherjee(Chatterjee):

CC-2: Title: Algebra-I

Unit -2: Abstract Algebra & Number Theory:

Mappings, surjective, injective and bijective, Composition of two mappings, Inversion of mapping. Extension and restriction of a mapping; Equivalence relation and partition of a set, partially ordered relation. Hesse's diagram, Lattices as partially ordered set, definition of lattice in terms of meet and join, equivalence of two definitions, linear order relation.

Syllabus allotted to Mr. Sukanta Addi:

CC-2: Title: Algebra-I

Unit -2: Abstract Algebra & Number Theory:

Principles of Mathematical Induction, Primes and composite numbers, Fundamental theorem of arithmetic, greatest common divisor, relatively prime numbers, Euclid's algorithm, least common multiple.

Congruences: properties and algebra of congruences, power of congruence, Fermat's congruence, Fermat's theorem, Wilson's theorem, Euler – Fermat's theorem, Chinese remainder theorem, Number of divisors of a number and their sum, least number with given number of divisors.

Eulers ϕ function-$\phi(n)$. Mobius μ-function, relation between ϕ function and μ function. Diophantine equations of the form $ax+by = c$, a, b, c integers.

Syllabus allotted to Mr. Laltu Gorai:

CC-1: Title: Calculus & Analytical Geometry (2D)

Unit -3: Two-Dimensional Geometry:

Pair of straight lines: Condition that the general equation of second degree in two variables may represent two straight lines, point of intersection, Angle between pair of lines, Angle bisector, Equation of two lines joining the origin to the points in which a line meets a conic.

General Equation of second degree in two variables: Reduction into canonical form.

Tangents, Normals, chord of contact, poles and polars, conjugate points and conjugate lines of Conics.

Polar Co-ordinates, Polar equation of straight lines, Circles, conics. Equations of tangents, normals Chord of contact of Circles and Conics.

Graphical Demonstration (Teaching Aid)

1. Plotting of graphs of function $eax + b$, $\log(ax + b)$, $1/(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$, $|ax + b|$ and to illustrate the effect of a and b on the graph.

2. Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.

3. Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid).

4. Obtaining surface of revolution of curves.

5. Tracing of conics in Cartesian coordinates/polar coordinates.

Syllabus allotted to Mr. Prasanta Choudhury:

CC-1: Title: Calculus & Analytical Geometry (2D)

Unit -1:

Differential Calculus:

Tangents and Normals, Sub-tangent and sub-normals, Derivatives of arc lengths, Pedal equation of a curve.

Concavity and inflection points, curvature and radius of curvature, envelopes, asymptotes, curve tracing in Cartesian and polar coordinates of standard curves.

Syllabus allotted to Mr. Arindam Mukherjee:

CC-1: Title: Calculus & Analytical Geometry (2D)

Unit -1:

Differential Calculus:

Higher order derivatives, Leibnitz rule of successive differentiation and its applications.

Indeterminate forms, L'Hospital's rule.

Basic ideas of Partial derivative, Chain Rules, Jacobian, Euler's theorem and its converse.

Unit -3:

Two-Dimensional Geometry:

Transformation of Rectangular axes: Translation, Rotation and Rigid body motion, Theory of Invariants.

SYLLABUS DISTRIBUTION FOR MATHEMATICS HONOURS SEMESTER-III

ACHHRURAM MEMORIAL COLLEGE JHALDA

DEPARTMENT OF MATHEMATICS

Syllabus allotted to Dr. Shibajee Singha Deo:

CC-5: Real Analysis-II:

Unit-1: Calculus of Single Variable: Rolle's theorem. Mean value theorem, intermediate value property of derivatives, Darboux's theorem. Applications of mean value theorem to inequalities and approximation of polynomials.

Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions, relative extrema. Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions. Application of Taylor's theorem to inequalities.

Syllabus allotted to Mr. Santigopal Mukherjee:

CC-7: Geometry-3D & Vector Analysis:

Unit-1: Three-Dimensional Geometry

Plane; Straight lines (these topics will be included in the syllabus for the students who will be admitted from the academic session 2019-20)

Sphere: General Equation, Circle, Sphere through circle, Tangent, Normal.

Cone: General homogeneous second degree equation, Enveloping cone, Section of cone by a plane, Tangent and normal, Condition for three perpendicular generators, Reciprocal cone, Right circular cone, Cylinder, Enveloping cylinder, Right circular Cylinder.

Conicoids: Ellipsoid, Hyperboloid, Paraboloid: Canonical equations only. Plane sections of it.

Ruled surface, Generating lines of hyperboloid of one sheet and hyperbolic paraboloid, their properties.

Transformation of Co-ordinates, Invariants, Reduction of general equation of three variables.

Knowledge of Cylindrical and Spherical polar co-ordinates.

Syllabus allotted to Mrs. Kalyani Mukherjee(Chatterjee):

CC-6: Algebra-II:

Group: Uniqueness of identity and inverse element, law of cancellation, order of a group and order of an element, Abelian Group, sub-group – Necessary and sufficient condition, Finite Group. Simple examples.

Symmetries of a square, Dihedral groups, definition and examples of groups including permutation groups and quaternion groups (through matrices), elementary properties of groups.

Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups.

Properties of cyclic groups, classification of subgroups of cyclic groups. Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem.

Syllabus allotted to Mr. Sukanta Addi:

Unit- 2: Multivariable Calculus

Functions of several variables, limit and continuity of functions of two or more variables

Partial differentiation, total differentiability and differentiability, sufficient condition for differentiability. Directional derivatives, the gradient, Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems.

Double integration over rectangular region, double integration over non-rectangular region, Double integrals in polar co-ordinates, Triple integrals, Triple integral over a parallelepiped and solid regions. Volume by triple integrals, cylindrical and spherical co-ordinates. Change of variables in double integrals and triple integrals.

Syllabus allotted to Mr. Laltu Gorai:

CC-5: Real Analysis-II

Unit-1: Calculus of Single Variable

Limits of functions (ε-δ approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity. Continuous functions, sequential criterion for continuity and discontinuity. Algebra of continuous functions. Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, uniform continuity theorem.

Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum theorem.

Syllabus allotted to Mr. Prasanta Choudhury:

CC-7: Geometry-3D & Vector Analysis:

Unit -2: Vector Analysis :

Product of three or more vectors,

Vector Calculus: Continuity and differentiability of vector-valued function of one variable, Space curve, Arc length, Tangent, Normal. Serret- Frenet's formulae. Integration of vector-valued function of one variable.

Vector-valued functions of two and three variables, Gradient of scalar function, Gradient vector as normal to a surface, Divergence and Curl, their properties.

Evaluation of line integral of the type

Evaluation of surface integrals of the type

Evaluation of volume integrals of the type

Green’s theorem in the plane. Gauss and Stokes’ theorems (Proof not required), Green’s first and second identities.

Syllabus allotted to Mr. Arindam Mukherjee:

CC-6: Algebra-II:

Definition and examples of Rings, properties of Rings, Subrings, Integral Domains, Characteristic of a Ring.

Definition and examples Field, Subfield, Finite Field, characteristics of a Field.

SYLLABUS DISTRIBUTION FOR MATHEMATICS HONOURS SEMESTER-V

ACHHRURAM MEMORIAL COLLEGE JHALDA

DEPARTMENT OF MATHEMATICS

Syllabus allotted to Dr. Shibajee Singha Deo:

CC-12: Metric Spaces & Complex Analysis

Unit-2: Complex Analysis

Introduction of complex number as ordered pair of real numbers, geometric interpretation, metric structure of the complex plane C, regions in C. Stereographic projection and extended complex plane $C\infty$ and circles in $C\infty$.

Limit, Continuity and differentiability of a complex function, sufficient condition for differentiability of a complex function, Analytic functions and Cauchy-Riemann equation, harmonic functions, Conjugate harmonic functions, Relation between analytic function and harmonic function.

Power series, radius of convergence, sum function and its analytic behavoiur within the circle of convergence, Cauchy-Hadamard theorem.

Transformation (mapping), Concept of Conformal mapping, Bilinear (Mobius) transformation and its geometrical meaning, fixed points and circle preserving character of Mobius transformation.

Syllabus allotted to Mr. Santigopal Mukherjee:

DSE-1: Linear Programming

General introduction to optimization problem, Definition of L.P.P., Mathematical formulation of the problem, Canonical & Standard form of L.P.P.

Basic solutions, feasible, basic feasible & optimal solutions, Reduction of a feasible solution to basic feasible solution.

Hyperplanes and Hyperspheres, Convex sets and their properties, convex functions, Extreme points, Convex feasible region, Convex polyhedron, Polytope, Graphical solution of L. P.P.

Fundamental theorems of L.P.P., Replacement of a basis vector, Improved basic feasible solutions, Unbounded solution, Condition of optimality, Simplex method, Simplex algorithm, Artificial variable technique (Big M method, Two phase method), Inversion of a matrix by Simplex method. Degeneracy in L.P.P. and itsresolution.

Duality in L.P.P.: Concept of duality, Fundamental properties of duality, Fundamental theorem of duality, Duality & Simplex method, Dual simplex method and algorithm.

Syllabus allotted to Mrs. Kalyani Mukherjee(Chatterjee):

CC-11: Algebra-III

Unit-2: Linear Algebra

Introduction to linear transformations, algebra of linear transformation.null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation. Inverse of a

matrix, characterizations of invertible matrices. Subspaces of Rn, dimension of subspaces of Rn, rank of a matrix, Eigen values, Eigen Vectors and Characteristic Equation of a matrix. Cayley-Hamilton theorem and its use in finding the inverse of a matrix.

Characteristic equation, statement of Caley-Hamilton theorem and its application, eigen values, eigen vectors, similar matrices, diagonalization of matrices of order 2 and 3, Real Quadratic Form involving three variables, Reduction to Normal Form (Statements of relevant theorems and applications).

Inner product spaces and norms, Gram-Schmidt orthogonalisation process, orthogonal complements, Bessel's inequality, the adjoint of a linear operator.

Syllabus allotted to Mr. Sukanta Addi:

CC-12: Metric Spaces & Complex Analysis

Unit-1: Metric Spaces

Metric, examples of standard metric spaces including Euclidean and Discrete metrics; open ball, closed ball, open sets; metric topology; closed sets, limit points and their fundamental properties; interior, closure and boundary of subsets and their interrelation; denseness; separable and second countable metric spaces and their relationship.

Continuity: Definition of continuous functions, algebra of real/complex valued continuous functions, distance between a point and a subset, distance between two subsets, Homeomorphism (definitions with simple examples)

Connectedness: Connected subsets of the real line R, open connected subsets in R2, components; components of open sets in R and R2; Structure of open set in R, continuity and connectedness; Intermediate value theorem.

Sequence and completeness: Sequence, subsequence and their convergence; Cauchy sequence, Cauchy's General Principle of convergence, Cauchy's Limit Theorems. completeness, completeness of Rn; Cantor's theorem concerning completeness, Definition of completion of a metric space, construction of the real as the completion of the incomplete metric space of the rational with usual distance (proof not required). Continuity preserves convergence. Compactness.

Syllabus allotted to Mr. Laltu Gorai:

CC-11: Algebra-III

Unit-1: Abstract Algebra

External direct product of a finite number of groups, normal subgroups, quotient groups, Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms.First, Second and Third isomorphism theorems, Automorphism.

Ideal, ideal generated by a subset of a ring, quotient rings, operations on ideals, prime, maximal and primary ideals, quotient ring.

Ring homomorphism, isomorphism, 1st, 2nd and 3rd isomorphism theorems, Every integral domain can be extended to a field.

DSE-1: Linear Programming

Transportation Problem (T.P.): Matrix form of T.P., the transportation table, Initial basic feasible solutions (different methods like North West corner, Row minima, Column minima, Matrix minima & Vogel's Approximation method), Loops in T.P. table and their properties, Optimal solutions, Degeneracy in T.P., Unbalanced T.P.

Assignment Problem, Mathematical justification for optimal criterion, optimal solution by Hungarian Method, Travelling Salesman Problem.

Theory of Games : Introduction, Two person zero-sum games, Minimax and Maximinprinciples, Minimax and Saddle point theorems, Mixed Strategies games without saddle points, Minimax (Maximin) criterion, The rules of Dominance, Solution methods of games without Saddle point; Algebraic method, Matrix method, Graphical method and Linear Programming method.

Syllabus allotted to Mr. Prasanta Choudhury:

DSE-2: Mechanics-I

Foundations of Classical Dynamics

Inertial frames, Newton's laws of motion, Galilean transformation, Form-invariance of Newton's laws of motion under Galilean transformation, Fundamental forces in classical physics (gravitation), Electric and Magnetic forces, action-at-a-distance. Body forces; contact forces: Friction, Viscosity.

System of particles

Fundamental concepts, centre of mass, momentum, angular momentum, kinetic energy, work done by a field of force, conservative system of forces – potential and potential energy, internal potential energy, total energy.

Syllabus allotted to Mr. Arindam Mukherjee:

DSE-2: Mechanics-I

The following important results to be deduced in connection with the motion of system of particles:

(i) Centre of mass moves as if the total external force were acting on the entire mass of the system concentrated at the centre of mass (examples of exploding shell, jet and rocket propulsion).

(ii) The total angular momentum of the system about a point is the angular momentum of the system concentrated at the centre of mass, plus the angular momentum for motion about the center.

(iii) Similar theorem as in (ii) for kinetic energy.

Conservation laws: conservation of linear momentum, angular momentum and total energy for conservative system of forces.

An idea of constraints that may limit the motion of the system, definition of rigid bodies, D'Alembert's principle, principle of virtual work for equilibrium of a connected system.

Rigid Body

Moments and products of inertia (in three-dimensional rectangular co-ordinates), Inertia matrix, Principal values and principal axes of inertia matrix. Principal moments and principal axes of inertia for (i) a rod, (ii) a rectangular plate, (iii) a circular plate, (iv) an elliptic plate, (v) a sphere, (vi) a right circular cone, (vii) a rectangular parallelepiped and (viii) a circular cylinder.

Equation of motion of a rigid body about a fixed axis, Expression for kinetic energy and moment of momentum of a rigid body moving about a fixed axis, Compound pendulum, Interchangeability of the points of a suspension and centre of oscillation, Minimum time of oscillation.

Equations of motion of a rigid body moving in two-dimension, Expression for kinetic energy and angular momentum about the origin of rigid body moving in two dimensions. Necessary and sufficient condition for pure rolling, Two-dimensional motion of a solid of revolution moving on a rough horizontal plane, the following examples of the two-dimensional motion of a rigid body to be studied:

(i) Motion of a uniform heavy sphere (solid and hollow) along a perfectly rough inclined plane

(ii) Motion of a uniform heavy circular cylinder (solid and hollow) along a perfectly rough inclined plane:

(iii) Motion of a rod when released from a vertical position with one end resting upon a perfectly rough table or smooth table.

(iv) Motion of a uniform heavy solid sphere along an imperfectly rough inclined plane;

(v) Motion of a uniform circular disc, projected with its plane vertical along an imperfectly rough horizontal plane with a velocity of translation and angular velocity about the centre.