DEPARTMENT OF MATHEMATICS

MADRAS CHRISTIAN COLLEGE

(AUTONOMOUS)

B.Sc. Mathematics

Curriculum & Syllabi

(with effect from 2011 – 2012)

B.Sc. Mathematics Curriculum

with effect from 2011 – 12

Semester I						
Component		**Course**	**Hours**	**Marks**		**Credits**
				CA	**ESE**	
Part I		Language I	4	50	50	3
Part II		English I	4	50	50	3
Part III	Major	Algebra and Trigonometry	5	50	50	4
		Calculus	5	50	50	4
	Allied I	Physics I	6	50	50	5
Part IV	(a)	Basic Tamil I / Advanced Tamil I / General Course I	4	50	50	2
	(d)	Value Education	2	50	50	1
		Total	**30**			**22**

Semester II						
Component		**Course**	**Hours**	**Marks**		**Credits**
				CA	**ESE**	
Part I		Language II	4	50	50	3
Part II		English II	4	50	50	3
Part III	Major	Differential Equations, Laplace Transforms and Fourier Series	5	50	50	4
		Differential Geometry and Analytical Geometry of 3 Dimension	5	50	50	4
	Allied I	Physics II	6	50	50	5
Part IV	(a)	Basic Tamil II /Advanced Tamil II /General Course II	4	50	50	2
	(d)	Value Education	2	50	50	1
		Total	**30**			**22**

Semester III						
Component		**Course**	**Hours**	**Marks**		**Credits**
				CA	**ESE**	
Part I		Language III	4	50	50	3
Part II		English III	4	50	50	3
Part III	Major	Algebraic Structures	5	50	50	4
		Multivariate Calculus and Theory of Numbers	5	50	50	4
	Allied II	Discrete Mathematics I /Chemistry I /Comp. Science I	6	50	50	5
Part IV	(b) Skill-based	Personality Development	2	25	-	-
		Inter Disciplinary (Mathematical Physics)	4	50	50	3
		Total	**30**			**22**

Semester IV						
Component		**Course**	**Hours**	**Marks**		**Credits**
				CA	**ESE**	
Part I		Language IV	4	50	50	3
Part II		English IV	4	50	50	3
Part III	Major	Linear Algebra	5	50	50	4
		Advanced Calculus	5	50	50	4
	Allied II	Discrete Mathematics II / Chemistry II / Computer Science II	6	50	50	5
Part IV	(b) Skill-based	Personality Development	2	25	50	3
	(c)	Environmental Studies	4	50	50	2
		Total	**30**			**24**

Semester V						
Component		**Course**	**Hours**	**Marks**		**Credits**
				CA	**ESE**	
Part III	Major	Real Analysis	7	50	50	5
		Mathematical Statistics	7	50	50	5
		Numerical Methods	6	50	50	5
		Elective: Programming in C / Mathematics of Finance	6	50	50	5
Part IV	(b) Skill-based	General Elective (Space Science)	4	50	50	3
		Total	**30**			**23**

Semester VI						
Component		**Course**	**Hours**	**Marks**		**Credits**
				CA	**ESE**	
Part III	Major	Complex Analysis	6	50	50	5
		Mechanics	6	50	50	5
		Linear Programming	5	50	50	4
		Elective: Astronomy / Fluid Dynamics	5	50	50	4
		Elective: Formal Languages & Graph Theory / Mathematical Modeling	6	50	50	5
Part IV	(b) Skill-based	Computer Training	2	-	-	3
		Total	**30**			**26**

Component	**Extension Activities**	**Hours**	**Marks**		**Credits**
			CA	**ESE**	
Part V	NCC/NSS/Sports/Scrub Soc./ Dept. Assn. Activities	-	-	-	1
	Grand Total				**140**

Department of Mathematics

Madras Christian College (Autonomous)

Allied and Non-Major Courses Offered by the Department

Allied I: (Offered to students of Physics and Chemistry Departments)

Semester I : Allied Mathematics I

Semester II : Allied Mathematics II (for Physics)

Allied Mathematics II (for Chemistry)

Allied II: (Offered to students of Mathematics Department)

Semester III : Discrete Mathematics I

Semester IV : Discrete Mathematics II

General Course: (Offered to students of Departments other than Mathematics)

Semester I : Basic Mathematics

Semester II : Basic Mathematics

Inter Disciplinary: (Offered to students of Mathematics, Physics and Chemistry Departments)

Semester III : Mathematical Physics

General Elective: (Offered to students of all Departments)

Semester V : Space Science

Computer Training: (Offered to students of Mathematics Department)

Semester VI : Computer Training

Environmental Studies:

Semester IV : Environmental Studies (Common to students of all Departments)

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: I **Part III (a) – Major** **Paper: 1**

Course Title: Algebra and Trigonometry **Course Code: 111MT1M01**

Credits: 4 **Hours / Cycle: 5**

Algebra

Unit I **Hours: 15**

Theory of Equations: Introduction to polynomials - Roots of polynomial equations – Imaginary and irrational roots – Relation between roots and coefficients – Symmetric function of the roots.

Treatment and Content as in

Algebra, Volume – I, T.K. Manicavachagom Pillay, T. Natarajan and K.S. Ganapathy, S. Viswanathan Publishers, 2004.

Chapter 6: Sections 1, 2, 9, 10, 11, 12

Unit II **Hours: 15**

Transformation of equations – Reciprocal equations.

Treatment and Content as in

Algebra, Volume – I, T.K. Manicavachagom Pillay, T. Natarajan and K.S. Ganapathy, S. Viswanathan Publishers, 2004.

Chapter 6: Sections 13 – 19, 24, 30

Descartes' rule of signs – Solution by Newton's and Horner's method, Cardon's method of solution of a cubic polynomial equation with real coefficients.

Treatment and Content as in

Mathematics, Volume – I (First Edition), P. Kandasamy and K. Thilagavathy, S. Chand & Co, 2004.

Chapter 1: Section 1

Unit III **Hours: 15**

Series: Summation of series using Binomial, Exponential and Logarithmic series and approximations**.**

Treatment and Content as in

Algebra, Volume – I , T.K. Manicavachagom Pillay, T. Natarajan and K.S. Ganapathy, S. Viswanathan Publishers, 2004.

Chapter 3: Section 10, Chapter 4: Sections 1, 3, 6, 7, 9

Trigonometry

Unit IV **Hours: 15**

Expansion of *cos nx, sin nx, tan nx, cos^{n}x, sin ^{n}x* – Expansion of *sin x, cos x, tan x* in terms of x – Hyperbolic functions

Chapter 3: Sections 1, 2, 3, 4, 5, Chapter 4: Sections 1, 2

Unit V **Hours: 15**

Logarithms of complex quantities – Sums of sines and cosines of *n* angles which are in Arithmetic Progression - Summation of trigonometric series using complex quantities.

Chapter 5: Section 5, Chapter 6: Sections 2, 3

Treatment and Content as in (For Units IV and V)

Trigonometry, S. Narayanan and T.K. Manicavachagom Pillay, S.Viswanathan Publishers, 2010.

References

1. Algebra, Analytical Geometry and Trigonometry - I Year – Paper I, by P. R. Vittal and V. Malini, Margham Publications, Chennai, 2001.
2. Trigonometry by Hari Kishan, Atlantic, New Delhi, 2005.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: I **Part III (a) – Major** **Paper: II**

Course Title: Calculus **Course Code: 111MT1M02**

Credits: 4 **Hours / Cycle: 5**

Differential Calculus

Unit I **Hours: 15**

Introduction to differentiation - Successive differentiation - n^{th} derivative – Leibnitz formula for nth derivative of a product – Partial differentiation – total differential Coefficient– Homogeneous functions – Euler's theorem.

Chapter 3: Sections 1.1 – 1.6, 2.1, 2.2, Chapter 8: Sections 1.1 – 1.6

Unit II **Hours: 13**

Maxima and minima of functions of 2 variables – Lagrange's method of undetermined multipliers – simple problems.

Chapter 8: Sections 4.1, 5

Treatment and content as in (For Units I and II)

Calculus, Vol. I, S. Narayanan and T K Manicavachagom Pillay, S. Viswanathan Printers and Publishers Pvt. Ltd., 2010.

Integral Calculus

Unit III **Hours: 17**

Introduction to integration - Methods of integration – Integration by parts - Bernoulli's formula.

Chapter 1: Sections 5, 6.1 – 6.6, 7.1 – 7.5, 8, 9, 10, 12, 15.1

Unit IV **Hours: 15**

Properties of definite integrals – reduction formulae for standard integrals.

Chapter 1: Sections 11, 13.1 – 13.10, 14

Geometrical Applications of Integration

Unit V **Hours: 15**

Areas in polar coordinates - Length of the curve (Cartesian and polar coordinates) – Area of surface of revolution (Cartesian and polar coordinates).

Chapter 2: Sections 1.4, 4.1, 4.2, 5

Treatment and content as in (For Units III, IV and V)

Calculus Vol. II, S. Narayanan and T K Manicavachagom Pillay, S. Viswanathan Printers and Publishers Pvt. Ltd., 2010.

References

1. Mathematics, Volume 1, P. Kandasamy and Thilagavathy, S. Chand, New Delhi, 2004.
2. Calculus, Thomas and Finney, Pearson Education, 9^{th} Edition, 2006.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: II **Part III (a) – Major** **Paper: III**

Course Title: Differential Equations, Laplace Transforms and Fourier Series

Course Code: 111MT2M01

Credits: 4 **Hours / Cycle: 5**

Unit I **Hours: 12**

Ordinary Differential Equations: Introduction to ordinary differential equations - First order but of higher degree equations – solvable for *p*, solvable for *x*, solvable for *y* – Clairaut's form – simple problems. Second order equation with constant coefficient with particular integrals for $e^{ax}x^m$, $e^{ax}\sin mx$, $e^{ax}\cos mx$.

Chapter 1: Sections 5.1 – 5.4, 6; Chapter 2: Sections 1, 2, 3, 4

Unit II **Hours: 12**

Second order differential equation with variable coefficients $ax^2\, d^2y/dx^2 + bx\, dy/dx + cy = g(x)$ – method of variation of parameters.

Chapter 2: Sections 8, 10

Unit III **Hours: 18**

Laplace Transforms: Introduction - Laplace transforms – inverse transform -Application of Laplace to solution of first and second order linear differential equation with constant coefficients.

Chapter 5: Sections 1 - 8

Unit IV **Hours: 15**

Partial Differential Equations: Introduction to partial differential equations (PDE) - Formation of PDE by eliminating arbitrary constants and arbitrary functions – complete integral – singular integral – general integral - Standard types $f(p,q)=0$; $f(x,p,q)=0$; $f(y,p,q)=0$; $f(z,p,q)=0$; $f(x,p)=f(y,q)$ – Clairaut's form and Lagrange's equation $Pp+Qq = R$. (Simple Problems)

Chapter 4: Sections 1, 2, 3, 5.1 – 5.4, 6

Unit V **Hours: 18**

Fourier Series: Introduction to Fourier series - Definition – Examples of Fourier series – Even or odd functions – Fourier series for even and odd functions – Half range expansions. (Simple problems).

Chapter 6: Sections 1, 2, 3, 4, 5

Treatment and content as in

Calculus, Volume 3, S. Narayanan and T.K. Manicavachagam Pillai, S. Vishwanathan Publications, 2010.

References

1. Engineering Mathematics Volume 3, Dr. M.K. Venkataraman, The National Publishing Company, 2001.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: II **Part III (a) – Major** **Paper: IV**

Course Title: Differential Geometry & Analytical Geometry of 3-Dimensions

Course Code: 111MT2M02

Credits: 4 **Hours / Cycle: 5**

Differential Geometry

Unit I **Hrs: 12**

Curvature – Cartesian formula for radius of curvature - The coordinates of the centre of curvature – Evolute and involute.

Chapter X: Sections 2.1 – 2.5.

Unit II **Hours: 14**

Radius of curvature in polar coordinates – p-r equation – Envelopes (definitions and problems only) – Linear asymptotes (definitions and simple problems only).

Treatment and content as in (For Units I and II)

Calculus, Volume I: S. Narayanan and T K Manicavachagom Pillay, S. Viswanathan Printers and Publishers, 2010.

Chapter X: Sections 1.1 – 1.4, 2.6 – 2.8, Chapter XI: Sections 1 – 4, 5.1 – 5.3, 6

Analytical Geometry of 3-Dimensions

Unit III **Hours: 17**

The plane – the general equation – several forms of the equations of a plane – angle between planes – length of perpendicular – equation of the planes bisecting the angle between the planes.

Chapter II: Sections 1 – 11

Unit IV **Hours: 16**

The Straight Line – symmetrical form – plane and straight line – coplanar lines – shortest distance between two lines.

Chapter III: Sections 1 – 7; Section 8 (Sections 8.1, 8.2 are excluded)

Unit V **Hours: 16**

The Sphere – standard form – plane section – equation of sphere passing through a given circle – intersection of two spheres – tangent plane to a sphere.

Chapter IV: Sections 1 – 8

Treatment and content as in (For Units III, IV and V)

A text book of Analytical Geometry – Part II (Three dimensions) – T.K. Manicavachagom Pillay and T. Natarajan , S. Viswanathan (Printers and Publishers) Pvt. Ltd 2007.

References

1. Analytical Geometry (3D) and Vector Calculus, S. Arumugam and A.Thangapandi Isaac, New Gamma Publishing House, Palayamkottai.
2. Text book of Analytical Geometry of Three Dimensions, P.K. Jain and Khalil Ahmed, Wiley Eastern Ltd, 1986.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: III **Part III (a) – Major** **Paper: V**

Course Title: Algebraic Structures **Course Code: 111MT3M01**

Credits: 4 **Hours / Cycle: 5**

UNIT I **Hours: 15**

Group Theory: Groups – Subgroups – Counting Principle – Normal Subgroups
Chapter 2: Sections 2.1 – 2.6

UNIT II **Hours: 15**

Homomorphisms – Automorphisms – Cayley's theorem – Permutation groups.
Chapter 2: Sections 2.7 – 2.10 (omit application 1 and 2)

UNIT III **Hours: 15**

Ring Theory: Definition and examples of Rings – Some special classes of rings – Homomorphisms.
Chapter 3: Sections 3.1 – 3.3

UNIT IV **Hours: 15**

Ideals and Quotient rings: More ideals and Quotient ideals – field of quotients of an integral domain.
Chapter 3: Sections 3.4 – 3.6

UNIT V **Hours: 15**

Euclidean rings: A particular Euclidean ring – Polynomial Rings – Polynomials over the rational field.
Chapter 3: Sections 3.7 – 3.10

Treatment and content as in

Topics in Algebra, Second Edition, I.N. Herstein, Wiley Student edition, 2009.

References

1. Modern Algebra, M.L. Santiago, Tata McGraw-Hill Publishing Co. Ltd, 2001.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: III **Part III (a) – Major** **Paper: VI**

Course Title: Multivariate Calculus and Theory of Numbers **Course Code: 111MT3M02**

Credits: 4 **Hours / Cycle: 5**

Unit I **Hours: 15**

Multiple Integral: Double integral – Polar and Cartesian coordinates – Change of order of integration – Jacobian – Application to area.

Chapter 5: Sections 1, 2.1, 2.2, 3.1, 5.1, Chapter 6: Section 1

Unit II **Hours: 15**

Triple integral – Volume under triple integral – Surface area.

Special functions: Beta and Gamma Functions, their properties and simple problems

Chapter 5: Sections 4, 6.3, 7, Chapter 7: Sections 2.1 – 2.3, 3, 4, 5

Treatment and content as in

Calculus, Volume II, S. Narayanan and T.K. Manicavachagom Pillay, S. Vishwanathan Publishers Pvt. Ltd, 2007.

Unit III **Hours: 12**

Vector Calculus: Introduction **–** Gradient – Divergent – Curl – Formulae involving ∇ **–** Invariance.

Chapter: 4

Unit IV **Hours: 18**

Line, Surface and Volume integrals – Theorems of Gauss, Stokes and Green's (Statements only) – simple problems.

Chapters: 5, 6

Treatment and content as in

Vector Analysis, Schaum's outline series, Murray R. Spiegel., Seymour Lipschutz, Dennis Spellman, Second Edition, McGraw Hill Book Company, 2009.

Theory of numbers

Unit V **Hours: 15**

Prime and Composite numbers – The sieve of Eratosthenes-Divisors of a given number N – Euler's function ϕ (N) – Integral part of a real number- The highest power of a prime p contained in n! – the product of r consecutive integers is divisible by r! – Congruences – Numbers in arithmetic progressions – Fermat's Theorem - (statement only) - Wilson's theorem – (statement only) – Simple Problems.

Chapter 5: Sections 1 – 17

Treatment and content as in:

Algebra, Volume II by T.K. Manicavachagom Pillay, T. Natarajan, K.S. Ganapathy, S. Vishwanathan Publishers Pvt. Ltd, 2006.

References

1. Engineering Mathematics, Volume2, Fifth Edition, Dr. M.K. Venkataraman, National Publishing Company, 2004.
2. Elementary Number Theory, Sixth Edition, David M. Burton, Tata McGraw-Hill Pvt. Ltd, 2009.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: IV **Part III (a) – Major** **Paper: VII**

Course Title: Linear Algebra **Course Code: 111MT4M01**

Credits: 4 **Hours / Cycle: 5**

Unit I **Hours: 18**

Vector Spaces: Definitions, examples – Subspaces and Quotient Spaces – Sums and Direct Sums – Linear Independence

Chapter 6: Sections 6.1 – 6.4

Unit II **Hours: 18**

Basis and Dimensions – Homomorphisms – Dual Spaces – Inner Product Spaces

Chapter 6: Sections 6.5 – 6.8

Unit III **Hours: 12**

Linear Transformations and Matrices: Algebra of Linear Transformations – Eigen values and Eigenvectors

Chapter 7: Sections 7.1 – 7.2

Unit IV **Hours: 14**

Matrix Algebra – Trace and Transpose of a Matrix – Rank of Matrix

Chapter 7: Sections 7.3, 7.5, 7.6

Unit V **Hours: 13**

Determinants – Hermitian and Unitary Transformations.

Chapter 7: Sections 7.8, 7.9

Treatment and content as in

Modern Algebra, M.L. Santiago, Tata McGraw-Hill Publishing Co. Ltd, 2001.

References

1. Topics in Algebra, Second Edition, I.N. Herstein, Wiley Student edition, 2009.
2. Linear Algebra, Second Edition, Serge Lang, Addison Wesley Publishing Co., 1970.

Madras Christian College
Department of Mathematics
B.Sc. Mathematics (with effect from 2011 – 12)

Semester: IV **Part III (a) – Major** **Paper: VIII**

Course Title: Advanced Calculus **Course Code: 111MT4M02**

Credits: 4 **Hours / Cycle: 5**

Unit I **Hours: 15**

Sets and Functions : Sets and elements – Operations on sets – Functions – Real valued functions – Equivalence – Countability – Real numbers – Least upper bounds.
Chapter 1

Unit II **Hours: 15**

Sequences of Real Numbers: Definition of a sequence and subsequence – Limit of a sequence – Convergent sequences – Divergent sequences – Bounded sequences – Monotone sequences – Operations on convergent sequences – Operations on divergent sequences.
Chapter 2: Sections 2.1 – 2.8

Unit III **Hours: 15**

Limit superior and limit inferior – Cauchy sequences.
Series of Real Numbers: Convergence and divergence; Series with non-negative numbers; Alternating series; Conditional convergence and absolute convergence.
Chapter 2: Sections 2.9, 2.10, Chapter 3: Section 3.1 – 3.4

Unit IV **Hours: 15**

Tests for absolute convergence; Series whose terms form a non-increasing sequence.
Limits and metric spaces: Limit of a function on a real line; Metric spaces; Limits in metric spaces.
Chapter 3: Sections 3.6, 3.7, 4.1, 4.2 (In 4.2C examples 4 and 5 are omitted), 4.3

Treatment and content as in
Methods of Real Analysis, Richard R. Goldberg (Oxford and IBH Publishing Co.), 1970.

Unit V **Hours: 15**

Fourier Transform: Complex form of Fourier integral formula, Properties of Fourier transform, Fourier Cosine and Fourier Sine Transforms, Properties, Convolution, Parseval's identity.
Chapter 6: Sections 9 – 15.

Treatment and Content as in
Calculus, Volume III, S. Narayanan and Manikavasagam Pillai, S. Viswanathan Printers & Publishers Pvt. Ltd, 2010.

References

1. Principles of Real analysis, Third edition, Walter Rudin, Mc-Graw Hill international edition, 1976.
2. Elements of Real Analysis, Shanti Narayan, M.D. Raisinhhania, S. Chand & Company Ltd., Twelfth Revised Edition, 2011.
3. Real analysis, Volume I, K. Chandrasehhara Rao, K.S Narayan, S. Viswanathan Printers & Publishers Pvt. Ltd., 2008.
4. Introduction to Calculus and Analysis, Volume I, Richard Courant, Fiitz John, Springer, 2010.
5. Sequence and Series, S. Arumugam, Issac, New Gamma Publishing House, 1993
6. Transforms and Partial Differential Equations, Fifth revised edition, G. Balaji, 2010.

Madras Christian College
Department of Mathematics
B.Sc. Mathematics (with effect from 2011 – 12)

Semester: V **Part III (a) – Major** **Paper: IX**

Course Title: Real Analysis **Course Code: 111MT5M01**

Credits: 5 **Hours / Cycle: 7**

Unit I **Hours: 21**

Continuous functions on Metric Spaces: Functions continuous at a point on the real line, Reformulation, Functions continuous on a metric space, Open sets, Closed sets, Discontinuous functions on the real line.

Chapter 5

Unit II **Hours: 2**

Connectedness Completeness and compactness: More about open sets, Connected sets, Boundedsets and totally bounded sets, Complete metric spaces, Compact metric spaces

Chapter 6: Sections 6.1 – 6.5

Unit III **Hours: 21**

Continuous functions on a compact metric space, Continuity of inverse functions, Uniform continuity. Sets of measure zero, Definition of the Riemann integral, Existence of the Riemann integral (Statement of theorem 7.3a only) – Properties of Riemann integral

Chapter 6: Sections 6.6 – 6.8, Chapter 7: Sections 7.1, 7.2, 7.4

Unit IV **Hours: 21**

Calculus: Derivatives, Rolle's theorem, Law of mean, Fundamental theorems of calculus, Taylor's theorem.

Chapter 7: Sections 7.5 – 7.8, Chapter 8: Section 8.5

Unit V **Hours: 21**

Sequences and Series of Functions: Pointwise convergence of sequences of functions – Uniform convergence of sequences of functions – Consequences of uniform convergence – Convergence and uniform convergence of series of functions – Integration and differentiation of series of functions.

Chapter 9: Sections 9.1 – 9.5

Treatment and Content as in

Methods of Real Analysis, Richard R. Goldberg, Oxford and IBH Publishing Co., 1970.

References

1. Transforms and Partial Differential Equations, Fifth revised edition, Walter Rudin, Mc-Graw Hill international edition, 1976.
2. Real analysis, Volume II, K. ChandrasekharaRao, K.S Narayan, S. Viswanathan Printers & Publishers Pvt. Ltd, 2008.
3. Elements of Real Analysis, Shanti Narayan, M.D. Raisinghania, S. Chand & Company Ltd., Twelfth Revised Edition, 2011.
4. Modern Analysis, Arumugam, Issac, New Gamma Publishing House, 1993.
5. Elementary Analysis: The Theory of Calculus, Kenneth A. Ross, Springer, 2010.
6. Understanding Analysis, Stephen Abbott, Springer, 2008.
7. MetricSpaces, Qamrulhasan Ansari, Narosa Publishing House, 2010.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: V **Part III (a) – Major** **Paper: X**

Course Title: Mathematical Statistics **Course Code: 111MT5M02**

Credits: 5 **Hours / Cycle: 7**

Unit I **Hours: 21**

Discrete and Continuous Probability Distributions: Random variables – Probability distributions – Discrete and Continuous, Mathematical expectation, moments, moment generating function, characteristic function.

Chapters 5: Sections 5.1 – 5.5.2, Chapter 7: Sections 7.1 – 7.3.2, 7.3.5

Unit II **Hours: 21**

Special Discrete and Continuous Distributions: Introduction – Binomial, Poisson distributions – Normal distribution.

Chapter 6: Sections 6.1 – 6.2.4, 6.3 - 6.3.5, Chapter 8: Sections 8.1 – 8.4

Unit III **Hours: 21**

Correlation and Regression: Correlation coefficient, linear regression – equations of lines of regression.

Chapter 10: Sections 10.1 – 10.6

Unit IV **Hours: 21**

Tests of Significance – Large Samples: Introduction – Types of Sampling – Large samples – Testing the significance for a single proportion - Testing of significance for difference of proportions – Sampling of values of a variable – Sampling distribution of the mean – Confidence limits - Testing the significance of difference between standard deviations of two large samples.

Chapter 12: Sections 12.1 – 12.8.2

Unit V **Hours: 21**

Tests of Significance – Small Samples: Introduction – Chi – square distribution – Student's *t* – distribution – Snedecor's *F* distribution (Definitions only) – Properties (Statements only) - Tests of significance based on t, F - distributions, χ^2 test of goodness of fit, χ^2 test of independence.

Chapter 13: Sections 13.1 – 13.2.2, 13.5 – 13.7.1, Chapter 15: Sections 15.2 – 15.2.2, 15.3.1, Chapter 16: Sections 16.1 - 16.3.3

Treatment and Content as in

Mathematical Statistics, J. N. Kapur and H. C. Saxena, 20th Edition, S. Chand & Co. Ltd., New Delhi, 2010.

References

1. S. C. Gupta & V. K. Kapoor, Fundamental of Mathematical Statistics, 9th Edition, Sultan Chand & Sons, New Delhi, 1994.
2. P. R. Vittal, Mathematical Statistics, Margham Publications, Chennai, 2002.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: V **Part III (a) – Major** **Paper: XI**

Course Title: Numerical Methods **Course Code: 111MT5M03**

Credits: 5 **Hours / Cycle: 6**

Unit I **Hrs: 18**

Algebraic and Transcendental Equations: Introduction, Errors in numerical computation, Iterative method, Bisection method, Regula-Falsi method, Newton-Raphson method.

Chapter 3: Sections 3.0 – 3.5

Unit II **Hours: 18**

Finite Differences: Difference operators, other difference operators, Error propagation in a difference table, Summation of series.

Chapter 6: Sections 6.0 – 6.3

Unit III **Hrs: 18**

Interpolation: Introduction, Newton's interpolation formulae, Bessels's and Stirling's formula, Lagrange's interpolation formulae, Divided differences, Newton's divided differences formula, Inverse interpolation.

Chapter 7: Sections 7.0 – 7.6

Unit IV **Hrs: 18**

Numerical Differentiation and Integration: Introduction, Derivatives using Newton's forward difference formula, Derivatives using Newton's backward difference formula, Numerical integration – Trapezoidal rule, Simpson's one – third, three – eighth rule, Weddle's rule.

Chapter 8: Sections 8.0 – 8.2, 8.5

Unit V **Hrs: 18**

Numerical Solutions of Ordinary Differential Equations: Introduction, Taylor's series method, Picard's method, Euler method, Runge-Kutta methods, Predictor-Corrector methods – Milne's method, Adam- Bashforth method.

Chapter 10: Sections 10.0 – 10.7

Treatment and content as in

Numerical Methods, S. Arumugam, A. Thangapandi Isaac, A. Somasundaram, SCITECH Publications Pvt. Ltd., Chennai, 2001.

References

1. Numerical Analysis, B. D. Gupta, Konark Publishers PVT LTD, New Delhi 2003.
2. Numerical Methods, First Edition, P. Kandaswamy, K. Thilagavathy, K. Gunavathi, S. Chand & Company LTD, New Delhi, 1997.
3. Numerical Methods, V. N. Vedamurthy, N.Ch.S.N. Iyengar, Vikas Publishing House Pvt. LTD, New Delhi, 1998.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: V **Part III (a) – Major** **Paper: XII A**

Course Title: Elective – Programming in C **Course Code: 111MT5M04**

Credits: 5 **Hours / Cycle: 6**

Unit I **Hrs: 18**

Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output Operations

Chapters: 2, 3, 4

Unit II **Hours: 18**

Decision Making and Branching – Decision Making and Looping

Chapters: 5, 6

Unit III **Hours: 18**

Arrays – Character Arrays and Strings

Chapters: 7, 8

Unit IV **Hours: 18**

User Defined Functions – Structures and Unions

Chapters: 9, 10

Unit V **Hours: 18**

Pointers – File Management in C

Chapters: 11, 12

Treatment and content as in

Programming in ANSI C (4th Edn.), E. Balagurusamy, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 2008.

References

1. Computer Programming in C, V. Rajaraman, Prentice-Hall of India Pvt. Ltd., New Delhi, 1994.
2. Programming in C, P. Pandiyaraja, Vijay Nicole Imprints Pvt. Ltd., Chennai, 2005.
3. The C Programming Language, B.W. Kernighan and D.M. Ritchie, Prentice-Hall of India Pvt. Ltd., New Delhi, 1986.
4. Programming with C, B.S. Gottfried, Schaum's Outline Series, Tata McGraw-Hill, New Delhi, 1995.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: V **Part III (a) – Major** **Paper: XII B**

Course Title: Elective – Mathematics of Finance **Course Code: 111MT5M05**

Credits: 5 **Hours / Cycle: 6**

Unit I **Hours: 18**

Simple Interest and Compound Interest: Simple interest, Equations of value, Partial payments, Simple discount, Compound Interest, Accumulated value, Discounted value, Finding the rate, Finding the time, Equations of value, Compound Discount.

Chapters: 3, 4

Unit II **Hours: 18**

Simple Annuities: Simple Annuities, Accumulated value and discounted value of ordinary simple annuity, Finding term and interest rate, General annuities, Perpetuities.

Chapters: 5, 6

Unit III **Hours: 18**

Amortization and Sinking Funds: Amortization of a debt, Outstanding funds, Mortgages, Sinking funds, Comparison of amortization and sinking fund methods

Chapter: 7

Unit IV **Hours: 18**

Bonds: Callable bonds, Premium and discount, Price of a bond between bond interest dates, Finding the yield rate, Other type of bonds

Chapter: 8

Unit V **Hours: 18**

Capital Budgeting and Depreciation: Net present value, Internal rate of return, Capitalized cost and capital budgeting, Depreciation

Chapter: 9

Treatment and content as in

Mathematics of Finance, Second edition – Petra Zima, Robert L.Brown, Schaum's Outlines Tata McGraw-Hill Edition, 2005

References

1. Business Mathematics, Third Edition, P.R. Vittal, Margham Publications, Chennai, 2005
2. Business Mathematics, V K Kapoor, Sultan Chand & Sons, 2005.
3. Financial Management, Ninth edition, I.M. Pandey, Vikass Publishing house Pvt. Ltd., 2005.
4. Principles of Management Accounting, Fifteenth Edition, S.N. Maheshwari, Majestic Books, 2005.
5. Management Accounting, Second Edition, T.S. Reddy, Hari Prasad Reddy, Margham Publications, 2004.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: VI **Part III (a) – Major** **Paper: XIII**

Course Title: Complex Analysis **Course Code: 111MT6M01**

Credits: 5 **Hours / Cycle: 6**

Unit I **Hours: 16**

Analytic functions: Functions of a Complex variable, Mappings, limits, Theorem on limits, Continuity, derivatives, differentiation formulas, Cauchy Riemann equations, sufficient conditions, Polar coordinates, Analytic functions, Harmonic functions

Chapter 2: Sections 11, 12, 14, 15, 17 - 25

Unit II **Hours: 16**

Conformal mapping – preservation of angles, Linear fractional transformations, an implicit form, mappings of the upper half plane, special linear fractional transformations, $w = z^2$, $w = e^z$.

Chapter 9: Section 94, Chapter 8: Sections 86 – 88, 90, Chapter 2: Section 13

Unit III **Hours: 20**

Integrals: Contours, Contour integrals, upper bounds for moduli of contour integrals, Anti derivatives, Cauchy Goursat theorem, Proof of the Cauchy Goursat theorem, Simply and Multiply connected domains,– Cauchy integral formula – Derivatives of Analytical functions. Liouville's theorem and Fundamental theorem of Algebra.– Maximum modulus principle.

Chapter 4: Sections 38 – 50

Unit IV **Hours: 19**

Convergence of sequence, Convergence of series, Taylor's series , Laurent series, Absolute and uniform convergence of power Series, Continuity of sums of power series ,Integration and differentiation of power series. Uniqueness of series representation

Chapter 5: Sections 51 – 60

Unit V **Hours: 19**

Residues – Cauchy Residue theorem, Using a single residue, The three types of isolated singular points, Residues at poles, Zeros of analytical functions, Zeros and poles, Evaluation of real improper integrals, improper integrals from Fourier Analysis, Jordans lemma, Definite integrals involving sines and cosines.

Chapter 6: Sections 62 – 69, Chapter 7: Sections 71 – 74, 78

Treatment and content as in

Complex variables and application Seventh Edition by James Ward Brown and Ruel V. Churchill, Mc-Graw Hill Book Co., International Student Edition, 2003.

References

1. Complex Analysis, Theodore W. gamelan, Springer Verlag, 2008.
2. Complex Analysis, S.Arumugam, A.Thangapandi Isaac, A.Somasundaram,Scitech publications(India)Pvt,Ltd.Dec2010.
3. ComplexAnalysis, T.K.ManicavachagomPillay, Dr.S.P.Rajagopalan, Dr.R.Sattanathan, S.Viswanathan Printers & Publishers Pvt. Ltd., 2008.
4. Complex Analysis, S.G.Venkatachalapathy, Margham Publication 2009.
5. Theory of functions of a Complex Variable, Shanti Narayan, Dr. P.K. Mittal, S. Chand and Company Ltd.2010.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: VI **Part III (a) – Major** **Paper: XIV**

Course Title: Mechanics **Course Code: 111MT6M02**

Credits: 5 **Hours / Cycle: 6**

Unit I **Hrs: 18**

Statics: Concurrent system of forces: Triangle law of forces, Lami's Theorem, Polygon law of forces, Moment of a force, Varignon's Theorem.

Chapter 2: Sections 2.1 – 2.9, 2.12 – 2.13, 2.14 – 2.16, Chapter 3: Sections 3.6, 3.7

Unit II **Hrs: 18**

Friction: Laws of friction, Angle of friction, Ladder problems.

Chapter 4: Sections 4.1 – 4.5

Treatment and content as in Statics, K.Viswanatha Naik, M.S.Kasi, Emerald Publishers, (1992**)**
Dynamics - Energy: Kinetic energy, Conservation of energy, Conservation forces.

Chapter 3: Sections 3.8 – 3.14

Unit III **Hrs: 18**

Projectiles: Trajectory, Horizontal and inclined planes. S.H.M : General solution, Elastic strings, Composition of two S.H.M, Simple Pendulum, Seconds Pendulum.

Chapter 5: Sections 5.1 – 5.7, Chapter 8: Sections 8.1 – 8.4, Chapter 9: Sections 9.3 – 9.5

Unit IV **Hrs: 18**

Motion of a particle along a curve: Conical Pendulum, Motion on a curved track, Circular track, Banked up track, Vertical curve, Motion on the outside of a smooth vertical circle, inside a vertical circle.

Chapter 9: Sections 9.8 – 9.14

Unit V **Hours: 18**

Central Orbits: Central forces, Differential equation of a central orbit, Pedal equation, Apse, p-r equation, Inverse square law.

Chapter 10: Sections 10.1 – 10.8, 10.11

Treatment and content as in
Dynamics, K. Viswanatha Naik, M.S. Kasi, Emerald Publishers, 1992.

References

1. Mechanics, P.Duraipandian, Laxmi Duraipandian, Muthamizh Jayapragasam, S.Chand & Company Ltd publications, 2010.
2. A text book of Statics, Dr. M.K. Venkataraman, Agasthiar Publications, 1994.
3. A text book of Dynamics, Dr. M.K. Venkataraman, Agasthiar Publications ,1994.

Madras Christian College
Department of Mathematics
B.Sc. Mathematics (with effect from 2011 – 12)

Semester: VI **Part III (a) – Major** **Paper: XV**

Course Title: Linear Programming **Course Code: 111MT6M03**

Credits: 4 **Hours / Cycle: 5**

Unit I **Hours: 14**

Linear programming Problem - Mathematical Formulation - Graphical Solution and Extension: Introduction - Linear Programming Problem – Mathematical formulation of L.P.P – Illustration on Mathematical formulation of L.P.P. Graphical Solution Method – Some Exceptional Cases – General Linear Programming Problem –Canonical and Standard Forms of L.P.P.

Chapter 2: Sections 2.1 – 2.4, Chapter 3: Sections 3.1 – 3.5

Unit II **Hours: 16**

Linear programming Problem - Simplex Method: Introduction - Fundamental Properties of Solutions (Theorems-Statement only)-The Computational Procedure-Use of Artificial Variables (only Big-M Method or Method of Penalties)-Degeneracy in Linear Programming.

Chapter 4: Sections 4.1 – 4.5

Unit III **Hours: 16**

Duality in Linear Programming: Introduction –General Primal-Dual Pair-Formulating a Dual Problem- Primal-Dual Pair in Matrix Form-Duality Theorems-Complementary Slackness Theorem-Duality and Simplex Method.

Chapter 5: Sections 5.1 – 5.7

Unit IV **Hours: 16**

Transportation Problem: Introduction – LP formulation of the transportation Problem – Existence of solutions in T.P-Duality in Transportation Problem-The Transportation table-Loops in Transportation tables-Triangular Basis in a T.P-Solution of a Transportation Problem –Finding an Initial Basic Feasible Solution –Test for Optimality-Economic Interpretation of u_j and v_j-Degeneracy in Transportation Problem - Transportation Algorithm(Modi Method)-Stepping Stone Solution Method-Some Exceptional Cases.

Chapter 10: Sections 10.1 – 10.15

Unit V **Hours: 13**

Assignment Problem: Introduction- Mathematical Formulation of the problem-Solution Methods of Assignment Problems –Special Cases in Assignment Problem.

Sequencing Problem: Introduction-Problem of Sequencing-Basic terms Used in Sequencing-Processing n jobs through Two Machines.

Chapter 11: Sections 11.1 – 11.4; Chapter 12: Sections 12.1 – 12.4

Treatment and content as in

Operations Research, Kanti Swarup, P.K. Gupta, Man Mohan , Sultan Chand and Sons Ltd, New Delhi,15th Edition,2010.

References

1. Operations Research, Prem Kumar Gupta, D.S. Hira, S. Chand &Company Ltd, Ram Nagar, New Delhi, 2007.
2. Operations Research Theory and Applications, Third Edition, J.K.Sharma, Macmilan India Ltd., 2007.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: VI **Part III (a) – Major** **Paper: XVI A**

Course Title: Elective – Astronomy **Course Code: 111MT6M04**

Credits: 4 **Hours / Cycle: 5**

Unit I **Hours: 17**

Spherical Trigonometry: Sphere – Great circles and small circles – axis and poles of a circle – Distance between two points on a sphere – angle between two circles – Secondaries – angular radius – length of an arc of a small circle – spherical triangle – cosine formula, sine formula, cotangent formula (without proof)

Celestial Sphere: Celestial sphere – diurnal motion, celestial axis and equator – celestial horizon – Zenith and Nadir – Celestial Meridian – Cardinal points – Declination circles – Verticals – Parallactic angle – Rising and setting – Transit or culmination – due east, west, north, south – annual motion of sun – First point of Aries and First point of Libra – Equinoxes and Solstices – Celestial coordinates – Horizontal, Equatorial, Meridian, ecliptic systems – Hour Angle and azimuth at rising and setting – latitude of a place – Circumpolar Star – Twilight.

Chapter I: Sections 1 – 8, 11 – 13, 21 – 23, Chapter II: Sections 39 – 82,
Chapter III: Sections 111 – 116

Unit II **Hours: 15**

Refraction: Laws of refraction – Astronomical refraction – Tangent formula – General effects – Effects on rising or setting – Effect on R.A, declination – effect on small horizontal arc, vertical arc, any small arc – Cassini's Formula – Horizontal refraction

Concepts of geocentric, heliocentric parallax, aberration, Precession and Nutation (definitions only)

Overview of the universe – The solar system in general – the other planets – comets – galaxies.

Chapter IV: Sections 117 – 131, Chapter V: Sections 135, 136, 140 – 145,
Chapter VIII: Sections 190, 191, 194, Chapter IX: Sections 195, 196,
Chapter X: Sections 204 – 206
Chapter XVII: Sections 327 - 340

Unit III **Hours: 15**

Kepler's Laws: Kepler's Laws of planetary motion – Longitude of Perigee – Forward motion of the apse line – eccentricity of earth's orbit – To fix the position of a planet in its elliptical orbit – To express v as a series of u- mean anomaly – Kepler's equation – To express u as a series in m.

Planetary Phenomena: Phases of the planets – Relation between sidereal and synodic period of a planet, brightness of the planets.

Chapter VI: Sections 146-149,156-160, Chapter XIV: Sections 285 – 297.

Unit IV **Hours: 13**

Time: Equation of time – Seasons – Calendar – Conversion of time

Chapter VII: Sections 166 – 170, 172 – 189

Unit V **Hours: 15**

Moon: Relation between sidereal and synodic month – elongation – Phases of moon.
Eclipses: Umbra and Penumbra – Lunar eclipse – Solar eclipse – Condition for occurrence of a solar eclipse – angular radius of the cross section of the shadow cone where moon enters – length of earth's shadow – condition for the occurrence of a solar eclipse – ecliptic limits – maximum and minimum number of eclipses near a node - in a year – Saros of Chaldeans
Chapter XII: Sections 229-241, Chapter XIII: Sections 256 – 275

Treatment and content as in
Astronomy by S. Kumaravelu and Susheela Kumaravelu, 2005.

References

1. Text Book on Spherical Astronomy, Sixth Edition, W.M. Smart, VIKAS Publishing House Pvt. Ltd., 1979.
2. Exploration of the Universe, Second Edition, George Abell, 1981.

Observational Astronomy
1. Systems of coordinates – a practical study.
2. Observation of moon – at different phases.
3. Observation of planets.
4. Observation of satellites of planets.
5. Identification of constellations.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: VI **Part III (a) – Major** **Paper: XVI B**

Course Title: Elective – FLUID DYNAMICS **Course Code: 111MT6M07**

Credits: 4 **Hours / Cycle: 5**

Unit I **Hours: 15**

Kinematics of fluids in motion: Real fluids and ideal fluids – velocity of a fluid at a point – stream lines and path lines; steady and unsteady flows – the velocity potential – the vorticity vector – local and particle rates of change – the Equations of continuity – worked examples – Acceleration of fluid – Conditions at a rigid boundary – general analysis of fluid motion.

Chapter 2: Sections 2.1 – 2.11

Unit II **Hours: 15**

Equations of motions of a fluid: Pressure at a point in a fluid at rest – Pressure at a point in moving fluid – Conditions at a boundary of two inviscid immiscible fluids – Euler's equation of motion, Bernoulli's equation – worked examples.

Chapter 3: Sections 3.1 – 3.6

Unit III **Hours: 15**

Discussion of the case of steady motion under conservative body forces – some flows involving axial symmetry – some special two dimensional flows – Impulsive motion – some further aspects of Vortex motion.

Chapter 3: Sections 3.7, 3.9 – 3.12

Unit IV **Hours: 15**

Some Three dimensional flows: Introduction – Sources, sinks and doublets – Images in a rigid infinite plane – Images in solid spheres – Axisymmetric flows; Stoke's stream function.

Chapter 4: Sections 4.1 – 4.5

Unit V **Hours: 15**

Some Two-dimensional flows: Meaning of two dimensional flow – use of cylindrical polar coordinates – stream function – the complex potential for two dimensional, irrotational, incompressible flow – the complex velocity potentials for standard two dimensional flows – some worked examples – Two dimensional image systems – Milne Thompson circle Theorem – The Theorem of Blasius.

Chapter 5: Sections 5.1 – 5.9

Treatment and content as in:

Text book of Fluid Dynamics, F. Chorlton, CBS Publishers and Distributors, 1985.

References

1. Fluid Dynamics, Walther Kaufmann, Tata McGraw-Hill, 1963.
2. Fluid Mechanics and its Applications, Vijay Gupta, Santosh K. Gupta, Wiley Eastern Ltd., 1984.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: I **Part III (a) – Major** **Paper: XVII A**

Course Title: Elective – Formal Languages and Graph Theory **Course Code: 111MT6M06**

Credits: 5 **Hours / Cycle: 6**

UNIT I **Hours: 18**

Phrase-Structure languages, Closure properties: Four types of grammars, Chomskian hierarchy, Closure operations, Derivation trees, Ambiguity.

Chapter 2: Sections 2.1 – 2.4, Chapter 3: Sections 3.1, 3.2, Chapter 4: Sections 4.1, 4.2

UNIT II **Hours: 18**

Normal form of CFG, Property of CFL: Auxiliary lemmas, Chomsky Normal form, u-v theorem.

Chapter 4: Sections 4.3, 4.4 (up to Theorem 4.1 and examples 4.10, 4.11, 4.12), 4.5 (up to Theorem 4.3 and example 4.15)

UNIT III **Hours: 18**

Finite State Automata: Finite Automaton, Non-Deterministic Finite Automaton, Finite Automata and Regular sets, Closure properties of Regular sets, Charaterisation of the family of Regular sets.

Chapter 5: Sections 5.1 – 5.4 (up to Theorem 5.7 and examples using it)

Treatment and content as in:

Formal Languages and Automata, Rani Siromoney, CLS, 1984.

UNIT IV **Hours: 18**

Introduction, Paths and Circuits: Graphs, Incidence and degree of a vertex, Walks, Paths and Circuits, Euler graphs, Operations on graphs, Hamiltonian paths and circuits, Travelling Salesman Problem

Chapter 1: Sections 1.1 – 1.6, Chapter 2: Sections 2.1 – 2.10

UNIT V **Hours: 18**

Trees, Fundamental Circuits, Cut-sets and Cut-vertices: Trees, Properties of trees, On counting trees, Spanning trees, Fundamental circuits, Cut-sets, Properties of cut-sets, Connectivity and separability.

Chapter 3: Sections 3.1 – 3.10, Chapter 4: Sections 4.1 – 4.5

Treatment and content as in:

Graph Theory with Applications to Engineering and Computer Science, Narsingh Deo, Prentice Hall of India Pvt. Ltd., 2005.

References

1. D.P. Acharjya, Theory of Computation, MJP Publications, 2010.
2. Peter Linz, An Introduction to Formal Languages and Automata, Narosa Publications, Fourth Edition, 2010.
3. Kamala Krithivasan and R. Rama, Introduction to Formal Languages, Automata Theory and Computation, Pearson, Chennai, 2011.
4. S.P. Rajagopalan and R. Sattanathan, Graph Theory, Margham Publications, Chennai, 2009.
5. S. Arumugam and S. Ramachandran, Invitation to Graph Theory, SCITECH Publications (India) Pvt. Ltd., Chennai, 2002.
6. S.A. Choudum, A First Course in Graph Theory, Macmillan India Ltd., New Delhi, 1999.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: VI **Part III (a) – Major** **Paper: XVII B**

Course Title: Elective – Mathematical Modeling **Course Code: 111MT6M08**

Credits: 5 **Hours / Cycle: 6**

UNIT I **Hours: 18**

Mathematical Modeling through Ordinary Differential Equations of First order: Linear Growth and Decay Models – Non-Linear Growth and Decay Models – Compartment Models – Dynamic problems – Geometrical problems.

Chapter 2: Sections 2.1 – 2.6

UNIT II **Hours: 18**

Mathematical Modeling through Systems of Ordinary Differential Equations of First Order: Population Dynamics – Epidemics – Compartment Models – Economics – Medicine, Arms Race, Battles and International Trade – Dynamics.

Chapter 3: Sections 3.1 – 3.6

UNIT III **Hours: 18**

Mathematical Modeling through Ordinary Differential Equations of Second Order: Planetary Motions – Circular Motion and Motion of Satellites – Mathematical Modeling through Linear Differential Equations of Second Order – Miscellaneous Mathematical Models.

Chapter 4: Sections 4.1 – 4.4

UNIT IV **Hours: 18**

Mathematical Modeling through Difference Equations: Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics – Probability Theory.

Chapter 5: Sections 5.1 – 5.5

UNIT V **Hours: 18**

Mathematical Modeling through Graphs: Solutions that can be Modelled Through Graphs – Mathematical Modeling in Terms of Directed Graphs, Signed Graphs, Weighted Digraphs and Unoriented Graphs.

Chapter 7: Sections 7.1 – 7.5

Treatment and content as in

Mathematical Modeling, J.N. Kapur, Wiley Eastern Limited, New Delhi, 1988.

References

1. J.N. Kapur, Mathematical Models in biology and Medicine, EWP, New Delhi, 1985.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: I **Part III (b) – Allied** **Paper: I**

Course Title: Allied I: Allied Mathematics – I (For both Physics and Chemistry)

Course Code: 111MT1A01

Credits: 5 **Hours / Cycle: 6**

Unit I **Hours: 18**

Introduction to Partial Differentiation - Partial Differentiation – Total differential co-efficient - Euler's Theorem – Maxima and Minima of functions of two variables – Lagrange's method of undetermined multipliers.

Treatment and Content as in

Calculus – Volume I by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers & Publishers Pvt. Ltd., 2009.

Chapter 8: Sections 1.1 – 1.6, 4, 5

Jacobian - Definition and simple problems.

Treatment and Content as in

Calculus – Volume II by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers & Publishers Pvt. Ltd., 2009.

Chapter 6: Sections 1.1, 2.3, 2.4

Unit II **Hours: 18**

Introduction - Integration of irrational functions - Methods of integration of the following types only:

$\int \frac{dx}{\sqrt{ax^2+bx+c}}$, $\int \frac{(px+q)}{\sqrt{(ax^2+bx+c)}}dx$, $\int \sqrt{ax^2+bx+c}\ dx$, $\int (px+q)\sqrt{ax^2+bx+c}\ dx$,

$\int \frac{dx}{(x+k)\sqrt{ax^2+bx+c}}$ and $\int \frac{dx}{\left(ax^2+b\right)\left(\sqrt{cx^2+d}\right)}$ -

Properties of Definite integrals - Integration by parts - Bernoulli's formula.

Treatment and Content as in

Calculus – Volumes II by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers & Publishers Pvt. Ltd., 2007.

Chapter 1: Sections 8, 11, 12, 15.1

Unit III **Hours: 18**

Second order linear differential equations with constants co-efficients – Methods of finding particular integral of the functions of e^{ax}, sin ax or cos ax, $e^{ax}v(x)$, x^m.

Fourier series – Even and odd functions – Half range Fourier series.

Treatment and Content as in

Calculus – Volume III by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers & Publishers Pvt. Ltd., 2007.

Chapter 2: Sections 1 – 4; Chapter 6: Sections 1 – 5

Unit IV **Hours: 18**

Analytical geometry of three dimensions: Direction Cosines – direction ratios. The plane: Three forms of an equation of a plane (without derivations) – Angle between the two planes – Length of the perpendicular from a point to the plane (simple problems only) – The straight line.

Treatment and Content as in

A Textbook of Analytical Geometry Part - II – Three Dimensions by T. K. Manicavachagom Pillay and T. Natarajan, S. Viswanathan Printers & Publishers Pvt. Ltd., 2009.

Chapter 1: Sections 7, 8; Chapter 2: Sections 1 – 3, 5 – 7, 10; Chapter 3: Sections 1 – 4

Unit V **Hours: 18**

Theory of equations: Nature of roots – Relation between the coefficients and the roots of an algebraic equation – Transformation of equations – Reciprocal equation.

Treatment and Content as in

Algebra Volume – I by T. K. Manicavachagom Pillay, T. Natarajan, K.S. Ganapathy, S. Viswanathan Printers and Publishers Pvt. Ltd., 2004.

Chapter 6: Sections 9 – 11, 15, 16

Matrices: Rank of a matrix – Eigen values and Eigen vectors – Cayley Hamilton theorem.

Treatment and Content as in

Algebra Volume – II by T. K. Manicavachagom Pillay, T. Natarajan, K.S. Ganapathy, S. Viswanathan Printers and Publishers Pvt. Ltd., 2004.

Chapter 2: Sections 11 – 16

References

1. Allied Mathematics (in single volume) P. R. Vittal, Margham Publications, Reprint 2005.
2. Allied Mathematics (For Physics, Chemistry and Computer Science Major Courses of Madras University) by A. Singaravelu (Meenakshi Traders), 2001.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: II **Part III (b) – Allied** **Paper: II**

Course Title: Allied I: Allied Mathematics - II (For Chemistry) **Course Code: 111MT2A02**

Credits: 5 **Hours / Cycle: 6**

Unit I: Partial Differential Equations **Hours: 18**

Introduction to Partial Differential Equations - Order and derivation of Partial Differential Equations, Different integrals of Partial Differential Equations, Solution of Partial Differential Equations in some simple cases, Standard types of first order Partial Differential Equations (standard types I to IV).

Treatment and Content as in

Calculus – Volume III by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers & Publishers Pvt. Ltd., 2007.

Chapter 4: Sections 1 – 4, 5.1 – 5.4

Unit II: Multiple Integrals **Hours: 18**

Introduction - Definition of double integral, evaluation of double integral (including changing the order of integration), triple integrals, application of multiple integrals (area enclosed between curves), volume as a triple integral.

Treatment and Content as in

Calculus – Volume II by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers & Publishers Pvt. Ltd., 2007.

Chapter 5: Sections 1, 2, 4, 5.1, 6.3

Unit III: Vector Calculus **Hours: 18**

Gradient, Divergence and curl, Vector identities, Line integral, Surface integral, Volume integral.

Treatment and content as in

Ancillary Mathematics Book III by S.Narayanan and T. K. Manicavachagam Pillay, S. Viswanathan Publishers, 1999.

Vector analysis – Chapter 2: Sections 1 – 12; Chapter 4: Sections 1 – 5

Unit IV: Vector Integration **Hours: 18**

Statement of Gauss divergence theorem, Green's Theorem, Stokes theorem (without proof) and Applications.

Treatment and content as in

Ancillary Mathematics Book III by S. Narayanan and T. K. Manicavachagam Pillay, S. Viswanathan Publishers, 1999.

Vector analysis – Chapter 4: Sections 6 – 10

Unit V: Groups **Hours: 18**

Binary operation, Definition of groups, Abelian group, Infinite group, properties of groups, Composition table for finite sets, Addition modulo m, Multiplication modulo m, Permutation and order of an element, cyclic permutation, Integral powers of an element of a group, Isomorphism of groups, Cayley's theorem, cyclic group, Properties of cyclic groups.

Treatment and content as in

Ancillary Mathematics Book I by S.Narayanan, T. K. Manicavachagom Pillay, Kandaswamy, R. Hanumantha Rao, 1999.

Chapter 8: Section II: 1 – 6

References

1. Allied Mathematics by P. R. Vittal, Margham Publications, Reprint 2005.
2. Allied Mathematics – Paper II – Second Semester by P. Kandaswamy and K. Thilagavathy, S. Chand & Co., Reprint 2010.
3. Ancillary Mathematics Paper IV by Arumugam and Isaac , New Gamma Publishing House, 1992.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: II **Part III (b) – Allied** **Paper: II**

Course Title: Allied I: Allied Mathematics – II (For Physics) **Course Code: 111MT1A01**

Credits: 5 **Hours / Cycle: 6**

Unit I: Partial Differential Equations **Hours: 18**

Order and derivation of Partial Differential Equations, Different integrals of Partial Differential Equations, Solution of Partial Differential Equations in some simple cases, Standard types of first order Partial Differential Equations (standard types I to IV).

Treatment and Content as in

Calculus – Volume III by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers & Publishers Pvt. Ltd., 2007.

Chapter 4: Sections 1 – 4, 5.1 – 5.4

Unit II: Multiple Integrals **Hours: 18**

Definition of double integral, evaluation of double integral (including changing the order of integration), triple integrals, application of multiple integrals (area enclosed between curves), volume as a triple integral.

Treatment and Content as in

Calculus – Volume II by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers & Publishers Pvt. Ltd., 2007.

Chapter 5: Sections 1, 2, 4, 5.1, 6.3

Unit III: Vector Calculus **Hours: 18**

Introduction - Gradient, Divergence and curl, Vector identities, Line integral, Surface integral, Volume integral.

Treatment and content as in

Ancillary Mathematics Book III by S.Narayanan & T. K. Manicavachagam Pillay, S. Viswanathan Publishers, 1999.

Vector analysis – Chapter 2: Sections 1 – 12, Chapter 4: Sections 1 – 5

Unit IV: Vector Integration **Hours: 18**

Statement of Gauss divergence theorem, Green's Theorem, Stokes theorem (without proof) and Applications.

Treatment and content as in

Ancillary Mathematics Book III by S.Narayanan and T. K. Manicavachagam Pillay, S. Viswanathan Publishers, 1999.

Vector analysis – Chapter 4: Sections 6 – 10

Unit V: Laplace transforms **Hours: 18**

Definitions, Laplace transform of periodic functions, The inverse transforms, Simple problems, Solving second order differential equations with constant coefficients using Laplace transforms.

Treatment and Content as in

Calculus – Volume III by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers & Publishers Pvt. Ltd., 2007.

Chapter 5: Sections 1 – 8

References

1. Allied Mathematics by P. R. Vittal, Margham Publications, Reprint 2005.
2. Allied Mathematics – Paper II – Second Semester by P. Kandaswamy and K. Thilagavathy, S. Chand & Co., Reprint 2010.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: III **Part III (b) – Allied** **Paper: I**

Course Title: Allied II: Discrete Mathematics – I (Optional Allied) **Course Code: 111MT3A01**

Credits: 5 **Hours / Cycle: 6**

Unit I **Hours: 18**

Basic Combinatorial Numbers – Stirling Numbers of the First Kind – Stirling Numbers of the Second Kind.

Section: I.1

Unit II **Hours: 18**

Generating Functions and Recurrence Relations – Symmetric Functions.

Sections: I.2 and I.3

Unit III **Hours: 18**

Multinomials – Multinomial Theorem – Inclusion and Exclusion Principle.

Sections: I.4 and I.5 (up to page 77)

Unit IV **Hours: 18**

Euler Function – Permutations with Forbidden Positions – The 'Menage' Problem – Problem of Fibonacci.

Sections: I.5 (from page 77) and I.6

Unit V **Hours: 18**

Polya Theory – Necklace Problem and Burnside's Lemma – Cycle Index of a Permutation Group – Polya's theorems and their Immediate Applications.

Sections: II.1, II.2 and II.3

Treatment and content as in

Combinatorics Theory and Applications, V. Krishnamurthy, East –West Press. 1989.

References

1. V.K. Balakrishnan, Theory and Problems of combinatorics, Schaums outline series – Mcgraw Hill, 1994.
2. Ian Anderson, Combinatorics of finite sets, Oxford Science Publication, 2011.
3. Kenneth P. Boggart, Introductory Combinatorics, Pitman Books Ltd, 1983.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: IV **Part III (b) – Allied** **Paper: 2**

Course Title: Allied II: Discrete Mathematics – II (Optional Allied) **Course Code: 111MT4A01**

Credits: 5 **Hours / Cycle: 6**

Unit I **Hours: 18**

Mathematical Induction, Recurrence Relations and Generating Functions

Techniques of Proof – Mathematical Induction – Recurrence – Polynomials and their Evaluations – Recurrence Relations – Generating Functions – Some Common Recurrence Relations – Primitive Recursive Functions – Recursive and Partial Recursive Functions.

Chapter IV: Sections 1 and 2, Chapter V: Sections 1, 2, 3, 6, 7, 8 and 9.

Unit II **Hours: 18**

Mathematical Logic: TF Statements – Connectives – Atomic and Compound Statements – Well-Formed Statement Formulae –Parsing – Truth Table of a Formula – Tautology – Tautological Implications and Equivalence of Formulae.

Chapter IX: Sections 1 – 8.

Unit III **Hours: 18**

Mathematical Logic (Contd…): Replacement Process – Functionally Complete sets of connectives and Duality law – Normal Forms – Principal Normal Forms.

Chapter IX: Sections 9 – 11, 12.

Unit IV **Hours: 18**

Lattices: Lattices – Some properties of Lattices – New Lattices – Modular and Distributive Lattices.

Chapter X: Sections 1 (omit Example 15, pp No. 10.6)**, 2, 3** (omit Remark, pp 10.14)**, 4** (omit Theorem 10 and 17, Example 4, pp 10.23, Example 11, pp 10.24)**.**

Unit V **Hours: 18**

Boolean Algebra: Boolean Algebra – Boolean Polynomials – Karnaugh Maps.

Chapter X: Sections 5 (omit Theorem 25)**, 6, 7** (omit K-Map for 5 and 6 vertices)

Treatment and Content as in:

Discrete Mathematics, M.K. Venkataraman, N. Sridharan and N. Chandrasekaran, The National Publishing Company, Chennai, 2003.

References

1. R. Johnsonbaugh, Discrete Mathematics, 5th Edn., Pearson Education, Asia, 2001.
2. C.L. Liu, Elements of Discrete Mathematics, McGraw Hill, New York, 1985.
3. J. Truss, Discrete Mathematics for Computer Scientists, 2nd Edn., Pearson Education, Asia, 2000.
4. M.K. Sen and B.C. Chakraborthy, Discrete Mathematics, 2nd Edn., Books and Allied Private Ltd., Kolkata, 2002.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: I & II **Part IV (a) – BT/AT/GC**

Course Title: General Course: Basic Mathematics **Course Code: 081MT1G01**

Credits: 2 **Hours / Cycle: 4**

Unit I **Hours: 12**

Algebra: Sets and functions – Matrices

Unit II **Hours: 12**

Roots of Polynomial: roots – relation between roots and coefficients – Remainder theorem and applications – Newton's Method.

Sequences and Series: Arithmetic Progression, Geometric Progression and Sum to n terms, Binomial, Exponential and Logarithmic series.

Calculus: Continuous and discontinuous functions – Graph of $y = x$, x^2, x^3, e^x, $\log_{10}x$, sin x, cos x and tan x – Derivative of the above functions.

Unit – III **Hours: 12**

Calculus: Derivative of addition, subtraction, multiplication and quotient of two functions. Geometrical meaning of derivative, maxima and minima. Simple applications in Biology and Physics.

Unit – IV **Hours: 12**

Integration: Geometrical meaning of integration, Integration of the above functions, Integration of Partial fractions, Definite integration, Integration by parts, areas and volumes involving functions of the above type only.

Unit – V **Hours: 12**

Differential Equations: First order first degree – Solution of $dy/dx + Py = Q$ where P, Q are functions of x only.

References

1. Applied Mathematics for the managerial, Life and Social Sciences (2^{nd} Edn.), S.T.Tan, Stone Hill College.
2. Algebra, Vol. I by T.K. Manicavachagom Pillay and others, S.Viswanathan Printers & Publishers Pvt. Ltd., 1993
3. Calculus Vol. II by S. Narayanan and others, S.Viswanathan Printers & Publishers Pvt. Ltd., 1999.
4. Calculus Vol. III by S. Narayanan and others, S.Viswanathan Printers & Publishers Pvt. Ltd., 1999.
5. Engineering Mathematics Vol. I by M.K. Venkataraman, National Publishing Co. 1994.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: III **Part IV (b) – Skill Based** **Paper: 1**

Course Title: Interdisciplinary: Mathematical Physics **Course Code: 111MT3I01**

Credits: 3 **Hours / Cycle: 4**

Partial differential Equations

Unit I **Hours: 12**

Introduction – Formation of Partial Differential Equations by Elimination of Arbitrary Functions – Formation of Partial Differential Equations by Elimination of Arbitrary Functions – Types of Solutions of Partial Differential Equations – Solutions by Direct Integration – First Order Partial Differential Equations – Solutions by Direct Integration – First Order Partial Differential Equations – Type I $f(p,q)=0$ - Type II $z = px + qy + f(p,q)$ (Clairaut's Form) - Type III $f(z,p,q)=0$ - Type IV $f_1(x,p) = f_2(y,q)$ - Equations Reducible to Standard Forms

Chapter 3: Sections 3.0 – 3.10

Unit II **Hours: 12**

Lagrange's Equation – Partial Differential Equations of Higher Order – Non-homogeneous Linear Equations with Constant Coefficient

Chapter 3: Sections 3.11 – 3.13

Applications of Partial Differential Equation

Unit III **Hours: 12**

Introduction – Derivation of One Dimensional Wave Equation – Solution of Wave Equation – One Dimensional Heat Flow – Solution of One Dimensional Heat Equation

Chapter 4: Sections 4.0 – 4.4

Unit IV **Hours: 12**

Two Dimensional Heat equation – Cartesian Form – Temperature Distribution in a Rectangular Plate – Temperature Distribution in an Infinite Plate – Temperature Distribution In Rectangular Plate with Insulated Sides

Chapter 4: Sections 4.5 – 4.8

Special Functions

Unit V **Hours: 12**

Introduction – Bessel Functions (Omit Series Solution) - Legendre's Equation (Omit Series Solution).

Chapter 6: Sections 6.0 – 6.2

Treatment and Content as in

Engineering Mahematics Volume – III by S. Arumugam, A. Thangapandi Isaac, A. Somasundaram, Second Edition, Scitech Publications (India) Pvt. Ltd., Chennai.

References

1. Engineering Mathematics Third Year – Part B by M.K. Venkataraman, The National Publishing Company, Chennai.
2. Higher Mathematics for Engineering and Science by M.K. Venkataraman, The National Publishing Company, Chennai.
3. Differential Equations, Third Edition by Shepley L. Ross, John Wiley & Sons, 2004.
4. B.D. Gupta, Mathematical Physics, Second Revised Edition, Vikas Publising House Pvt. Ltd. 2004
5. Courant and Hilbert, Mathematical Physics

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: V **Part IV (b) – Skill Based**

Course Title: General Elective: Space Science **Course Code: 111MT5L01**

Credits: 3 **Hours / Cycle: 4**

UNIT I **Hours: 12**

Aspects of the Sky: Introduction - The celestial sphere – Its apparent daily rotation – Celestial coordinates – Diurnal circles of the stars – The sun's apparent annual path – Morning and Evening stars – Circumpolar stars – Twilight .

Chapter 2: Sections 39 – 63, 66 – 73, 75 – 78, 80 – 82, Chapter 3: Sections 111 – 114

UNIT II **Hours: 12**

The Earth in Motion: Introduction -The Earth's rotation – Its revolution – Length of the Day – Terrestrial latitude and longitude – Date line - The seasons - Calendar.

Chapter 3: Sections 87 – 93, Chapter 7: Sections 173 – 177

UNIT III **Hours: 12**

Astronomical Instruments: Introduction - Sidereal Clock – Chronometer – Gnomon – Sundial - Astronomical Telescope – Zenith Sector – Heliometer– Equatorial - Spectroscope – Radio Telescope.

Chapter 15: Sections 305 – 311, 315, 319, 320

UNIT IV **Hours: 12**

The Solar system: Introduction - The Sun – The Planets – Satellites – Asteroids – Comets – Meteors.

Chapter 17

UNIT V **Hours: 12**

The Stellar Universe: Introduction – Stellar motion – Distance of stars – Magnitude of stars – Apparent, visual and photo visual magnitudes – absolute magnitudes – relation between apparent and absolute magnitude of stars – colour and size of stars – double and multiple stars – variable stars – Novae – Star clusters – Nebulae – Constellations – Zodiacal Constellations – Milky Way – Seasonal changes in the night sky.

Chapter 18: Sections 341 – 358

Treatment and Content as in

Kumaravelu and Suseela Kumaravelu, Astronomy, 2005.

References

1. Exploration of the Universe, George O. Abell, 1981.
2. Foundations of Astronomy, Third Edition, Michael Seeds, Wadsworth Publishing Company, California, 1992.

Madras Christian College

Department of Mathematics

B.Sc. Mathematics (with effect from 2011 – 12)

Semester: VI **Part IV (b) – Skill Based**

Course Title: Computer Training **Course Code: 111MT6M05**

Credits: 3 **Hours / Cycle: 2**

Unit I **Hours: 6**

Introduction to Maxima, **Equations –** Find Roots, Roots of Polynomials, Solve Linear Systems, Solve Algebraic Systems, Solve ODE, Initial Value Problems, Boundary Value Problems, Solve ODE with Laplace.

Unit II **Hours: 6**

Algebra – Generate Matrix, Generate Matrix from Expression, Enter Matrix, Invert Matrix, Characteristic Polynomial, Determinants, Eigenvalues, Eigenvectors, Adjoint Matrix, Transpose Matrix.

Unit III **Hours: 6**

Calculus – integration, Change Variables, Differentiation, Find Limits, Find Minimum, Get Series, Calculate Sum, Calculate Product, Laplace Transform, Inverse Laplace Transform, Greatest Common Divisor, Least Common Multiple, Divide Polynomials, Partial Fractions, Continued Fractions.

Unit IV **Hours: 6**

Simplify – Simplify Expressions, Simplify Radicals, Factor Expression, Factor Complex, Expand Expression, Expand Logarithms, Contract Logarithms, Factorials and Gamma, Trigonometric Simplification, Complex Simplification.

Unit V **Hours: 6**

Plot – Plot 2D, Plot 3D, Plot Format;
Numeric – Toggle Numeric Output, To Float, To Bigfloat, Set Precision,
Solving Linear Programming Problems – Simplex Methods

References

Maxima 5.25.0 Manual
(Internet Source: http://andrejv.github.com/wxmaxima/help.html)