# SITANANDA COLLEGE,NANDIGRAM

**P.O. NANDIGRAM,PURBA MEDINIPUR,721631**

## CURRICULUM FOR B.SC HONOURS/GENERIC ELECTIVE IN MATHEMATICS(2021-22)

## [SEMESTER-I]

| MONTH | CORE COURSE | UNIT | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|
| August | CC-1/GE-1 | Unit-1<br>• Leibnitz rule.<br>unit-2<br>• Reduction formulae. | • Brief concept on higher order derivative<br>• State and proof Leibnitz rule<br>• Describe some important application on this rule.<br>• Brief concept on integration[class-xii]<br>• Problem solving some useful reduction formula.<br>• Definition,example,<br>• What is Argand plane?...<br>• De moivre's theory and its application. | 32 | CC-1:-<br>unit-1:- SM<br>unit-2:N.M<br>GE-1:<br>Unit-1: SM<br>Unit-2: NM<br>CC-2:-<br>For unit-1:-S.M |
| | CC-2 | Unit-1<br>• Complex number | | | |
| September | CC-1/GE-1 | Unit-1<br>• Asymptotes<br>unit-2<br>• Reduction formulae. | • Brief concept on asymptotes<br>• Describe some important application on asymptotes.<br>• Explain polynomial, division algorithm,multiple roots.<br>• Explain decart's rule of sign and its application..<br>• What is the relation between roots and coefficients and its application.<br>• Define matrix, determinant,rank of matrix.and its application.<br>• Problem solving some useful reduction formula.<br>• Explain system of linear equation, explain row reduce echelon form and application. | | CC-1, GE-1:-<br>For unit-1:-<br>S.M<br>For unit-2:N.M<br><br>CC-2:-<br>For unit-1:-<br>SAM<br>For unit-3:-DD |
| | CC-2 | Unit-1<br>• Theory of equation<br>Unit-3<br>• Matrix and determinant | | | |

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| **MONTH** | **CORE COURSE** | **UNIT** | | **SKILLS** | **Number of classes** | **Lecturer's name** |
|---|---|---|---|---|---|---|
| October & November | CC-1/GE-1 | Unit-1<br>• Curve traching<br>• L' hospital rule<br><br>unit-4<br>• Differential equation | | • Traching conics in certesian co ordinate and polar co ordinate.<br>• Briefly describe –L' Hospital rule,its application in business,economics and life science.<br>• Concept of differential equation,its order,degree,linearity,exactness and uniqueness theorem of diff. equ.<br>• Explain decart's rule of science & its application.<br>• Explain about set,relation-equivalence relation.<br>• Define mapping.sketching different types of mapping(into,onto,one-to-one,surjective,bijective).<br>• Explain about inverse mapping.<br>• Solve exercise problem on relation,mapping.<br>• Explain about field.define vector space,subspace,dimention,linear dependence and independence.<br>• Explain polynomial of matrix, characteristic polynomial.<br>• Briefly concepts about eigenvalue and eigenvector with suitable examples. | 32 | CC-1:-<br>For unit-1:-S.M<br>For unit-4: KPB<br>CC-2:-<br>For unit-1:-SAM<br>For unit-2:- AD<br>For unit-4:-DD<br><br>GE-1:<br>Unit-1: SM<br>Unit-4: DM |
| | CC-2 | Unit-1<br>• Descarts rule of sign<br>Unit-2<br>• Relation, mapping or function<br>Unit-4<br>• Subspace<br>• Eigen value and eigenvector | | | | |
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| **MONTH** | **CORE COURSE** | **UNIT** | | **SKILLS** | **Number of classes** | **Lecturer's name** |
|---|---|---|---|---|---|---|
| December | CC-1/GE-1 | Unit-4<br>• Differential equation.<br>unit-2<br>• Parametric curve<br>Unit-3<br>• Conics ,rotation of axes, general Equation of Second degree. | | • Briefly describe about linear equation<br>• Explain about integrating factor.<br>• Bernoulii's problem and linear problem.<br>• Sketching parametric curve-eq. trochoid,cycloid,epicyloid,hypocycloid.<br>• Sketching conics-circles,parabola,ellipse,hyperbola,etc. and explain refection properties of conics.<br>• Translation and rotation—explain with pictorial diagram.<br>• Briefly explain about general equation of second degree and its canonical form.<br>• Explain set, number system,integers,well ordering properties.<br>• Briefly describe about division algorithm,G.C.D,L.C.M , divisibility.<br>• State and proof cayley Hamilton theorem.<br>• Solve some problem to find inverse of any square matrix. | 32 | CC-1:-<br>For unit-2:- NM<br>For unit-4: KPB<br>For unit-3:-SK<br>GE-1:<br>Unit-2: NM<br>Unit-3,4: DM |
| | CC-2 | Unit-2<br>• Well ordering properties.<br>• Division algorithm,divisibility<br>Unit-4<br>• Cayley-Hamilton theory. | | | | CC-2:-<br>For unit-2:- AD<br>For unit-4:-DD |

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| **MONTH** | **CORE COURSE** | **UNIT** | | **SKILLS** | **Number of classes** | **Lecturer's name** |
|---|---|---|---|---|---|---|
| January | CC-1/GE-1 | Unit-2<br>• Volume of surface of revolution.<br>unit-3<br>• Sphere, central conicoid, cone, paraboloid, ellipsoid | | • Explain about surface of revolution.<br>• Obtaining surface of revolution curves.<br>• Find area of surface and its volume.<br>• Sketching sphere, cone, paraboloid,ellipsoid, and solve important problem on its.<br>• Explain in-equation and equation. Explain A.M>=G.M>=H.M<br>• Briefly explain Cauchy's Schwartz's inequality. And its application.<br>• Define congruence relation between integers, principle of mathematical induction, proof some basic theorem on it.<br>• Explain about linear transformation. And its basic theorem.<br>• Explain about matrix of linear transformation and its importance examples. | 32 | CC-1:-<br>unit-2:- N.M<br>Unit-3: SK<br><br>GE-1:<br>Unit-2:NM<br>Unit-3 DM |
| | CC-2 | Unit-1<br>• In equality A.M>=G.M>=H.M<br>Unit-2<br>• Congruence<br>Unit-4<br>• Linear transformation. | | | | CC-2:-<br>For unit-1:-SAM<br>For unit-2:-AD<br>For unit-4:-DD |

# SITANANDA COLLEGE,NANDIGRAM

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**[Semester-II]**

| **MONTH** | **CORE COURSE** | **UNIT** | **SKILLS** | **Number of classes** | **Lecturer's name** |
|---|---|---|---|---|---|
| MARCH | CC-3 | Unit-1<br>• Set in R<br>unit-2<br>• Sequence of real numbers | • Review of algebraic and order properties or R<br>• Idea of enumerable sets .<br>• Idea of sequence<br>• Limit of sequence , lim sup, lim inf<br>• Boundedness and convergence of sequence<br>• Lipschitz condition<br>• Picard's theory<br>• General solution of homogeneous equations of second order . | 32 | CC-3:-<br>unit-1:- DD<br>unit-2: AD |
| | CC-4 | Unit-1<br>• Differential Equations<br>Unit-4<br>• Vector functions | | | CC-4:-<br>unit-1 K.P.B<br>unit 4: SAM |
| | GE-2 | Unit-1<br>• Complex numbers<br>Unit-2<br>• Relation and mapping<br>Unit-3<br>• Row reduction and echelon forms | • Polar representation of complex number<br>• nth roots of unity , De Moivre's theorem<br>• Equivalence relation , composition of functions invertible functions<br>• Row echelon form of a matrix | | GE-2<br>Unit 1 SK<br>Unit 2: SK<br>Unit 3: KPB |

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| **MONTH** | **CORE COURSE** | **UNIT** | | **SKILLS** | **Number of classes** | **Lecturer's name** |
|---|---|---|---|---|---|---|
| APRIL | CC-3 | Unit-1<br>• Set in R<br>unit-2<br>• Subsequences | | • Concept of supremum and infimum of a set<br>• Completeness property of R<br>• Archemedean property<br>• Density of rational and irrational numbers in R<br>• Bolzano Weierstrass theorem<br>• Cauchy convergence theorem for sequence<br>• Wronskian: Its properties and application<br>• Higher order linear equation with constant coefficients<br>• Euler's equation, method of variation of parameters | 32 | CC-3:-<br>unit-1:-DD<br>unit-2: AD |
| | CC-4 | Unit-1<br>• Differential equations<br>Unit-2<br>• Limit and continuity of vector functions | | | | CC-4:-<br>unit-1:-KPB<br>Unit-2: NM |
| | GE-2 | Unit-1<br>• Theory of equations<br>Unit-2<br>• Integers<br>Unit-3<br>• System of linear equations | | • Relation between roots and coefficients<br>• Transformation of equations<br>• Well-ordering property<br>• Division algorithm and Euclidean algorithm<br>• Solution of system of linear equations | | GE-2<br>Unit-1-S.K<br>Unit-2-SK<br>Unit-3-KPB |

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| **MONTH** | **CORE COURSE** | **UNIT** | | **SKILLS** | **Number of classes** | **Lecturer's name** |
|---|---|---|---|---|---|---|
| MAY | CC-3 | Unit-1<br>• Set in R<br><br>unit-3<br>• Series of real numbers | | • Compact sets in R, Heine-Borel theorem<br>• Convergence and divergence of series<br>• Cauchy criterion, test for convergence<br>• System of linear differential equations, differential operators<br>• Solutions of homogeneous linear systems with constant coefficients | 32 | CC-3:-<br>unit-1:- DD<br>unit-3:KRM |
| | CC-4 | Unit-2<br>• Differential equations<br>Unit-4<br>• Differentiation and integration vector functions | | | | CC-4:-<br>unit-2:-NM<br>Unit-4: SAM |
| | GE-2 | Unit-1<br>• Theory of equations<br>Unit-2<br>• Integers<br>Unit-4<br>• Linear transformation | | • Descartes rule of signs, cubic and biquadratic equation<br>• Congruence relation between integers<br>• Principles of Mathematical induction<br>• Fundamental theorem of Arithmetic<br>• Introduction to linear transformations, matrix representation, invertible matrix | | GE-2<br>Unit-1-S.K<br>Unit-2-SK<br>Unit-4-DM |

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| **MONTH** | **CORE COURSE** | **UNIT** | | **SKILLS** | **Number of classes** | **Lecturer's name** |
|---|---|---|---|---|---|---|
| June | CC-3 | Unit-1<br>• Set in R<br>unit-3<br>• Series of real numbers | | • Some problems of sets in R,<br>• Test for convergence of series, Leibniz test, absolute and conditional convergence<br>• What is equilibrium points?<br>• Interpretation of phase plane,<br>• Concept of regular and irregular singular points, power series solution of differential equation | 32 | CC-3:-<br>unit-1:- DD<br>unit-3:KRM |
| | CC-4 | Unit-3<br>• Differential equations<br>Unit-4<br>• Differentiation and integration vector functions | | | | CC-4:-<br>unit-3:-SM<br>Unit-4: SAM |
| | GE-2 | Unit-1<br>• Inequality<br>Unit-2<br>• Integers<br>Unit-4<br>• Linear transformation | | • Explain in-equation and equation. Explain A.M>=G.M>=H.M<br>• Briefly explain Cauchy's Schwartz's inequality and its application.<br>• Problems in itegers<br>• Concept of vector space and subspace, dimension of subspace, rank of a matrix<br>• Eigenvalue and eigenvector, characteristic equation of a matrix , Cayley-Hamilton theorem and its application. | | GE-2<br>Unit-1-S.K<br>Unit-2-SK<br>Unit-4-DM |

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**[SEMESTER-III]**

| MONTH | CORE COURSE | UNIT | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|
| August | CC-5 | Unit-1<br>• Theory of Real functions<br>unit-4<br>• Metric space | • Introduction to limit of function, Sequential criterion for limkits, Limit theorems<br>• Continuous functions, sequential criterion for continuity, algebra of continuous functions<br>• Introduction to metric space, open and closed balls , nbd , open set, interior of a set<br>• Introduction to Group theory, subgroups, elementary properties<br>• Normal subgroup, factor group, Cauchy theorem<br>• Estimation of errors<br>• Gauss elimination, Gauss Jordan, Gauss Jacobi, LU decomposition methods<br>• Proposotion, Predicates and quantifiers of logic sets<br>• Lipschitz condition<br>• Picard's theory<br>• General solution of homogeneous equations of second order .<br>• Wronskian: Its properties and application<br>• Higher order linear equation with constant coefficients | 48 | CC-5:-<br>unit-1:- DD<br>unit-4: NM |
| | CC-6 | Unit-2<br>• Group Theory<br>Unit-4<br>• Normal Group | | | CC-6:-<br>unit-2 KPB<br>unit 4: DD |
| | CC-7 | Unit-1<br>• Numerical methods<br>Unit-3<br>• Solution methods | | | CC-7<br>Unit 1 SAM<br>Unit 3: SAM |
| | SEC-1 | Unit-1<br>• Logic and sets | | | SEC-1<br>UNIT 1: SK |
| | GE-3 | Unit-1<br>• Differential Equations | | | GE-3<br>UNIT1 : KPB |

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| MONTH | CORE COURSE | UNIT | | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|---|
| September | CC-5 | Unit-1<br>• Theory of Real functions<br>Unit-2<br>• Differentiability<br>unit-4<br>• Metric space | | • Types of discontinuity, Intermediate value theorem, related theories<br>• Differentiability of a function, algebra of differentiable functions<br>• Point set of metric space, subspace, separable space<br>• Permutation group, properties of permutation, Symmetries of a sqare<br>• External direct product<br>• Numerical Interpolation<br>• Solution methods for Transcendental and polynomial equations, Rate of Convergence<br>• Sets, subsets, power set, different types of sets, operations, Venn diagrams<br>• Euler's equation, method of variation of parameter<br>• System of linear differential equation<br>• Introduction to vector functions, triple product, operations with vector-valued functions. | 48 | CC-5:-<br>unit-1:- DD<br>unit-2:K.R.M<br>Unit-4: NM |
| | CC-6 | Unit-1<br>• Group Theory<br>Unit-4<br>• Normal Group | | | | CC-6:-<br>unit-1 KPB<br>unit 4: DD |
| | CC-7 | Unit-4<br>• Interpolation<br>Unit-2<br>• Solution methods | | | | CC-7<br>Unit 4 SM<br>Unit 2: SAM |
| | SEC-1 | Unit-2<br>• Logic and sets | | | | SEC-1<br>UNIT 2: DM |
| | GE-3 | Unit-1,2: Differential Equations<br>Unit-4 : Vector Calculus | | | | GE-3<br>UNIT1 : KPB<br>Unit 2: NM<br>UNIT-4: DM |

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| MONTH | CORE COURSE | UNIT | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|
| October & November | CC-5 | Unit-1<br>• Theory of Real functions<br>unit-2<br>• Relative extrema, MVT | • Uniform continuity and related theorems<br>• Rolles, Lagrange , Darboux theoremtheorem, application of MVT<br>• Cyclic subgroups, Lagrange's theorem, related properties including Fermat's little theorem<br>• Introduction of group homomorphism with properties, Cayley's theorem.<br>• Method based on interpolations, finite differences<br>• Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule<br>• Euler's method, modified Euler's, RK method of orders 2 & 4.<br>• Relation with congruence modulo relation<br>• Equilibrium points, interpretation of phase plane<br>• Differentiation and integration of vector functions. | 48 | CC-5:-<br>unit-1:- DD<br>unit-2:K.R.M |
| | CC-6 | Unit-3<br>• Group Theory<br>Unit-5: Group homomorphism | | | CC-6-<br>unit-3 DD<br>unit 5: DD |
| | CC-7 | Unit-4,5<br>• Numerical Differentiation & Integration<br>Unit-6<br>• Solution methods | | | CC-7:<br>Unit 4:SM<br>Unit 5: SM<br>Unit 6: SM |
| | SEC-1 | Unit-3<br>• Logic and sets | | | SEC-1:<br>UNIT 3: DM |
| | GE-3 | Unit-3<br>• Differential Equations<br>Unit-4 :<br>• Vector Calculus | | | GE-3<br>UNIT 3: DM<br>Unit 4:DM |

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| **MONTH** | **CORE COURSE** | **UNIT** | | **SKILLS** | **Number of classes** | **Lecturer's name** |
|---|---|---|---|---|---|---|
| December | CC-5 | unit-3<br>• MVT | | • Taylor's, Maclaurin's theorem, convex functions, Taylor's series expansion<br>• Dihedral groups, quaternion groups<br>• 1st, 2nd and 3rd isomorphism theorems, properties<br>• Newton Cotes formula, Weddle's rule, Boole's rule, midpoint rule, composite rule, Gauss quadrature formula, eigenvalue problem: power method, least square polynomial approximation<br>• Power series solution of differential equation | 48 | CC-5:-<br>unit-3: AD |
| | CC-6 | Unit-1<br>• Group Theory<br>Unit-5: Group homomorphism | | | | CC-6-<br>unit-1 KPB<br>unit 5: DD |
| | CC-7 | Unit-5<br>• Numerical Integration | | | | CC-7<br>Unit-5 SM |
| | | | | | | |
| | GE-3 | Unit-3<br>• Differential Equations | | | | GE-3<br>UNIT 3: DM |

# SITANANDA COLLEGE,NANDIGRAM

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**[SEMESTER-IV]**

| MONTH | CORE COURSE | UNIT | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|
| February | CC-8 | Unit-1: Riemann Integration<br>unit-3: Sequence of functions | • Inequality of upper and lower sums, Dourbox theorem, Reimaan condition of integrability, Reimaan sum<br>• Pointwise and uniform convergence of sequence of functions, related theorems, problems<br>• Limit, continuity, differentiability of two or more variables, Partial differentiation, total differentiability and differentiability, sufficient condition for differentiability.<br>• Definition of vector field, divergence, curl<br>• Introduction of rings, subrings, integral domain, field<br>• Vector space, subspace, quotient space, linear span, basis and dimension<br>• Definition, properties of graph, Pseudo, complete, bipartite graphs, isomorphism of graphs<br>• Estimation of errors<br>• Gauss elimination, Gauss Jordan, Gauss Jacobi, LU decomposition methods | 48 | CC-8:-<br>unit-1:- DD<br>unit-3:K.R.M |
| | CC-9 | Unit-1: Function of several variables<br><br>Unit-3: Vector calculus | | | CC-9:-<br>unit-1:NM<br>unit 3: SM |
| | CC-10 | Unit-1: Ring theory<br><br>Unit-3: Vector Space | | | CC-10<br>Unit 1 SK<br>Unit 3: AD |
| | SEC-2 | Unit-1: Graph theory | | | SEC-2<br>UNIT 1: DM |
| | GE-4 | Unit-1,3:Numerical methods | | | GE-4<br>UNIT1 : SAM<br>UNIT3: SAM |

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| MONTH | CORE COURSE | UNIT | | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|---|
| March | CC-8 | Unit-1: Riemann Integration<br>unit-3: Series of functions | | • Riemann integrability of monotone and continuous functions, properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions.<br>• Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion, Weierstrass M-Test.<br>• Chain rule, directional derivatives, gradient, maximal and normal property of the gradient, tangent planes, extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems.<br>• Line integrals, applications, Fundamental theorem for line integrals, conservative vector fields, independence of path.<br>• Ideal, operations on ideals, prime and maximal ideals.<br>• Linear transformations, null space, range, rank and nullity, matrix representation.<br>• Eulerian, semi-Eulerian graph, Hamiltonian cycles, theorems, representation of a graph by matrix, the adjacency, incidence matrix, weighted graph.<br>• Numerical Interpolation<br>• Solution method for transcendental, polynomial equation, ROC. | 48 | CC-8:-<br>unit-1:- DD<br>unit-3:K.R.M |
| | CC-9 | Unit-1: Function of several variables<br>Unit-3: Vector calculus | | | | CC-9:-<br>unit-1: NM<br>unit 3: SM |
| | CC-10 | Unit-1: Ring theory<br><br>Unit-4: Linear algebra | | | | CC-10<br>Unit 1 SK<br>Unit 4: AD |
| | SEC-2 | Unit-2: Graph theory | | | | SEC-2<br>UNIT 2: DM |
| | GE-4 | Unit-2,4, :Numerical methods | | | | GE-4<br>UNIT2 : SAM<br>UNIT4: SM |

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| MONTH | CORE COURSE | UNIT | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|
| April | CC-8 | Unit-1: Riemann Integration<br>unit-4: Fourier series<br>Unit-5: Power series | • Intermediate Value theorem for Integrals; Fundamental theorem of Integral Calculus.<br>• Definition of Fourier coefficients and series, Reimann Lebesgue lemma, Bessel's inequality, Parseval's identity, Dirichlet's condition, Fourier expansions for series.<br>• Power series, radius of convergence, Cauchy Hadamard theorem, differenti-ation and integration of power series, Abel's theorem, Weierstrass approximation theorem.<br>• Double integration over rectangular region, non-rectangular region, in polar co-ordinates, Triple integrals, triple integral over a parallelepiped, solid regions.<br>• Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stoke's theorem, the divergence theorem.<br>• Ring homomorphisms, properties, Isomorphism theorems I, II, III, quient fields.<br>• Algebra of linear transformations. Isomorphisms. Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix. | 48 | CC-8:-<br>unit-1:- DD<br>unit-4 DM<br>Unit-5: DM |
| | CC-9 | Unit-2: Multivariate calculus<br>Unit-4: Vector calculus | | | CC-9:-<br>unit-2: SM<br>unit 4: SAM |
| | CC-10 | Unit-2: Ring theory<br><br>Unit-4: Linear algebra | | | CC-10<br>Unit 2 SK<br>Unit 4: AD |
| | SEC-2 | Unit-3: Graph theory | | | SEC-2<br>UNIT 3: SAM |
| | GE-4 | Unit-4,5: Numerical differentiation & integration<br>Unit-6: Numerical solution methods | | | GE-4<br>UNIT4,5 : SM<br>UNIT6: SM |

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|---|---|---|---|---|---|---|
| | | | | • Travelling salesman's problem, shortest path, Tree and their properties, spanning tree, Dijkstra's algorithm, Warshall algorithm.<br>• Method based on interpolations, finite differences<br>• Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule<br>• Euler's method, modified Euler's, RK method of orders 2 & 4. | | |

| **MONTH** | **CORE COURSE** | **UNIT** | | **SKILLS** | **Number of classes** | **Lecturer's name** |
|---|---|---|---|---|---|---|
| May | CC-8 | Unit-2: Improper integrals | | • Improper integrals, convergence of Beta and Gamma functions<br>• Volume by triple integrals, cylindrical and spherical coordinates, change of variables in double integrals and triple integrals.<br>• Some problems on Ring theory<br>• Some problems on linear algebra<br>• Some problems on graph theory<br>• Newton Cotes formula, Weddle's rule, Boole's rule, midpoint rule, composite rule, Gauss quadrature formula, eigenvalue problem: power method, least square polynomial approximation . | 48 | CC-8:-<br>unit-2:- KPB |
| | CC-9 | Unit-2: Multivariate calculus | | | | CC-9:-<br>unit-2: SM |
| | CC-10 | Unit-2: Ring theory<br><br>Unit-4: Linear algebra | | | | CC-10<br>Unit 2 SK<br>Unit 4: AD |
| | SEC-2 | Unit-3: Graph theory | | | | SEC-2<br>Unit-3: SAM |
| | GE-4 | Unit-5: Numerical Integration | | | | GE-4<br>UNIT 5: SM |

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**[SEMESTER-V]**

| **MONTH** | **CORE COURSE** | **UNIT** | | **SKILLS** | **Number of classes** | **Lecturer's name** |
|---|---|---|---|---|---|---|
| July | CC-11 | Unit-1:partial differential equation<br>Unit-4: dynamics | | • Basic concepts and definitions, Mathematical problems ,First- order equations: classification, construction and geometrical interpretation. Method of characteristics for obtaining general solution of quasi linear equations.<br>• Central force. Constrained motion, varying mass, tangent and normal components of acceleration,<br>• Automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups,<br>• Group actions, stabilizers and kernels, permutation representation associated with a given group action.<br>• Introduction to linear programming problem. Theory of simplex method, graphical solution, convex sets, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method. Big-M method and their comparison.<br>• Sample space, probability axioms, real random variables (discrete, continuous), cumulative distribution function, probability mass/density functions. | 48 | CC-11:-<br>unit-1:- SM<br>Unit-4: NM |
| | CC-12 | Unit-1:Group Automorphism<br>Unit-3: Group actions | | | | CC-12:-<br>unit-1: AD<br>unit 3: DD |
| | Dse-1 | Unit -1: L.P.P | | | | DSE-1<br>Unit 1 SAM |
| | DSE-2 | Unit-1: Probability | | | | DSE-2<br>UNIT 1 KRM |
| | | | | | | |

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| MONTH | CORE COURSE | UNIT | | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|---|
| August | CC-11 | Unit-1:partial differential equation<br>Unit-4: dynamics | | • Method of separation of variables for solving first order partial differential equations.<br>• Modelling ballistics and planetary motion, Kepler's second law.<br>• Applications of factor groups to automorphism groups, Characteristic subgroups, Commutator subgroup and its properties.<br>• Applications of group actions. Generalized Cayley's theorem. Index theorem.<br>• Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual.<br>• Mathematical expectation, moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, geometric, negative binomial, continuous distributions: uniform, normal, exponential. | 48 | CC-11:-<br>unit-1:- SM<br>Unit-4: NM |
| | CC-12 | Unit-1:Group Automorphism<br>Unit-3: Group actions | | | | CC-12:-<br>unit-1: AD<br>unit 3: DD |
| | DSE-1 | Unit -2: L.P.P | | | | DSE-1<br>Unit 2 SAM |
| | DSE-2 | Unit-1: Probability | | | | DSE-2<br>UNIT 1: KRM |
| | | | | | | |

# SITANANDA COLLEGE,NANDIGRAM

**P.O. NANDIGRAM,PURBA MEDINIPUR,721631**

| MONTH | CORE COURSE | UNIT | | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|---|
| September | CC-11 | Unit-2:partial differential equation | | • Derivation of heat equation, wave equation and Laplace equation. Classification of second order linear equations as hyperbolic, parabolic or elliptic. Reduction of second order linear equations to canonical forms.<br>• Properties of external direct products, the group of units modulo n as an external direct product, internal direct products, Fundamental theorem of finite abelian groups<br>• Groups acting on themselves by conjugation, class equation and consequences.<br>• Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution<br>• Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables, conditional expectations, independent random variables, bivariate normal | 48 | CC-11:-<br>unit-2:- SM |
| | CC-12 | Unit-2:Group Automorphism<br>Unit-4: Group actions | | | | CC-12:-<br>unit-2: AD<br>unit 4: DD |
| | DSE-1 | Unit -2: L.P.P | | | | DSE-1<br>Unit 2 SAM |
| | DSE-2 | Unit-2: Probability | | | | DSE-2<br>UNIT 2: KRM |

# SITANANDA COLLEGE,NANDIGRAM

**P.O. NANDIGRAM,PURBA MEDINIPUR,721631**

| MONTH | CORE COURSE | UNIT | | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|---|
| October & November | CC-11 | Unit-3:partial differential equation | | • The Cauchy problem, Cauchy-Kowalewskaya theorem, Cauchy problem of an infinite string. Initial boundary value problems. Semi-infinite string with a fixed end, semi-infinite string with a free end. Equations with non-homogeneous boundary conditions.<br>• conjugacy in Sn, p-groups, Sylow's theorems and consequences, Cauchy's theorem, Simplicity of An for n ≥ 5, non-simplicity tests.<br>• formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution<br>• conditional expectations, independent random variables, bivariate normal distribution, correlation coefficient, joint moment generating function (jmgf) and calculation of covariance (from jmgf), linear regression for two variable<br>• Random Samples, Sampling Diatributions | 48 | CC-11:-<br>unit-3:- SM |
| | CC-12 | Unit-4: Group actions | | | | CC-12:-<br>unit-4: DD |
| | DSE-1 | Unit -3 : Game Theory | | | | DSE-1<br>Unit 3 DM |
| | DSE-2 | Unit-2: Probability<br>Unit -4: statistics | | | | DSE-2<br>UNIT 2: KRM<br>UNIT-4: KPB |

# SITANANDA COLLEGE,NANDIGRAM

**P.O. NANDIGRAM,PURBA MEDINIPUR,721631**

| MONTH | CORE COURSE | UNIT | | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|---|
| December | CC-11 | Unit-3:partial differential equation | | • Non- homogeneous wave equation. Method of separation of variables, solving the vibrating string problem. Solving the heat conduction problem .<br>• Inearprogramming solution of games.<br>• Chebyshev's inequality, statement and interpretation of (weak) law of large numbers and strong law of large numbers. Central limit theorem for independent and identically distributed random variables with finite variance, Markov chains, Chapman-Kolmogorov equations, classification of states.<br>• Estimation of parameters, Testing of hypothesis. | 48 | CC-11:-<br>unit-1:- DD<br>unit-3:K.R.M<br>Unit-4: KPB |
| | CC-12 | Unit-4: Group actions | | | | CC-12:-<br>unit-2: NM<br>unit 3: SK |
| | DSE-1 | Unit -4: L.P.P | | | | DSE-1<br>Unit 4 DM |
| | DSE-2 | Unit-3: Probability<br>Unit-4 : statistics | | | | DSE-2<br>UNIT 3,4: KPB |

# SITANANDA COLLEGE,NANDIGRAM

**P.O. NANDIGRAM,PURBA MEDINIPUR,721631**

**[SEMESTER-VI]**

| MONTH | CORE COURSE | UNIT | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|
| January | CC-13 | Unit-1:Metric space<br>Unit -3: Complex analysis | • Metric spaces: sequences in metric spaces, Cauchy sequences. Complete metric spaces, Cantor's theorem.<br>• Limits, limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings.<br>• Polynomial rings over commutative rings, division algorithm and consequences, principal ideal domains, factorization of polynomials, reducibility tests, irreducibility tests,<br>• Dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, annihilators. Eigen spaces of a linear operator.<br>• Co-planar forces. Astatic equilibrium. Friction. Equilibrium of a particle on a rough curve.<br>• Equations of motion referred to a set of rotating axes. Motion of a projectile in a resisting medium. Stability of nearly circular orbits. Motion under the inverse square law.Slightly disturbed orbits.<br>• Power series solution of Bessel's equation and Legendre's equation, | 48 | CC-13:-<br>unit-1:- AD<br>unit-3:K.R.M |
| | CC-14 | Unit-1:Polynomials rings<br>Unit _2 : Dual spaces | | | CC-14:-<br>unit-1: SK<br>unit 2: SK |
| | DSE-3 | Unit –1: Statics<br>Unit 2: Rigid Dynamics | | | DSE-3<br>Unit 1 SAM<br>Unit 2: SM |
| | DSE-4 | Unit-1:mathematical Modelling | | | DSE-4<br>UNIT 1: NM |

# SITANANDA COLLEGE,NANDIGRAM

**P.O. NANDIGRAM,PURBA MEDINIPUR,721631**

| MONTH | CORE COURSE | UNIT | | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|---|
| February | CC-13 | Unit-2:Metric space<br>Unit -3: Complex analysis | | • Continuous mappings, sequential criterion and other characterizations of continuity. Uniform continuity. Connectedness, connected subsets of R.<br>• Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.<br>• Eisenstein criterion, and unique factorization in Z [x]. Divisibility in integral domains, irreducible, primes, unique factorization domains, Euclidean domains.<br>• diagonalizability, invariant subspaces and Cayley-Hamilton theorem, the minimal polynomial for a linear operator, canonical forms.<br>• Virtual work.. Forces in three dimensions. General conditions of equilibrium. Centre of gravity for different bodies. Stable and unstable equilibrium.<br>• Motion of artificial satellites. Motion of a particle in three dimensions. Motion on a smooth sphere, cone, and on any surface of revolution.<br>• Laplace transform and inverse transform, application to initial value problem up to second order. | 48 | CC-13:-<br>unit-2:- AD<br>unit-3:K.R.M |
| | CC-14 | Unit-1:Polynomials rings<br>Unit -2: Dual space | | | | CC-14:-<br>Unit-1: SK<br>Unit 2: SK |
| | DSE-3 | Unit 1: Statics<br>Unit 2: Rigid Dynamics | | | | DSE-3<br>Unit 1 SAM<br>Unit 2: SM |
| | DSE-4 | Unit-1:mathematical Modelling | | | | DSE-4<br>UNIT 1: NM |

# SITANANDA COLLEGE,NANDIGRAM

**P.O. NANDIGRAM,PURBA MEDINIPUR,721631**

| MONTH | CORE COURSE | UNIT | | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|---|
| March | CC-13 | Unit-2 : Compactness<br>Unit -4: Complex analysis | | • Sequential compactness, Heine-Borel property, totally bounded spaces, finite intersection property, and continuous functions on compact sets.<br>• Analytic functions, examples of analytic functions, exponential function, logarithmic function, trigonometric function, derivatives of functions, and definite integrals of functions.<br>• Inner product spaces and norms, Gram-Schmidt orthogonalization process, orthogonal complements, Bessel's inequality, the adjoint of a linear operator<br>• Degrees of freedom. Moments and products of inertia. Momental Ellipsoid. Principal axes. D'Alembert's Principle. Motion about a fixed axis.<br>• Monte Carlo simulation modelling: simulating deterministic behavior (area under a curve, volume under a surface), generating random numbers: middle square method | 48 | CC-13:-<br>unit-2:- AD<br>Unit-4: KRM |
| | CC-14 | Unit 3: Inner product | | | | CC-14:-<br>unit 3: DD |
| | DSE-3 | Unit 3: Rigid Dynamics | | | | DSE-3<br>Unit 3 SM |
| | DSE-4 | Unit-2:mathematical Modelling | | | | DSE-4<br>UNIT 2: DM |

# SITANANDA COLLEGE,NANDIGRAM

**P.O. NANDIGRAM,PURBA MEDINIPUR,721631**

| **MONTH** | **CORE COURSE** | **UNIT** | | **SKILLS** | **Number of classes** | **Lecturer's name** |
|---|---|---|---|---|---|---|
| April | CC-13 | Unit-2 : Compactness<br>Unit -4: Complex analysis | | • Homeomorphism. Contraction mappings. Banach fixed point theorem and its application to ordinary differential equation.<br>• Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy- Goursat theorem, Cauchy integral formula.<br>• Least squares approximation, minimal solutions to systems of linear equations. Normal and self-adjoint operators. Orthogonal projections and Spectral theorem.<br>• Compound pendulum. Motion of a rigid body in two dimensions under finite and impulsive forces. Conservation of momentum and energy.<br>• linear congruence, queuing models: harbor system, morning rush hour, Overview of optimization modelling. | 48 | CC-13:-<br>unit-2:- AD<br>unit-4:K.R.M |
| | CC-14 | Unit 3: Inner product | | | | CC-14:-<br>unit-3: DD |
| | DSE-3 | Unit 3: Rigid Dynamics | | | | DSE-3<br>Unit 3 SM |
| | DSE-4 | Unit-2:mathematical Modelling | | | | DSE-4<br>UNIT 2: DM |

# SITANANDA COLLEGE,NANDIGRAM

**P.O. NANDIGRAM,PURBA MEDINIPUR,721631**

| MONTH | CORE COURSE | UNIT | | SKILLS | Number of classes | Lecturer's name |
|---|---|---|---|---|---|---|
| May | CC-13 | Unit -5,6: Complex analysis | | • Liouville,s theorem, fundamental theorem of algebra, convergence of sequence and series, Taylor's series and its example.<br>• Laurent series and its examples, absolute and uniform convergence of power series.<br>• Orthogonal projections and Spectral theorem.<br>• Conservation of momentum and energy.<br>• Linear programming model: geometric solution algebraic solution, simplex method, sensitivity analysis | 48 | CC-13:-<br>unit-5,6:- DD |
| | CC-14 | Unit 3: Inner product | | | | CC-14:-<br>unit-3: DD |
| | DSE-3 | Unit 3: Rigid Dynamics | | | | DSE-3<br>Unit 3: SM |
| | DSE-4 | Unit-2:mathematical Modelling | | | | DSE-4<br>UNIT 2: DM |