UNIVERSITY OF CALCUTTA

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Ref.No : CUS/ 111 (Cir.) /18
Dated the 12th March, 2018

To
The Principals/T.I.C.
of all the Undergraduate Colleges
offering B.Sc. (General) in Mathematics
affiliated to the University of Calcutta

Sir/Madam,

The undersigned is to inform you that the proposed **revised semester wise draft Syllabus for Mathematics (General)** Courses of Studies under **CBCS has been uploaded in the Calcutta University website (www.caluniv.ac.in).**

The said syllabus has been prepared by the **U.G. Board of Studies in Mathematics, C.U.**

You are requested kindly to go through it and send your feedback within 29th March, 2018.

In this regard you may send your observation/ suggestion to the **Department of U.G. Councils, C.U**. or through email (u.g.councilsc.u@gmail.com), and you also may contact **Prof. Tanuka Chattopadhyay,** Department of Mathematics, C.U. through e-mail **(tanuka2008@gmail.com).**

Your cooperation in this regard will be highly appreciated. Kindly treat the matter as urgent.

Thanking you,

Yours faithfully,

12/03/18

Secretary

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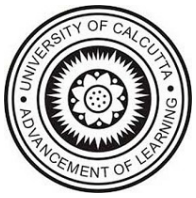
University of Calcutta

Syllabus for three-year B.Sc. in Mathematics

(General)

Under

CBCS System



2018

1. Credit Distribution across Courses

Course Type	Total Papers	Credits		
		Theory + Tutorial	Theory + Practical	Total
Core Courses	4 (Mathematics)	$4 \times 5 + 4 \times 1 = 24$	—	72
	8 (Other disciplines)	To be decided	To be decided	
Discipline Specific Electives	2 (Mathematics)	$2 \times 5 + 2 \times 1 = 12$	—	36
	4 (Other disciplines)	To be decided	To be decided	
Ability Enhancement Language Courses	2	$2 \times 2 = 4$	—	4
Skill Enhancement Courses	4 (at least one from each discipline)	$4 \times 2 = 8$	—	8
Totals	24			120

2. Course Structure : Semester-wise distribution of Courses

Semester	Course Name	Course Detail	Credits	Page No.
I	Ability Enhancement Compulsory Course-I	English communication / Environmental Science	2	
	Core Course-1A	Mathematics-I	6	4
	Core Course-2A	Other Discipline	6	
	Core Course-3A	Other Discipline	6	
		Total	**20**	
II	Ability Enhancement Compulsory Course-II	English communication / Environmental Science	2	
	Core Course-1B	Mathematics-II	6	6
	Core Course-2B	Other Discipline	6	
	Core Course-3B	Other Discipline	6	
		Total	**20**	
III	Core Course-1C	Mathematics-III	6	8
	Core Course-2C	Other Discipline	6	
	Core Course-3C	Other Discipline	6	
	Skill Enhancement Course-1	For Mathematics Course see SEC *	2	3
		Total	**20**	
IV	Core Course-1D	Mathematics-IV	6	10
	Core Course-2D	Other Discipline	6	
	Core Course-3D	Other Discipline	6	
	Skill Enhancement Course-2	For Mathematics Course see SEC *	2	3
		Total	**20**	
V	Skill Enhancement Course-3	For Mathematics Course see SEC *	2	3
	Discipline Specific Elective-1A	Mathematics-V (See DSE-1)	6	3
	Discipline Specific Elective-2A	Other Discipline	6	
	Discipline Specific Elective-3A	Other Discipline	6	
		Total	**20**	
VI	Skill Enhancement Course-4	For Mathematics Course see SEC *	2	3
	Discipline Specific Elective-1B	Mathematics-VI (See DSE-1)	6	3
	Discipline Specific Elective-2B	Other Discipline	6	
	Discipline Specific Elective-3B	Other Discipline	6	
		Total	**20**	
		Grand Total	**120**	

* A student has to opt for 4 Skill Enhancement Courses in four Semesters (3rd to 6th) taking **at least one Course from each discipline.**

Course Structure | Credit Distribution | DSE | SEC

3. Choices for Skill Enhancement Courses in Mathematics (SEC)

	Course Detail
Skill Enhancement Course-1	C Programming Language [12]
Skill Enhancement Course-2	Mathematical Logic [13]
Skill Enhancement Course-3	Object Oriented Programming in C++ [14]
Skill Enhancement Course-4	Boolean Algebra [15]

The number within the bracket [ ] refers to page number.

Course Structure | Credit Distribution | DSE

4. Choices for Discipline Specific Electives-1 . (DSE-1 : Mathematics)

DSE-1A: Mathematics-V	**DSE-1B: Mathematics-VI**
Particle Dynamics [16]	Advanced Calculus [18]
Graph Theory [17]	Mathematical Finance [19]

The number within the bracket [ ] refers to page number. A student has to opt for any one of the subjects available under each category.

Course Structure | Credit Distribution | SEC

Mathematics - I

Semester : I Core Course-1A Paper Code : MG(GE1)101	Credits : 5+1*=6 Full Marks : 80+20**=100
Minimum number of classes required : 60	
*1 Credit for Tutorial	
**20 Mark is reserved for Internal Assessment & Attendance of 10 mark each	

Course Structure | SEC | DSE | Credit Distribution

Unit-1 : Algebra-I (15 Marks) [10 classes]

- Complex Numbers : De Moivre's Theorem and its applications. Exponential, Sine, Cosine and Logarithm of a complex number. Definition of a^z $(a \neq 0)$. Inverse circular and Hyperbolic functions.
- Polynomials : Fundamental Theorem of Algebra (Statement only). Polynomials with real coefficients, the n-th degree polynomial equation has exactly n roots. Nature of roots of an equation (surd or complex roots occur in pairs). Statement of Descarte's rule of signs and its applications.
- Statements of : (i) If a polynomial $f(x)$ has opposite signs for two real values a and b of x, the equation $f(x) = 0$ has odd number of real roots between a and b. If $f(a)$ and $f(b)$ are of same sign, either no real root or an even number of roots lies between a and b.

  (ii) Rolle's Theorem and its direct applications. Relation between roots and coefficients, symmetric functions of roots, transformations of equations. Cardan's method of solution of a cubic equation.
- Rank of a matrix : Determination of rank either by considering minors or by sweep-out process. Consistency and solution of a system of linear equations with not more than 3 variables by matrix method.

Unit-2 : Differential Calculus-I (25 Marks) [20 classes]

- Rational numbers, Geometrical representations, Irrational number, Real number represented as point on a line — Linear Continuum. Acquaintance with basic properties of real number (No deduction or proof is included).
- Real-valued functions defined on an interval, limit of a function (Cauchy's definition). Algebra of limits. Continuity of a function at a point and in an interval. Acquaintance (on proof) with the important properties of continuous functions no closed intervals. Statement of existence of inverse function of a strictly monotone function and its continuity.
- Derivative - its geometrical and physical interpretation. Sign of derivative-Monotonic increasing and decreasing functions. Relation between continuity and derivability. Differential - application in finding approximation.
- Successive derivative - Leibnitz's theorem and its application.
- Functions of two and three variables : their geometrical representations. Limit and Continuity (definitions only) for function of two variables. Partial derivatives. Knowledge and use of chain Rule. Exact differentials (emphasis on solving problems only). Functions of two variables - Successive partial Derivatives : Statement of Schwarz's Theorem on Commutative property of mixed derivatives. Euler's Theorem on homogeneous function of two and three variables.
- Applications of Differential Calculus : Curvature of plane curves. Rectilinear Asymptotes (Cartesian only). Envelope of family of straight lines and of curves (problems only). Definitions and examples of singular points (Viz. Node. Cusp, Isolated point).

Unit-3 : Differential Equation-I (15 Marks) [10 classes]

- Order, degree and solution of an ordinary differential equation (ODE) in presence of arbitrary constants, Formation of ODE.
- First order equations : (i) Exact equations and those reducible to such equation. (ii) Euler's and Bernoulli's equations (Linear). (iii) Clairaut's Equations : General and Singular solutions.
- Second order linear equations : Second order linear differential equation with constant coefficients. Euler's Homogeneous equations.
- Second order differential equation : (i) Method of variation of parameters, (ii) Method of undetermined coefficients.

Unit-4 : Coordinate Geometry (25 Marks) [20 classes]

- Transformations of Rectangular axes : Translation, Rotation and their combinations. Invariants.
- General equation of second degree in x and y : Reduction to canonical forms. Classification of conic.
- Pair of straight lines : Condition that the general equation of 2nd degree in x and y may represent two straight lines. Point of intersection of two intersecting straight lines. Angle between two lines given by $ax^2 + 2hxy + by^2 = 0$. Equation of bisectors. Equation of two lines joining the origin to the points in which a line meets a conic.
- Equations of pair of tangents from an external point, chord of contact, poles and polars in case of General conic : Particular cases for Parabola, Ellipse, Circle, Hyperbola.
- Polar equation of straight lines and circles. Polar equation of a conic referred to a focus as pole. Equation of chord joining two points. Equations of tangent and normal.
- Sphere and its tangent plane. Right circular cone.

Course Structure | SEC | DSE | Credit Distribution

Mathematics - II

Semester : II Core Course-1B Paper Code : MG(GE2)201	Credits : 5+1*=6 Full Marks : 80+20**=100
Minimum number of classes required : 60	
*1 Credit for Tutorial	
**20 Mark is reserved for Internal Assessment & Attendance of 10 mark each	

Course Structure | SEC | DSE | Credit Distribution

Unit-1 : Differential Calculus-II (20 Marks) [15 classes]

- Sequence of real numbers : Definition of bounds of a sequence and monotone sequence. Limit of a sequence. Statements of limit theorems. Concept of convergence and divergence of monotone sequences-applications of the theorems, in particular, definition of e. Statement of Cauchy's general principle of convergence and its application.
- Infinite series of constant terms; Convergence and Divergence (definitions). Cauchy's principle as applied to infinite series (application only). Series of positive terms : Statements of comparison test. D.AIembert's Ratio test. Cauchy's nth root test and Raabe's test Applications. Alternating series. Statement of Leibnitz test and its applications.
- Real-Valued functions defined on an interval: Statement of Rolle's Theorem and its geometrical interpretation. Mean value theorems of Lagrange and Cauchy. Statements of Taylor's and Maclaurin's Theorems with Lagrange's and Cauchy's from of remainders. Taylor's and Maclaurin's Infinite series of functions like $e^x, \sin x, \cos x, (1+x)^n, \log(1+x)$ with restrictions wherever necessary.
- Indeterminate Forms : L'Hospital's Rule : Statement and Problems only.
- Application of the principle of Maxima and Minima for a function of single variable in geometrical, physical and to other problems.
- Maxima and minima of functions of not more than three variables Lagrange's Method of undetermined multiplier - Problems only.

Unit-2 : Differential Equation-II (15 Marks) [10 classes]

- Linear homogeneous equations with constant coefficients, Linear non-homogeneous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Simple eigenvalue problem.
- Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Unit-3 : Vector Algebra (15 Marks) [10 classes]

- Addition of Vectors, Multiplication of a Vector by a Scalar. Collinear and Coplanar Vectors. Scalar and Vector products of two and three vectors. Simple applications to problems of Geometry. Vector equation of plane and straight line. Volume of Tetrahedron. Applications to problems of Mechanics (Work done and Moment).

Unit-4 : Discrete Mathematics (30 Marks) [25 classes]

- Integers : Principle of Mathematical Induction. Division algorithm. Representation of integer in an arbitrary base. Prime Integers. Some properties of prime integers. Fundamental theorem of Arithmetic. Euclid's Theorem. Linear Diophantine equations. [Statement of Principle of Mathematical Induction, Strong form of Mathematical induction. Applications in different problems. Proofs of division algorithm. Representation of an integer uniquely in an arbitrary base, change of an integer from one base to another base. Computer operations with integers â“ Divisor of an integer, g.c.d. of two positive integers, prime integer, Proof of Fundamental theorem, Proof of Euclid's Theorem. To show how to find all prime numbers less than or equal to a given positive integer. Problems related to prime number. Linear Diophantine equation â“ when such an equation has solution, some applications.]
- Congruences : Congruence relation on integers, Basic properties of this relation. Linear congruences, Chinese Remainder Theorem. System of Linear congruences. [Definition of Congruence â“ to show it is an equivalence relation, to prove the following : $a \equiv b$ (mod m) implies
(i) $(a + c) \equiv (b + c)$ (mod m)
(ii) $ac \equiv bc$ (mod m)
(iii) $a^n \equiv b^n$ (mod m), for any polynomial $f(x)$ with integral coefficients $f(a) \equiv f(b)$ (mod m) etc. Linear Congruence, to show how to solve these congruences, Chinese remainder theorem â“ Statement and proof and some applications. System of linear congruences, when solution exists â“ some applications.]
- Application of Congruences : Divisibility tests. Check-digit and an ISBN, in Universal product Code, in major credit cards. Error detecting capability. [Using Congruence, develop divisibility tests for integers based on their expansions with respect to different bases, if d divides $(b - 1)$ then $n = (a_k a_{k-1} a_1 b)$ is divisible by d if and only if the sum of the digits is divisible by d etc. Show that congruence can be used to schedule Round-Robin tournaments. Check digits for different identification numbers â“ International standard book number, universal product code etc. Theorem regarding error detecting capability.]
- Congruence Classes : Congruence classes, addition and multiplication of congruence classes. Fermat's little theorem. Euler's theorem. Wilson's theorem. Some simple applications. [Definition of Congruence Classes, properties of Congruence classes, addition and multiplication, existence of inverse. Fermat's little theorem. Euler's theorem. Wilson's theorem - Statement, proof and some applications.]
- Boolean algebra : Boolean Algebra, Boolean functions, Logic gates, Minimization of circuits.

Course Structure | SEC | DSE | Credit Distribution

Mathematics - III

Semester : III Core Course-1C Paper Code : MG(GE3)301	Credits : 5+1*=6 Full Marks : 80+20**=100
Minimum number of classes required : 60	
*1 Credit for Tutorial	
**20 Mark is reserved for Internal Assessment & Attendance of 10 mark each	

Course Structure | SEC | DSE | Credit Distribution

Unit-1 : Integral Calculus (20 Marks) [10 classes]

- Evaluation of definite integrals.
- Integration as the limit of a sum (with equally spaced as well as unequal intervals).
- Reduction formulae of $\int \sin^n x \cos^m x dx$, $\int \frac{\sin^m x}{\cos^n x} dx$, $\int \tan^n x dx$ and associated problems (m and n are non-negative integers).
- Definition of Improper Integrals : Statements of (i) μ-test (ii) Comparison test (Limit from excluded) - Simple problems only. Use of Beta and Gamma functions (convergence and important relations being assumed).
- Working knowledge of double integral.
- Applications : Rectification, Quadrature, volume and surface areas of solids formed by revolution of plane curve and areas problems only.

Unit-2 : Numerical Methods (30 Marks) [25 classes]

- Approximate numbers, Significant figures, Rounding off numbers. Error : Absolute, Relative and percentage.
- Operators - Δ, ∇ and E (Definitions and some relations among them).
- Interpolation : The problem of interpolation Equispaced arguments Difference Tables, Deduction of Newton's Forward Interpolation Formula, remainder term (expression only). Newton's Backward interpolation Formula (Statement only) with remainder term. Unequally- spaced arguments Lagrange's Interpolation Formula (Statement only). Numerical problems on Interpolation with both equally and unequally spaced arguments.
- Numerical Integration : Trapezoidal and Simpson's $\frac{1}{3}$-rd formula (statement only). Problems on Numerical Integration.
- Solution of Numerical Equation : To find a real root of an algebraic or transcendental equation. Location of root (tabular method), Bisection method, Newton-Raphson method with geometrical significance, Numerical Problems. (Note : Emphasis should be given on problems)

Unit-3 : Linear Programming (30 Marks) [25 classes]

- Motivation of Linear Programming problem. Statement of L.P.P. Formulation of L.P.P. Slack and Surplus variables. L.P.P. is matrix form. Convex set, Hyperplane, Extreme points, convex Polyhedron, Basic solutions and Basic Feasible Solutions (B.F.S.). Degenerate and Non-degenerate B.F.S.
- The set of all feasible solutions of an L.P.P. is a convex set. The objective function of an L.P.P. assumes its optimal value at an extreme print of the convex set of feasible solutions, A.B.F.S. to an L.P.P. corresponds to an extreme point of the convex set of feasible solutions.

- Fundamental Theorem of L.P.P. (Statement only) Reduction of a feasible solution to a B.F.S. Standard form of an L.P.P. Solution by graphical method (for two variables), by simplex method and method of penalty. Concept of Duality. Duality Theory. The dual of the dual is the primal. Relation between the objective values of dual and the primal problems. Dual problems with at most one unrestricted variable, one constraint of equality. Transportation and Assignment problem and their optimal solutions.

Course Structure | SEC | DSE | Credit Distribution

Mathematics - IV

Semester : IV Core Course-1D Paper Code : MG(GE4)401	Credits : 5+1*=6 Full Marks : 80+20**=100
Minimum number of classes required : 60	
*1 Credit for Tutorial	
**20 Mark is reserved for Internal Assessment & Attendance of 10 mark each	

Course Structure | SEC | DSE | Credit Distribution

Unit-1 : Algebra-II (20 Marks) [10 classes]

- Introduction of Group Theory : Definition and examples taken from various branches (example from number system, roots of Unity, 2×2 real matrices, non singular real matrices of a fixed order). Elementary properties using definition of Group. Definition and examples of sub- group - Statement of necessary and sufficient condition and its applications.
- Definitions and examples of (i) Ring, (ii) Field, (iii) Sub-ring, (iv) Sub- field.
- Concept of Vector space over a Field : Examples, Concepts of Linear combinations, Linear dependence and independence of a finite number of vectors, Sub- space, Concepts of generators and basis of a finite-dimensional vector space. Problems on formation of basis of a vector space (No proof required).
- Real Quadratic Form involving not more than three variables (problems only).
- Characteristic equation of square matrix of order not more than three determination of Eigen Values and Eigen Vectors (problems only). Statement and illustration of Cayley-Hamilton Theorem.

Unit-2 : Computer Science & Programming (30 Marks) [25 classes]

- Computer Science and Programming : Historical Development, Computer Generation, Computer Anatomy Different Components of a computer system. Operating System, hardware and Software.
- Positional Number System. Binary to Decimal and Decimal to Binary. Other systems. Binary Arithmetic. Octal, Hexadecimal, etc. Storing of data in a Computer - BIT, BYTE, WORD etc. Coding of a data- ASCII, etc.
- Programming Language : Machine language, Assembly language and High level language, Compiler and interpreter. Object Programme and source Programme. Ideas about some HLL– e.g. BASIC, FORTRAN, C, C++, COBOL, PASCAL, etc.
- Algorithms and Flow Charts– their utilities and important features, Ideas about the complexities of an algorithm. Application in simple problems. FORTRAN 77/90: Introduction, Data Type– Keywords, Constants and Variables - Integer, Real, Complex, Logical, character, subscripted variables, Fortran Expressions.

Unit-3 : Probability & Statistics (30 Marks) [25 classes]

- Elements of probability Theory : Random experiment, Outcome, Event, Mutually Exclusive Events, Equally likely and Exhaustive. Classical definition of probability, Theorems of Total Probability, Conditional probability and Statistical Independence. Baye's Theorem. Problems, Shortcoming of the classical definition. Axiomatic approach problems, Random Variable and its Expectation, Theorems on mathematical expectation. Joint distribution of two random variables.
- Theoretical Probability Distribution Discrete and Continuous (p.m.f., p.d.f.) Binomial, Poisson and Normal distributions and their properties.

- Elements of Statistical Methods. Variables, Attributes. Primary data and secondary data, Population and sample. Census and Sample Survey. Tabulation Chart and Diagram, Graph, Bar diagram, Pie diagram etc. Frequency Distribution Un-grouped and grouped cumulative frequency distribution. Histogram, Frequency curve, Measures of Central tendencies. Averages : AM,; GM, HM, Mean, Median and Mode (their advantages and disadvantages). Measures of Dispersions - Range, Quartile Deviation, Mean Deviation, Variance / S.D., Moments, Skewness and Kurtosis.
- Sampling Theory : Meaning and objects of sampling. Some ideas about the methods of selecting samples, Statistic and parameter, Sampling Proportion. Four fundamental distributions, derived from the normal: (i) standard Normal Distribution, (ii) Chi-square distribution (iii) Student's distribution (iv) Snedecor's F-distribution. Estimation and Test of Significance. Statistical Inference. Theory of estimation Point estimation and Interval estimation. Confidence Interval / Confidence Limit. Statistical Hypothesis - Null Hypothesis and Alternative Hypothesis. Level of significance. Critical Region. Type I and II error. Problems.
- Bivariate Frequency Distribution. Scatter Diagram, Co-relation co-efficient Definition and properties. Regression lines.

Course Structure | SEC | DSE | Credit Distribution

C Programming Language

Semester : III Skill Enhancement Course-1 Paper Code : MG(SEC1 CPL)304	Credits : 2 Full Marks : 30
Minimum number of classes required : 30	

Course Structure | DSE | SEC | Credit Distribution

Unit-1

[30 classes]

- An overview of theoretical computers, history of computers, overview of architecture of computer, compiler, assembler, machine language, high level language, object oriented language, programming language and importance of C programming.
- Constants, Variables and Data type of C-Program : Character set. Constants and variables data types, expression, assignment statements, declaration.
- Operation and Expressions : Arithmetic operators, relational operators, logical operators.
- Decision Making and Branching : decision making with if statement, if-else statement, Nesting if statement, switch statement, break and continue statement.
- Control Statements : While statement, do-while statement, for statement.
- Arrays : One-dimension, two-dimension and multidimensional arrays, declaration of arrays, initialization of one and multi-dimensional arrays.
- User-defined Functions : Definition of functions, Scope of variables, return values and their types, function declaration, function call by value, Nesting of functions, passing of arrays to functions, Recurrence of function.
- Introduction to Library functions: stdio.h, math.h, string.h stdlib.h, time.h etc.

References

[1] B. W. Kernighan and D. M. Ritchi : The C-Programming Language, 2nd Edi.(ANSI Refresher), Prentice Hall, 1977.

[2] E. Balagurnsamy : Programming in ANSI C, Tata McGraw Hill, 2004.

[3] Y. Kanetkar : Let Us C ; BPB Publication, 1999.

[4] C. Xavier : C-Language and Numerical Methods, New Age International.

[5] V. Rajaraman : Computer Oriented Numerical Methods, Prentice Hall of India, 1980.

Course Structure | DSE | SEC | Credit Distribution

Mathematical Logic

Semester : IV Skill Enhancement Course-2 Paper Code : MG(SEC2 ML)404	Credits : 2 Full Marks : 30
Minimum number of classes required : 30	

Course Structure | DSE | SEC | Credit Distribution

Unit-1

[5 classes]

- Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators.
- General Notions : Formal language, object and meta language, general definition of a Formal Theory/Formal Logic.

Unit-2

[15 classes]

- Propositional Logic : Formal theory for propositional calculus, derivation, proof, theorem, deduction theorem, conjunctive and disjunctive normal forms, semantics, truth tables, tautology, adequate set of connectives, applications to switching circuits, logical consequence, consistency, maximal consistency, Leindenbaum lemma, soundness and completeness theorems, algebraic semantics.

Unit-3

[10 classes]

- Predicate Logic : First order language, symbolizing ordinary sentences into first order formulae, free and bound variables, interpretation and satisfiability, models, logical validity, formal theory for predicate calculus, theorems and derivations, deduction theorem, equivalence theorem, replacement theorem, choice rule, Prenex normal form, soundness theorem, completeness theorem, compactness theorem, First Order Theory with equality, examples of First Order Theories (groups, rings, fields etc.).

References

[1] Elliott Mendelson; Introduction to mathematical logic; Chapman & Hall; London(1997)

[2] Angelo Margaris; First order mathematical logic; Dover publications, Inc, New York (1990).

[3] S.C.Kleene; Introduction to Metamathematics; Amsterdam; Elsevier (1952).

[4] J.H.Gallier; Logic for Computer Science; John.Wiley & Sons (1987).

[5] H.B.Enderton; A mathematical introduction to logic; Academic Press; New York (1972).

Course Structure | DSE | SEC | Credit Distribution

Object Oriented Programming in C++

Semester : V Skill Enhancement Course-3 Paper Code : MG(SEC3 OOP)501	Credits : 2 Full Marks : 30
Minimum number of classes required : 30	

Course Structure | DSE | SEC | Credit Distribution

Unit-1

[10 classes]

- Programming paradigms, characteristics of object oriented programming languages, brief history of C++, structure of C++ program, differences between C and C++, basic C++ operators, Comments, working with variables, enumeration, arrays and pointer.

Unit-2

[10 classes]

- Objects, classes, constructor and destructors, friend function, inline function, encapsulation, data abstraction, inheritance, polymorphism, dynamic binding, operator overloading, method overloading, overloading arithmetic operator and comparison operators.

Unit-3

[10 classes]

- Template class in C++, copy constructor, subscript and function call operator, concept of namespace and exception handling.

References

[1] Arnold Robbins, Linux Programming by Examples The Fundamentals, 2nd Ed., Pearson Education, 2008.

[2] Cox K, Red Hat Linux Administrator's Guide, PHI, 2009.

[3] R. Stevens, UNIX Network Programming, 3rd Ed., PHI, 2008.

[4] Sumitabha Das, UNIX Concepts and Applications, 4th Ed., TMH, 2009.

[5] Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, Linux in a Nutshell, 6th Ed.,O'Reilly Media, 2009.

[6] Neil Matthew, Richard Stones, Alan Cox, Beginning Linux Programming, 3rd Ed., 2004.

Course Structure | DSE | SEC | Credit Distribution

Boolean Algebra

Semester : VI Skill Enhancement Course-4 Paper Code : MG(SEC4 BA)601	Credits : 2 Full Marks : 30
Minimum number of classes required : 30	

Course Structure | DSE | SEC | Credit Distribution

[30 classes]

- Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle, maximal and minimal elements, lattices as ordered sets, complete lattices, lattices as algebraic structures, sublattices, products and homomorphisms. Definition, examples and properties of modular and distributive lattices, Boolean algebras.
- Boolean polynomials, minimal forms of Boolean polynomials, Quinn-McCluskey method, Karnaugh diagrams, switching circuits and minimization of switching circuits using Boolean algebra.

References

[1] B A. Davey and H. A. Priestley, Introduction to Lattices and Order, Cambridge University Press, Cambridge, 1990.

[2] Rudolf Lidl and Günter Pilz, Applied Abstract Algebra, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

Course Structure | DSE | SEC | Credit Distribution

Particle Dynamics

Semester : V Discipline Specific Elective-1A Paper Code : MG(DSE1A PD)501	Credits : 5+1*=6 Full Marks : 80+20**=100
Minimum number of classes required : 60	
*1 Credit for Tutorial	
**20 Mark is reserved for Internal Assessment & Attendance of 10 mark each	

Course Structure | DSE | SEC | Credit Distribution

[60 classes]

- Velocity and Acceleration of a particle. Expressions for velocity and acceleration in rectangular Cartesian and polar co-ordinates for a particle moving in a plane. Tangential and normal components of velocity and acceleration of a particle moving along a plane curve.
- Concept of Force : Statement and explanation of Newton's laws of motion. Work, power and energy. Principles of conservation of energy and momentum. Motion under impulsive forces. Equations of motion of a particle (i) moving in a straight line, (ii) moving in a plane.
- Study of motion of a particle in a straight line under (i) constant forces, (ii) variable forces (S.H.M., Inverse square law, Damped oscillation, Forced and Damped oscillation, Motion in an elastic string). Equation of Energy. Conservative forces.
- Motion in two dimensions : Projectiles in vacuum and in a medium with resistance varying linearly as velocity. Motion under forces varying as distance from a fixed point.
- Central orbit. Kepler's laws of motion. Motion under inverse square law.

References

[1] Loney, S. L., An Elementary Treatise on the Dynamics of particle and of Rigid Bodies, Loney Press.

[2] A.S. Ramsey; Dynamics, Part-II; ELBS.

Course Structure | DSE | SEC | Credit Distribution

Graph Theory

Semester : V Discipline Specific Elective-1A Paper Code : MG(DSE1A GT)501	Credits : 5+1*=6 Full Marks : 80+20**=100
Minimum number of classes required : 60	
*1 Credit for Tutorial	
**20 Mark is reserved for Internal Assessment & Attendance of 10 mark each	

Course Structure | DSE | SEC | Credit Distribution

Unit-1

[60 classes]

- Definition, examples and basic properties of graphs, pseudographs, complete graphs, bi-partite graphs, isomorphism of graphs
- Paths and circuits, Eulerian circuits, Hamiltonian cycles, the adjacency matrix, weighted graph, travelling salesman's problem, shortest path, Dijkstra's algorithm, Floyd-Warshall algorithm.
- Definition of Trees and their elementary properties. Definition of Planar graphs, Kuratowski's graphs.

References

[1] Robin J. Wilson; Introduction to Graph Theory; 4th edition, Pearson, 2007.

[2] Edgar G. Goodaire and Michael M. Parmenter; Discrete Mathematics with Graph Theory 2nd Ed.; Pearson Education (Singapore) P. Ltd., Indian Reprint, 2003.

[3] Rudolf Lidl and Günter Pilz; Applied Abstract Algebra, 2nd Ed.; Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

Course Structure | DSE | SEC | Credit Distribution

Advanced Calculus

Semester : VI Discipline Specific Elective-1B Paper Code : MG(DSE1B AC)601	Credits : 5+1*=6 Full Marks : 80+20**=100
Minimum number of classes required : 60	
*1 Credit for Tutorial	
**20 Mark is reserved for Internal Assessment & Attendance of 10 mark each	

Course Structure | DSE | SEC | Credit Distribution

[60 classes]

- Concept of Point-wise and Uniform convergence of sequence of functions and series of functions with special reference of Power Series. Statement of Weierstrass M-Test for Uniform convergence of sequence of functions and of series of functions. Simple applications. Statement of important properties like boundedness, continuity, differentiability and integrability of the limit function of uniformly convergent sequence of functions and of the sum function of uniformly convergent series of functions. Determination of Radius of convergence of Power Series. Statement of properties of continuity of sum function power series. Term by term integration and Term by term differentiation of Power Series. Statements of Abel's Theorems on Power Series. Convergence of Power Series. Expansions of elementary functions such as $e^x, \sin x, \log(1+x), (1+x)^n$. Simple problems.
- Periodic Fourier series on $(-\pi, \pi)$: Periodic function. Determination of Fourier coefficients. Statement of Dirichlet's conditions of convergence and statement of the theorem on convergence of Fourier Sine and Cosine series.
- Laplace Transform and its application to ordinary differential equation. Laplace Transform and Inverse Laplace Transform. Statement of Existence theorem. Elementary properties of Laplace Transform and its Inverse. Application to the solution of ordinary differential equation of second order with constant coefficients.

References

[1] David Widder; Advance Calculus; Prentice Hall.

[2] Angus E. Taylor and W. Robert Mann; Advanced Calculus (3rd Edition); John Wiley & Sons, Inc.

[3] Robert C. Wrede and Murray Spiegel; Advanced Calculus, (Schaum's outline series); McGraw - Hill.

Course Structure | DSE | SEC | Credit Distribution

Mathematical Finance

Semester : VI Discipline Specific Elective-1B Paper Code : MG(DSE1B MF)601	Credits : 5+1*=6 Full Marks : 80+20**=100
Minimum number of classes required : 60	
*1 Credit for Tutorial	
**20 Mark is reserved for Internal Assessment & Attendance of 10 mark each	

Course Structure | DSE | SEC | Credit Distribution

Unit-1

[60 classes]

- Basic principles: Comparison, arbitrage and risk aversion, Interest (simple and compound, discrete and continuous), time value of money, inflation, net present value, internal rate of return (calculation by bisection and Newton-Raphson methods)
- Comparison of NPV and IRR. Bonds, bond prices and yields. Floating-rate bonds, immunization. Asset return, short selling, portfolio return, (brief introduction to expectation, variance, covariance and correlation), random returns, portfolio mean return and variance, diversification, portfolio diagram, feasible set, Markowitz model (review of Lagrange multipliers for 1 and 2 constraints).

References

[1] David G. Luenberger; Investment Science; Oxford University Press, Delhi, 1998.

[2] John C. Hull; Options, Futures and Other Derivatives, 6th Ed.; Prentice-Hall India, Indian reprint, 2006.

[3] Sheldon Ross; An Elementary Introduction to Mathematical Finance, 2nd Ed.; Cambridge University Press, USA, 2003.

Course Structure | DSE | SEC | Credit Distribution