THIAGARAJAR COLLEGE MADURAI - 625009

(An Autonomous Institution, affiliated to Madurai Kamaraj University)

(Re-Accredited with 'A' Grade by NAAC)

Department of Mathematics

B.Sc., Mathematics (Aided & SF)

M.Sc., Mathematics (Aided & SF)

M. Phil. – Maths

THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)

POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

B.Sc. Mathematics

COURSE STRUCTURE

Semester – I

Course	Code No	Subject	Contact Hours / Week	Credits	Total No. of Hours Allotted	Max. Marks CA	Max. Marks SE	Total
Part I - Tamil	P111	Ikkala Ilakkiyam	6	3	90	25	75	100
Part II - English	P211	Communicative English - I	6	3	90	25	75	100
Core 1	MM11	Differential Calculus	5	4	75	25	75	100
Core 2	MM12	Theory of Equations and Trigonometry	5	5	75	25	75	100
Allied	AC11	General Chemistry - I	4	4	60	25	75	100
Allied Lab	ACL11	Chemistry Lab	2		30			
AECC	ES	Environmental Studies	2	2	30	15	35	50
TOTAL			**30**	**21**				

Semester – II

Course	Code No	Subject	Contact Hours / Week	Credits	Total No. of Hours Allotted	Max. Marks CA	Max. Marks SE	Total
Part I Tamil	P121	Tamil	6	3	90	25	75	100
Part II English	P221	English	6	3	90	25	75	100
Core 3	MM21	Integral Calculus	5	4	75	25	75	100
Core 4	MM22	Differential Equations and its Applications	5	5	75	25	75	100
Allied (C)- 1	AC21	Chemistry	4	4	60	25	75	100
Allied (C)- 1 Lab	ACL21	Chemistry Lab	2	2	30	40	60	100
AECC	MAEC21	Quantitative Aptitude	2	2	30	15	35	50
TOTAL			**30**	**23**				

Semester – III

Course	Code No	Subject	Contact Hours / Week	Credits	Total No. of Hours Allotted	Max. Marks CA	Max. Marks SE	Total
Part I Tamil	P131	Tamil	6	3	90	25	75	100
Part II English	P231	English	6	3	90	25	75	100
Core 5	MM31	Analytical Geometry of 3D and Vector Calculus	4	4	60	25	75	100
Core 6	MM32	Programming in C	4	4	60	25	75	100
Core Lab 1	MML31	Programming in C Lab	2	1	30	15	35	50
Allied (P)-2	AP31	Physics	4	4	60	25	75	100
Allied (P)-2 Lab	APL31	Physics Lab	2	1	30			
Non Major Elective	MNME31	Mathematical Logic	2	2	30	15	35	50
TOTAL			**30**	**22**				

Semester – IV

Course	Code No	Subject	Contact Hours / Week	Credits	Total No. of Hours Allotted	Max. Marks CA	Max. Marks SE	Total
Part I Tamil	P141	Tamil	6	3	90	25	75	100
Part II English	P241	English	6	3	90	25	75	100
Core 7	MM41	Sequences and Series	4	4	60	25	75	100
Core 8	MM42	Numerical Methods	4	4	60	25	75	100
Core Lab 2	MML41	Numerical Methods Lab	2	1	30	15	35	50
Allied (P)-2	AP41	Physics	4	4	60	25	75	100
Allied (P)-2 Lab	APL41	Physics Lab	2	1	30	40	60	100
SEC	MSEC41	A-Theory of Numbers/B-Statistical Test of Significance	2	2	30	15	35	50
TOTAL			**30**	**22**				

Semester – V

Course	Code No	Subject	Contact Hours / Week	Credits	Total No. of Hours Allotted	Max. Marks CA	Max. Marks SE	Total
Core 9	MM51	Abstract Algebra	6	5	90	25	75	100
Core 10	MM52	Real Analysis	6	5	90	25	75	100
Core 11	MM53	Statistics	4	4	60	25	75	100
Core 12	MM54	Operations Research - I	5	4	75	25	75	100
Core Elective I	EMM51	Mechanics/ Combinatorics/ Cryptography	5	5	75	25	75	100
Non Major Elective	MNME51	Mathematical Aptitute for Competitive Examinations	2	2	30	15	35	50
Value Education	VE	Value Education	2	1	30	15	35	50
Self Study Paper		Soft Skills				-	100	100
TOTAL			**30**	**26**				

Self Study Paper* 05 Credits (extra)

Semester – VI

Course	Code No	Subject	Contact Hours / Week	Credits	Total No. of Hours Allotted	Max. Marks CA	Max. Marks SE	Total
Core 13	MM61	Complex Analysis	6	5	90	25	75	100
Core 14	MM62	Linear Algebra	6	5	75	25	75	100
Core 15	MM63	Graph Theory	6	4	75	25	75	100
Core 16	MM64	Operations Research – II	5	4	90	25	75	100
Core Elective 2	EMM61	Stochastic Processes/ Fuzzy Sets/ Computer Algorithms	5	5	60	25	75	100
SEC	MSEC61	C-Web Designing with HTMLL-Practical/D-Theory of Lattices	2	2	30	15	35	50
Part V				1		100		100

TOTAL			**30**	**26**				
TOTAL CREDITS FOR SEMESTERS I to VI				**140**				

SEC (2 Hours / week)

1) Theory of Numbers
2) Statistical Test of Significance
3) Web Designing with HTML – Practical
4) Theory of Lattices
5) Mathematical Logic**(NME)**
6) Mathematical Aptitude for competitive Examinations**(NME)**

Core Electives for Semester V

1) Mechanics
2) Combinatorics
3) Cryptography

Core Electives for Semester VI

1) Stochastic Processes
2) Fuzzy sets
3) Computer Algorithms
4) Management Accounting

Self study paper:

Offered by Placement Cell

Curriculum Credits

Part I & II	24 Credits
Core	73 Credits
Core Elective	10 Credits
Allied	20 Credits
AECC	04 Credits
Value Education	01 Credits
Skill Based Elective	04 Credits
Non Major Elective	04 Credits
Total	**(140) Credits**

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Course	: Core	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: I	Max. Marks	:100
Sub. Code	: MM11	Hours / week	:5
Title of the Paper	**: Differential Calculus**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. Understand the basic concepts of differentiation and partial differentiation
2. Develop problem solving skills using derivatives and partial derivatives

Unit - I **(18 Hours)**

Differentiability - Algebra of derivatives – Derivatives of standard functions - The Chain rule for differentiation - Differentiation of inverse function – n^{th} derivative of some standard functions.

Unit - II **(15 Hours)**

Leibnitz's theorem – Partial differentiation.

Unit - III **(15 Hours)**

Curvature - Evolute - Envelope.

Unit - IV **(15 Hours)**

Polar curves –Jacobians – Multiple point.

Unit - V **(12 Hours)**

Asymptotes - Methods of finding asymptotes for the curve y = f(x) - Method of finding asymptotes for the curve f(x, y)= 0 – Asymptotes of polar cures.

Text Book: Arumugam and Issac, 2014, Calculus,New Gamma publishing House

Unit	Chapter/section
I	Part – I : 2(2.1 – 2.5, 2.12)
II	Part – I : 2(2.13 – 2.14)
III	Part – I : 3(3.4 – 3.6)
IV	Part – I : 3(3.2, 3.9, 3.10)
V	Part – I : 3(3.11)

Reference Books:

1) Vittal, P.R. and Malini. V., 2012, Calculus, Third Edition, Margham Publications.

2) Tom M. Apostal,2007, Calculus – Vol. I, Wiley Student publication.

3) Shanti Narayan,2002, Differential Calculus, 14th Edition, S. Chand and Company Ltd.

Course designers:

1) Dr. G. Prabakaran

2) Mrs. R.Latha

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Course	: Core	Int. Marks	: 25
Class	: I Year	Ext. Marks	:75
Semester	: I	Max.Marks	: 100
Sub. Code	: MM12	Hours / week	: 5
Title of the Paper	**: Theory of Equations and Trigonometry**	Credits	: 5

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand various methods of solving equations
2. Analyze the nature of the roots of the equations
3. Explore trigonometry as a tool in solving problems

Unit - I **(15 Hours)**

Relations between the roots and coefficients of equations – Symmetric function of the roots – Sum of the powers of the roots of an equation – Newton's theorem on the sum of the powers of the roots.

Unit - II **(15 Hours)**

Transformations of equations – Reciprocal equation – To increase or decrease the roots of a given equation by a given quantity – Form of the quotient and remainder when a polynomial is divided by a binomial – Removal of terms.

Unit -III **(15 Hours)**

Descartes' Rule of signs – Rolles' Theorem – Strum's Theorem – Horner's Method – General Solution of the Cubic equations(Cardon's method and Trigonometrical method) – Solution of biquadratic equations.

Unit -IV **(15 Hours)**

Applications of De Moivre's theorem: Expression for $\sin n\theta$, $\cos n\theta$ and $\tan n\theta$ – Expression for $\sin^n \theta$ and $\cos^n \theta$ – Expansion of $\sin\theta$, $\cos\theta$, $\tan\theta$ in powers of θ.

Unit -V **(15 Hours)**

Hyperbolic functions – Inverse Hyperbolic functions – Logarithm of a complex number.

Text Books:

1) Manicavachagom Pillay.T.K., Natarajan. T. and Ganapathy. K.S., 2016, Algebra, Volume – 1,S.Viswanathan (Printers and Publishers) Pvt.Ltd., Chennai.

2) Arumugam. S and Thangapandi Isaac. A., 2012, Trigonometry, New Gamma Publishing House, Palayamkottai.

Unit	Book	Chapter/ Section
I	1	6(11 - 14)
II	1	6(15 - 19)
III	1	6(24, 25, 27, 30,34.1,35)
IV	2	1
V	2	2& 3

Reference Books:

1) Arumugam. S. and Thangapandi Isaac. A., 2011,Algebra: Theory of Equations, Theory of Numbers and Trigonometry, New Gamma Publishing House, Palayamkottai.

2) Rawat, K.S., 2008, Trigonometry, First Edition, Sarup Book Publishers Pvt. Ltd., Delhi.

3) Narayanan. S. and Manickavachagom Pillay. T. K., 2001,Trigonometry, S. Viswanathan Publishers(Printers and Publishers), Pvt., LTD., Chennai.

Course designers:

1) Ms. K. Ponmari
2) Mrs. S. Shanavas Parvin

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Course	: Core	Int.Marks	: 25
Class	: I Year	Ext.Marks	: 75
Semester	: II	Max.Marks	:100
Sub. Code	: MM21	Hours / week	: 5
Title of the Paper	**: Integral Calculus**	Credits	:4

Course Outcomes: On the successful completion of the course, students will be able to

1. Solve problems in Integration, double integrals and triple integrals.
2. Understand Fourier series expansions for periodic functions.

Unit - I **(18 Hours)**

Definition of Riemann Integration – Relation between upper and lower integrals – Geometric interpretation – Darboux theorem.

Unit – II **(18 Hours)**

Evaluation of Definite Integrals – Integration by parts – Reduction formulae – Integration as the limit of sum.

Unit - III **(15 Hours)**

Double integrals - Evaluation of double integrals - Triple integrals – Change of variables in double and triple integrals.

Unit - IV **(12 Hours)**

Beta and Gamma functions - Properties and results involving Beta and Gamma functions.

Unit - V **(12 Hours)**

Fourier Series– The Cosine and Sine Series.

Text Book:

Arumugam and Issac, 2014, Calculus,New Gamma publishing House.

Unit	Chapter/section
I	Part – II : 1(1.1 – 1.4)
II	Part – II : 2(2.6 – 2.9)
III	Part – II : 3
IV	Part – II : 4
V	Part – II : 5

Reference Books:

1) Vittal. P.R. and Malini. V., 2012, Calculus, Third Edition,Margham Publications.

2) Tom M. Apostal, 2007, Calculus – Vol. II –Wiley Student publication.

3) Shanti Narayan, 2002, Integral Calculus, 9th Edition,S. Chand and Company Ltd.

Course designers:

1) Dr. G.Prabakaran 2) Mrs.R.Latha

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Course	: Core	Int.Marks	: 25
Class	: I Year	Ext.Marks	: 75
Semester	: II	Max.Marks	:100
Sub. Code	: MM22	Hours /week	: 5
Title of the Paper	: **Differential Equations and its Applications**	Credits	:5

Course Outcome: On the successful completion of the course, students will be able to

1. Classify differential equations by order, linearity, and homogeneity.
2. Use Laplace transforms and their inverses to solve differential equations.
3. Create a mathematical model which reasonably describes the behavior of the system.

Unit – I **(15 Hours)**

Differential Equations of first order: Definitions-Formation of Differential Equations-Solution of a Differential Equations-Geometrical Meaning of a Differential Equations-Equations of first order and first degree- Variable separable- Homogeneous Equations-Equations reducible to homogeneous form- Linear Equations-Bernoulli's Equations-Exact Differential Equations-Equations reducible to exact equations-Equations of the first order and higher degree – Clairaut's equation.

Unit – II **(15 Hours)**

Linear Differential Equations: Definitions-Theorems-Operator D -Rules for finding the complementary functions-Inverse operator-Rules for finding the particular integral-Working procedure to solve equations-Method of variation of parameters-Method of undetermined coefficients-Equations reducible to linear equations with constant coefficients-Linear dependence of solutions-Simultaneous linear equations with constant coefficients.

Unit – III **(15 Hours)**

Laplace Transforms: Introduction-Definitions-Transforms of elementary functions-Properties of Laplace Transforms-Transforms of periodic functions-Transforms of special functions-Transforms of derivatives-Transforms of integrals- Multiplication by t^n- Division by t -Evaluation of integrals by Laplace Transforms-Inverse Transforms-Convolution Theorem-Applications to Differential Equations-Simultaneous linear equations with constant coefficients-Unit step function-Unit impulse function.

Unit – IV **(15 Hours)**

Partial Differential Equations: Introduction-Formation of Partial Differential Equations-Solution of a Partial Differential Equation: Equations solvable by direct integration-Linear equations of the first order-Non-Linear Equations of the first order-Charpit's Method-Homogeneous linear equations with constant coefficients.

Unit – V **(15Hours)**

Applications of Differential Equations: Introduction-Geometric Applications-Orthogonal Trajectories-Physical Applications-Simple Electric Circuits-Simple harmonic motion-Simple pendulum-Oscillations of a spring.

Text Book:

Grewal.B.S, 2015, Higher Engineering Mathematics – Khanna Publishers

Unit	Chapter/Section
I	11
II	13
III	21
IV	17(17.1 – 17.11)
V	12(12.1 - 12.5),14(14.1 – 14.4)

Reference Books:

1) Erwin Kreyszig, 2016, Advanced Engineering Mathematics-, Wiley, 10th Edition.
2) Raisinghania M.D.,2016, Advanced Differential Equations,S.Chand.
3) Daniel A. Murray, 2012, Introductory Course in Differential Equations, University Press.

Course designers:

1) Dr. M. Senthilkumaran
2) Mrs. R. Latha

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Course	: Core	Int.Marks	: 25
Class	: II Year	Ext.Marks	: 75
Semester	: III	Max.Marks	: 100
Sub. Code	: MM31	Hours / week	: 4
Title of the Paper	: **Analytical Geometry of 3D and Vector Calculus**		
		Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. Expose various concepts of Analytical Geometry of 3D.
2. Apply calculus concepts to other disciplines.

Unit - I **(12 Hours)**

Direction Cosines - Equation of a Plane -Angle between two planes-Angle bisectors of two planes.

Unit – II **(12 Hours)**

Equation of a straight line –A Plane and a line-Equations of two skew lines in a simple form-The intersection of three planes-Volume of a tetrahedron.

Unit – III **(12 Hours)**

Equation of a sphere - Tangent line and Tangent plane –Section of a Sphere.

Unit – IV **(12 Hours)**

Vector Algebra–Differentiation of Vectors – Gradient - Divergence and Curl.

Unit – V **(12 Hours)**

Line integrals- Surface integrals – Theorems of Green, Gauss and Stokes.

Text Book: Arumugam. S. and Thangapandi Isaac.A., 2014,Analytical Geometry of 3D and Vector Calculus, New Gamma publications.

Unit	Chapter/Section
I	1(1.3), 2 (2.1 - 2.3)
II	3 (3.1 - 3.5)
III	4 (4.1 - 4.3)
IV	5 (5.1 - 5.4)
V	7 (7.1 - 7.3)

Reference Books:

1) Pandey. H.D., Dubey. S.K.D. and Pandey. S.N., 2011, A text book of Vector Analysis
and Geometry,Wisdom Press.

2) Manikavachagam Pillay.T.K. and Natarajan, 1997, A Text Book of Analytical Geometry(Two & Three dimension), S. Viswanathan (Printers & Publishers) Ltd.

Course Designers:

1) Mr. M. Madhavan 2) Dr. G. Prabakaran

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Course	: Core	Int.Marks	: 25
Class	: II Year	Ext.Marks	: 75
Semester	: III	Max.Marks	: 100
Sub. Code	: MM32	Hours / week	: 5
Title of the Paper	**: Programming in C**	Credits	: 4

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand fundamental Programming principles.
2. Develop skills to solve mathematical problems and some simple applications.

Unit - I **(15 Hours)**

Constants, Variable and Data Types:Introduction –Character set- C Tokens – Keywords and identifiers – Constants – Variables – Data types – Declaration of variables – Declaration of storage class –Assigning values to variables – Defining symbolic constants – Declaring a variable as Constant -Declaring a variable as volatile. Operators and Expressions: Introduction – Various types of operators – Arithmetic expressions – Evaluation of expressions – Precedence of arithmetic operators – Some computational problems- Type conversions in Expressions – Operator precedence and associativity.

Unit - II **(15 Hours)**

Managing Input and Output Operations:Introduction – Reading and writing a character- Formatted input and output.Decision Making and Branching:Introduction - Decision Making with different types of if **–** statements – Switch statement - The ?: operator- The goto statement.

Unit - III **(15 Hours)**

Decision Making and Looping:Introduction – While, do and for statements – Jumps in loops – Concise Test expressions. Arrays : Introduction – One Dimensional Arrays (Declaration and Initialization) – Two Dimensional and Multi- dimensional Arrays - Dynamic arrays - More about Arrays.

Unit - IV **(15 Hours)**

Character Arrays and Strings : Introduction – Declaring and initializing string variables – Reading strings from terminal – Writing strings to screen – Arithmetic operations on characters – Putting strings together – Comparison of two Strings – String handling functions – Table of strings – Other features of strings. User defined functions : Introduction – Need for user – Defined functions – A multi- function program – Elements of user –defined functions – Definition offunctions – Return values and their types – Function calls – Function declaration – Different categories of functions – Nesting of functions – Recursion – Passing arrays to functions – Passing strings to functions – The scope , visibility and lifetime of variables – Multifile Programs.

Unit - V **(15 Hours)**

Structures and Unions : Introduction - Defining a structure – Declaring structure variables – Accessing structure members – Structure initialization – Copying and comparing structure variables – Operations on individual members – Arrays of structures – Arrays within structures – Structures within structures – Structures and functions – Unions – Size of structures – Bit fields.

Text Book:

Balagurusamy. E**,** 2017, Programming in ANSI C, McGraw Hill Education (India), Private Limited, New Delhi

Unit	Chapter / Section
I	2 &3
II	4 & 5
III	6 & 7
IV	8 & 9
V	10

Reference Books:

1) Yashavant Kanetkar , 2016, Let us C, 14th Edition, BPB Publications, New Delhi.
2) Ashok N. Kamthane, 2009, Programming with ANSI and Turbo C, Pearson Education, New Delhi.
3) **C** Pradip Dey, Manas Ghosh, 2008,Fundamentals of Computers with Programming in C , Oxford University press, New Delhi.

Course designers:

1) Dr. B. Arivazhagan
2) Dr. D. Pandiaraja

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

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Course	: Core Lab	Int.Marks	: 15
Class	: II Year	Ext.Marks	: 35
Semester	: III	Max.Marks	: 5
Sub. Code	: MML31	Hours / week	: 2
Title of the Paper	: **Programming in C – Lab**	Credits	: 2

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand fundamental Programming principles.
2. Develop skills to solve mathematical problems and some simple applications.

List of Practicals

1. Fahrenheit to Celsius
2. Simple interest and Compound interest
3. Largest of three numbers
4. Odd/Even Number
5. Reverse the Number
6. Sum of Digits
7. Number of Multiples of 7 between 1 and 100
8. Prime Number
9. Quadratic Equation using switch case
10. Fibbonacci Series
11. Average of n values
12. nCr value
13. Multiplication table
14. Standard deviation
15. Median
16. Ascending order
17. Descending order
18. Sorting a list of Names
19. Matrix addition and subtraction
20. Matrix multiplication

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Course	: Core	Int.Marks	: 25
Class	: II Year	Ext.Marks	: 75
Semester	: IV	Max.Marks	:100
Sub. Code	: MM41	Hours week	: 4
Title of the Paper	: **Sequences and Series**	Credits	: 4

Course Outcome: On the successful completion of the course,students will be able to

1.Understand the concepts of convergence and divergence of sequences and series.

2. Evaluate the limit superior and limit inferior for different sequences.

Unit – 1 **(12 Hours)**

Sets and functions:Sets and elements – Operations on sets – Functions – Real-valued functions – Equivalence,Countability – Real numbers –Least upper bound**s.**

Unit-II **(12 Hours)**

Sequences of real numbers: Definition of sequence and subsequence–Limit ofa sequence–Convergent sequences–Divergent sequences–Bounded sequences-Monotone sequences–Operations on convergence sequences–Operations on divergent sequences

Unit–III **(12 Hours)**

Sequences of real numbers:Limit superior and limit inferior – Cauchy sequences – Summability of sequences – Limit superior and limit inferior for sequences of sets.

Unit – IV **(12 Hours)**

Series of real Numbers: Convergence and divergence – Series with non negative terms – Alternating series – Conditional convergence and absolute convergence – Rearrangements of series – Tests for absolute convergence.

Unit – V **(12 Hours)**

Series of real numbers:Series whose terms form a non increasing sequence - Summation by parts –(C,1) Summability of series – The class l^2 – Real numbers and decimal expansions.

T**ext Book:**

Richard R.Goldberg,1970,Methods of Real Analysis Oxford &IBH Publishing Co. Pvt.Ltd.,New Delhi.

Unit	Chapter/section
I	1 (1.1. - 1.7)
II	2 (2.1 - 2.8)
III	2 (2.9 - 2.12)
IV	3 (3.1 - 3.6)
V	3 (3.7 - 3.11)

Reference Books :

1)Satish Shirali,HarKrishan, and Vasudeva.L.,2014, An introduction to Mathematical Analysis, Narosa Publishing House Pvt.Ltd., New Delhi.

2)Somasundaram. D. and Choudhary. B.,2011,A first course in Mathematical Analysis, Narosa Publishing House Pvt.Ltd.,New Delhi

3) Bali N.P., 2009,Sequences and Infinite Series,Firewall Media(An imprint of Laxmi Publications Pvt.Ltd.,New Delhi.

Course Designers: 1) Mrs.R.Latha 2) Dr.G.Prabakaran

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Course	: Core	Int.Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: IV	Max.Marks	: 100
Sub. Code	: MM42	Hours / week	: 4
Title of the Paper	**: Numerical Methods**	Credits	: 4

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand the basic concepts in numerical methods.
2. Know the standard numerical techniques as a powerful tool in scientific computing.
3. Develop the skills in solving algebraic, transcendental, differential and integral equations numerically.

Unit - I **(12 Hours)**

Solution of Algebraic and Transcendental Equations: Introduction – Bisection method –Method of false position– Iteration method – Newton-Raphson Method – Some deductions from Newton-Raphson formula.

Unit - II **(12 Hours)**

Solution of Simultaneous Algebraic Equations:Solution of linear simultaneous equations – Direct methods of solution: Gauss elimination method –Gauss-Jordan method – Iterative Methods of solution: Jacobi's iteration method – Gauss - Seidal iteration method.

Unit - III **(12 Hours)**

Interpolation: Introduction – Newton's forward interpolation formula – Newton's backward interpolation formula – Interpolation with unequal intervals –Lagrange's interpolation formula – Divided differences – Newton's divided difference formula.

Unit- IV **(12 Hours)**

Numerical Differentiation and Integration: Numerical differentiation – Formulae for derivatives: Derivatives using Newton's forward difference formula – Derivatives using Newton's backward difference formula – Maxima and minima of a tabulated function – Numerical integration – Newton-Cotes quadrature formula: Trapezoidal rule – Simpson's one-third rule – Simpson's three-eighth rule.

Unit - V **(12 Hours)**

Numerical Solution of ordinary differential equations**:**Introduction – Taylor's series method – Euler's method – Modified Euler's method – Runge-Kutta method – Predictor-Corrector methods – Milne's method.

Text Book:

Grewal. B.S., 2015, Numerical Methods in Engineering & Science, Khanna Publishers, New Delhi.

Unit	Chapter/section
I	2(2.1, 2.8, 2.9, 2.11-2.13)
II	3(3.3, 3.4(3, 4), 3.5(1, 2))
III	7(7.1-7.3, 7.11 – 7.14)
IV	8(8.1, 8.2(1, 2), 8.3, 8.4, 8.5(I, II,III))
V	10(10.1, 10.3 – 10.5,10.7-10.9)

Reference Books:

1) Arumugam. S., Thangapandi Isaac. A. and Somasundaram. A., 2015, Numerical Methods, Second Edition, SciTech Publications (India) Pvt. Ltd., Chennai.
2) Venkataraman.M.K.,2009, Numerical Methods in Science and Engineering, 5th Edition, The National Publishing company, Chennai.
3) Kandasamy.P., Thilagavathy. K. and Gunavathy.K., 2006. Numerical Methods, 3rd Edition,S. Chand & Company Pvt. Ltd., New Delhi.

Course Designers:

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THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Core Lab	Int.Marks	: 15
Class	: II Year	Ext.Marks	: 35
Semester	: IV	Max.Marks	: 50
Sub. Code	: MML41	Hours / week	: 2
Title of the Paper	**: Numerical Methods – Lab**	Credits	: 1

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand the basic concepts in numerical methods.
2. Know the standard numerical techniques as a powerful tool in scientific computing.
3. Develop the skills in solving algebraic, transcendental, differential and integral equations numerically.

List of Practicals

1. Finding a root of the given equation using bisection method

2. Finding a root of a given equation using Newton Raphson method

3. Solving the given system of equation by Gauss elimination method

4. Finding f(x) at given x using Newton's interpolation formula

5. Finding f(x) at given x using Lagrange's interpolation formula

6. Evaluating dy/dx, at a given x using Newton's differentiation formula

7. Evaluating $\int f(x)\,dx$ using Trapezoidal rule

8. Evaluating $\int f(x)\,dx$ using Simpson's 1/3 rule

9. Solving the given differential equation by Euler's method

10. Solving the given differential equation by Runge-Kutta method (4^{th} Order only)

THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Core	Int.Marks	: 25
Class	: III Year	Ext.Marks	: 75
Semester	: V	Max.Marks	: 100
Sub.Code	: MM51	Hours / week	: 6
Title of the Paper	**: Abstract Algebra**	Credits	: 5

Course Outcome: On the successful completion of the course, students will be able to

1. Understand the fundamental concepts of the algebraic structures such as groups, rings and fields.
2. Apply the fundamental properties of algebraic structures, quotient structures and their mappings.

Unit - I **(20 Hours)**

Definition and Examples of groups – Elementary properties of a group - Equivalent definitions of a group - Permutation groups - Subgroups - Cyclic groups – Order of an element - Cosets and Lagrange's theorem.

Unit - II **(16 Hours)**

Normal subgroups and quotient groups - Isomorphisms - Homomorphisms.

Unit - III **(18 Hours)**

Definition and examples of Rings – Elementary properties of Rings - Isomorphism – Types of Rings - Characteristic of a Ring - Subrings - Ideals - Quotient Rings - Maximal and Prime ideals - Homomorphism of Rings.

Unit - IV **(16 Hours)**

Field of quotients of an integral domain - Ordered integral domain – Unique Factorization Domain (U.F.D) - Euclidean domain.

Unit – V **(20 Hours)**

Every P.I.D. is a U.F.D. – Polynomial Rings – Polynomial Rings over U.F.D. – Polynomials over Q.

Text Book:

Arumugam. S. and Isaac. A.T., 2016, Modern Algebra, SCITECH publications(India) Pvt. ltd.

Unit	Chapter/Section
I	3(3.1 – 3.8)
II	3(3.9 – 3.11)
III	4(4.1 – 4.10)
IV	4(4.11 – 4.14)
V	4(4.15 – 4.18)

Reference Books:

1) Herstein. I.N.,2014, Topics in Algebra, Wiley India Pvt. Ltd.
2) Vijay K Khanna and Bhambri. S.K., 2011, A course in Abstract Algebra, Vikas Publishing House Pvt. Ltd.
3) Kenneth Hoffman and Ray Kunze, 2009, Linear Algebra, PHI Learning Pvt. Ltd.

Course Designers:

1) Dr. G. Prabakaran 2) Dr. M. Senthilkumaran

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
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Course	: Core	Int.Marks	: 25
Class	: III Year	Ext. Marks	: 75
Semester	: V	Max.Marks	: 100
Sub. Code	: MM52	Hours / week	: 6
Title of the Paper	**: Real Analysis**	Credits	: 6

Course Outcome: On the successful completion of the course,students will be able to

1. Understand the basic concepts of countable and uncountable sets and inequalities.
2. Familiarize the concepts of continuity, completeness and connectedness in metric spaces.

Unit –I **(18 hours)**

Limits and metric spaces:Limit of a function on the real line – Metric spaces – Limits in metric spaces.

Unit -II **(18 hours)**

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 R^1.

Unit -III **(18 hours)**

Connectedness, Completeness and Compactness:More about open sets – Connected sets – Bounded sets and totally bounded sets – Complete metric spaces.

Unit –IV **(18 hours)**

Connectedness, Completeness and Compactness: Compact metric spaces – Continuous functions on compact metric spaces – Continuity of the inverse function – Uniform continuity.

Unit - V **(18 hours)**

Calculus:Sets of measure zero – Definition of the Riemann Integral – Existence of the Riemann Integral – Properties of the Riemann Integral.

Text Book:

Richard R.Goldberg,1970, Methods of Real Analysis, Oxford & IBH Publishing Co. Pvt.Ltd.,New Delhi.

Unit	Chapter/section
I	4 (4.1 - 4.3)
II	5 (5.1 - 5.6)
III	6 (6.1 - 6.4)
IV	6 (6.5 - 6.8)
V	7 (7.1 - 7.4)

Reference Books:

1. Arumugam. S. and Thangapandi Isaac. A., 2012,Modern Analysis, NewGammapublishing house, Palayamkkottai
2. Somasundaram. D. and Choudary. B., 2011,A first course inMathematical Analysis,Narosa Publishing House Pvt.Ltd., New Delhi.
3. Chandrasekara Rao. K. andNarayanan. K.S., 2008,Real Analysis,Vol.I,Second Edition,S. Viswanathan(Printers and Publishers) Pvt. Ltd., Chennai.

Course Designers:

Mrs.R.Latha

Dr.G.Prabakaran

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

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Course	: Core	Int.Marks	: 25
Class	: III Year	Ext.Marks	: 75
Semester	: V	Max.Marks	:100
Sub. Code	: MM53	Hours / week	: 4
Title of the Paper	**: Statistics**	Credits	: 4

Course Outcome: On the successful completion of the course,students will be able to

1.Acquire various skills about analyzing data using statistical tools.

2.Understand different types of distribution and their statistical properties.

Unit - I **(12 Hours)**

Measures of Dispersion, Skewness and Kurtosis:Dispersion –Characteristics for an ideal measure of Dispersion – Measures of Dispersion – Range – Quartile Deviation – Mean deviation – Standard Deviation and Root mean square deviation - Coefficient of Dispersion – Moments –Pearson's β and γ Co-efficients – Skewness – Kurtosis.

Unit- II **(12 Hours)**

Mathematical Expectation and Generating Functions:Mathematical Expectation– Addition theorem of Expectation – Multiplication theorem of expectation – Co-variance – Expectation of a linear combination of random variables -Variance of a linear combination of random variables - Expectation of a continuous random variable – Conditional expectation and Conditional variance - Moment Generating Function –Cumulants –Characteristic Function.

Unit – III **(12 Hours)**

Theoretical Discrete Distributions: Introduction – Bernoulli Distribution –Binomial Distribution - Poisson Distribution.

Unit–IV **(12 Hours)**

Theoretical Continuous Distributions:Rectangular Distribution – Normal Distribution–Gamma Distribution-- Beta Distribution of First Kind –Beta Distribution of Second Kind –The Exponential Distribution**.**

Unit –V **(12 Hours)**

Correlation and Regression: Bivariate Distribution, Correlation – Scatter diagram – Karl Pearson's coefficient of correlation – Calculation of the correlation coefficient for a Bivariate frequency distribution – Probable error of correlation coefficient - Rank Correlation – Regression.

Text Book:

Gupta.S.C. andKapoor.V.K., 2015,Elements of Mathematical Statistics, Third Edition,SultanChand&Sons,EducationalPublishers,New Delhi.

Unit	Chapter/Section
I	3
II	6 (6.1-6.11)
III	7
IV	8
V	10

Reference Books:

1 Vittal. P.R., 2013,Mathematical Statistics, Margham Publications, Chennai.

2 Arumugam. S.andThangapandi Isaac. A., Statistics, 2011, New Gamma Publishing House, Palayamkkottai.

3 Gupta. S.C. andKapoor. V.K.,2007, Fundamentals of Mathematical Statistics, Eleventh edition, Sultan Chand & sons,New Delhi.

Course Designers:

Mrs.R.Latha

Dr.M.Senthilkumaran

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

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Course	: Core	Int.Marks	: 25
Class	: III Year	Ext.Marks	: 75
Semester	: V	Max.Marks	: 100
Sub. Code	: MM54	Hours / week	: 5
Title of the Paper	**: Operations Research – I**	Credits	: 4

Course Outcome: On the successful completion of the course,students will be able to

1. Know the origin and development of Operations Research.
2. Develop the skills of formulation of LPP and different techniques to solve it.
3. Know the application of Transportation and Assignment problems.

Unit – I **(15 Hours)**

Linear Programming Problem(LPP)- Mathematical formulation: Introduction – Linear Programming Problem – Mathematical formulation of the problem – Illustration on Mathematical formulation of LPPs. Linear Programming Problem – Graphical solution and extension: Introduction - Graphical solution method – Some exceptional cases-General Linear Programming Problem – Canonical and standard forms of LPP – Insights into the simplex method.

Unit – II **(15 Hours)**

Linear Programming Problem- Simplex method: Introduction – Fundamental properties of solutions- The computational procedure- Use of artificial variables- Degeneracy in Linear Programming.

Unit – III **(15 Hours)**

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 – Dual simplex method.

U**nit – IV** **(15 Hours)**

Transportation Problem :Introduction - LP formulation of the Transportation Problem - The Transportation table- Loops in Transportation table-Solution of a Transportation Problem- Finding an initial basic feasible solution- Test for optimality – Degeneracy in Transportation Problem - Transportation Algorithm (MODI Method).

Unit – V **(15 Hours)**

Assignment Problem:Introduction-Mathematical formulation of the problem – Solution methods of the Assignment problem – Special cases in Assignment Problem-The Travelling Salesman Problem.

Text Book:

Kanti Swarup, Gupta. P.K. and Man Mohan, 2014, Operations Research, Seventeenth Edition, Sultan Chand & Sons, New Delhi.

Unit	Chapter/section
I	2(2:1 – 2:4), 3(3:1 – 3:5)
II	4(4:1 – 4:5)
III	5(5:1 – 5:7, 5:9)
IV	10 (10:1, 10:2, 10:5, 10:6, 10:8 – 10:10, 10:12,10:13)
V	11(11:1 – 11:4, 11:7).

Reference Books :

1) Kalavathy. S.,2013, Operations Research, 4th Edition, Vikas Publishing House Pvt. Ltd., New Delhi.

2) Hamdy A. Taha, 2012, Operations Research – An Introduction, 9th Edition, Pearson Education.

3)Sharma. S.D.,2002, Operations Research, 13th Edition, Kedar Nath Ramnath & Co.,

Course Designers:

1) Ms. D. Murugeswari
2) Mrs. S. Shanavas Parvin

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

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Course	: Core	Int.Marks	: 25
Class	: III Year	Ext.Marks	: 75
Semester	: VI	Max.Marks	: 100
Sub. Code	: MM61	Hours / week	: 6
Title of the Paper	**: Complex Analysis**	Credits	: 5

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand the basic concepts of an analytic function and bilinear transformations.
2. Acquire skills in Complex and contour integration.
3. Analyze the Taylor and Laurent's series expansions.

Unit – I **(18 Hours)**

Analytic functions : Functions of a complex variable – Limits – Theorems on limit – Continuous functions – Differentiability – The Cauchy – Riemann equations –Analytic functions – Harmonic functions – Conformal mapping.

Unit – II **(18 Hours)**

Bilinear transformations: Elementary transformations – Bilinear transformations – Cross ratio – Fixed points of Bilinear transformations – Some special bilinear transformations – Mapping by elementary functions: The mappings $w = z^2$, $w = e^z$, $w = \sin z$ and $w = \frac{1}{2}(z + 1/z)$.

Unit – III **(18 Hours)**

Complex integration: Definite integral - Cauchy's theorem– Cauchy's integral formula – Higher derivatives.

Unit – IV **(18 Hours)**

Series expansions: Taylor's series– Laurent's series – Zeros of an analytic functions – Singularities.

Unit – V **(18 Hours)**

Calculus of residues: Residues– Cauchy's residue theorem – Evaluation of definite integrals.

Text Book:

Arumugam. S., ThangapandiIssac. A. and A. Somasundaram, 2015, Complex Analysis,SciTech publications(India) Pvt. Ltd. Chennai.

Unit	Chapter/Section
I	2(2.1 – 2.9)
II	3(3.1 – 3.5) 5(5.1, 5.3, 5.4, 5.7)
III	6(6.1 – 6.4)
IV	7(7.1 – 7.4)
V	8(8.1 – 8.3)

Reference books:

1) Roopkumar. R, 2015, Complex analysis, Dorling Kinderley Pvt. Ltd , New Delhi.

2) ManickavasagamPillay T.K. and Narayanan. S., 2008, Complex Analysis, S. V. Publishers,India.

3) Karunakaran V, 2006, Complex Analysis, Narosa Publishing House Pvt. Ltd., Second Edition, New Delhi.

Course Designers:

1. Mrs. S.ShanavasParvin
2. Ms. K. Ponmari

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
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Course	: B.Sc.	Int.Marks	: 25
Class	: III Year	Ext. Marks	: 75
Semester	: VI	Max.Marks	: 100
Sub.Code	: MM62	Hours / week	: 6
Title of the Paper	: **Linear Algebra**	Credits	:5

Course Outcomes: On the successful completion of the course, students will be able to

1. Acquire competence in the concepts of linear systems, independence, linear transformations, bases and dimensions.
2. Evaluate the eigenvalues and eigenvectors of a matrix.

Unit - I **(18 Hours)**

Definition and examples of vector spaces– Subspaces - Linear transformation– Span of a set.

Unit - II **(18 Hours)**

Linear independence - Basis and dimension – Rank and Nullity – Matrix of a linear Transformation.

Unit – III **(18 Hours)**

Definition and examples of inner product spaces - Orthogonality – Orthogonal Complement.

Unit – IV **(20 Hours)**

Algebra of Matrices – Types of Matrices – The Inverse of a Matrix – Elementary Transformations – Rank of a Matrix – Simultaneous Linear Equations.

Unit – V **(16 Hours)**

Characteristic Equation and Cayley-Hamilton theorem – Eigen values and Eigen Vectors – Bilinear forms – Quadratic forms

Text Book:

Arumugam. S. and Isaac. A.T., 2016, Modern Algebra, SCITECH publications(India) Pvt.

Unit	Chapter/Section
I	5(5.1 – 5.4)
II	5(5.5 – 5.8)
III	6(6.1 – 6.3)
IV	7(7.1 – 7.6)
V	7(7.7 , 7.8) 8(8.1. 8.2)

Reference Books:

1) Herstein. I.N., 2014, Topics in Algebra, Wiley India Pvt. Ltd, Second Edition.

2) Vijay K Khanna and Bhambri. S.K., 2011, A course in Abstract Algebra, Vikas Publishing House Pvt. Ltd.

3) Kenneth Hoffman and Ray Kunze, 2009, Linear Algebra, PHI Learning Pvt. Ltd.

Course Designers:

1.Dr. G. Prabakaran

2. Dr. M. Senthilkumaran

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Course	: Core	Int. Marks	: 25
Class	: III Year	Ext. Marks	: 75
Semester	: VI	Max. Marks	: 100
Sub. Code	:MM63	Hours/Week	: 6
Title of the paper	: **Graph Theory**	Credits	: 4

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand the basic concepts in Graph Theory.
2. Describe algorithms to solve some practical problems.

Unit – I **(20 Hours)**

Basics:Graphs – Pictorial representation – Subgraphs – Isomorphism and degrees – Walks and connected graphs – Cycles in graphs – Cut-vertices and cut-edges – Matrix representations.

Unit – II **(18 Hours)**

Eulerian and Hamiltonian Graphs: Eulerian graphs – Fleury's algorithm – Hamiltonian graphs – Weighted graphs – Chinese Postman problem – Travelling Salesman problem.

Unit – III **(20 Hours)**

Bipartite Graphs: Bipartite graphs – Marriage problem –Trees – Connector problem - Kruskal's Algorithm - Prim's Algorithm.

Unit – IV **(14 Hours)**

Planar Graphs: Planar graphs – Euler's formula – Platonic solids – Dual of a plane graph.

Unit – V **(18 Hours)**

Colouring: Vertex colouring – Edge colouring – An algorithm for vertex colouring.

Text book:

Choudum.S.A.,2009, A First Course in Graph Theory, Macmillan Publishers India Limited, New Delhi.

Unit	Chapter/Sections
I	1 (1.1-1.7),4 (4.1)
II	2 (2.1-2.4)
III	3 (3.1-3.4)
IV	5 (5.1-5.4)
V	6 (6.1-6.3)

Reference books:

1. Bondy. J.A. and Murty. U.S.R., 2008, Graph Theory, Springer.
2. Gary Chartrand and Ping Zhang, 2006, Introduction to Graph Theory, Tata McGraw – Hill.
3. Robin J.Wilson, 2005, Introduction to Graph Theory, Fourth Edition, Pearson Education.
4. Narsingh Deo, 2001, Graph Theory with Applications to Engineering and computer Science, Prentice – Hall of India.
5. Arumugam. S., and Ramachandran. S., 2001, Invitation to Graph Theory, Scitech Publications (India) Pvt. Ltd.

Course designers:1. Dr. K. Kayathri 2. Dr. G. Prabakaran

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
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Course	: Core	Int.Marks	: 25
Class	: III year	Ext. Marks	: 75
Semester	: VI	Max.Marks	: 100
Sub. Code	: MM64	Hours / week	: 5
Title of the Paper	: **Operations Research – II**	Credits	: 4

Course Outcome: On the successful completion of the course,students will be able to

1. Solve problems in sequencing, game theory, inventory and queueing theory.
2. Understand and analyze networks using PERT and CPM.

Unit -I **(15 Hours)**

Sequencing Problem: Introduction - Problem of sequencing - Basic terms used in sequencing - Processing n jobs through two machines - Processing n jobs through k machines - Processing 2 jobs through k machines.

Unit – II **(15 Hours)**

Games and Strategies :Introduction –Two - person zero – sum games – Some basic terms - The maximin - minimaxprinciple - Games without saddle points-Mixed strategies - Graphic solution of 2 x n and m x 2 games - Dominance property.

Unit –III **(15 Hours)**

Inventory Control -I : Introduction – Types of inventories - Reasons for carrying inventories - The inventory decisions - Objectives of scientific inventory control - Costs associated with inventories - Factors affecting inventory control - An inventory control problem - The concept of EOQ - Deterministic inventory problems with no shortages- Deterministic inventory problems with shortages – Problem of EOQ with price breaks.

Unit – IV **(15 Hours)**

Queueing Theory: Introduction – Queueing system – Elements of a queueing system Operating characteristics of a queueing system – Probability distributions in queueing system – Classification of queueing models – Definition of transient and steady states – Poisson queueing systems (Models I to V)

Unit –V **(15 Hours)**

Network scheduling by PERT/CPM: Introduction – Network**:** Basic components – Rules of network construction – Critical path analysis – Probability consideration in PERT – Distinction between PERT and CPM.

Text Book:

Kanti Swarup, Gupta. P.K. and Man Mohan, 2014, Operations Research, Sultan Chand & Sons, New Delhi.

Unit	Chapter/section
I	12(12:1 – 12:6)
II	17(17:1 – 17:7)
III	19(19:1 – 19:12)
IV	21(21:1 – 21:4, 21:6 – 21:9)
V	25(25:1, 25:2, 25:4, 25:6, 25:7, 25:8)

Reference Books:

1) Kalavathy. S., 2013, Operations Research, 4th Edition, Vikas Publishing House Pvt. Ltd., New Delhi.

2) Hamdy A. Taha, 2012, Operations Research – An Introduction, 9th Edition, Pearson Education.

3)Sharma. S.D.,2002, Operations Research, 13th Edition, Kedar Nath Ramnath & Co.

Course designers:

1) Ms. D. Murugeswari
2) Mrs. S. Shanavas Parvin

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Course	: SEC	Int.Marks	: 15
Class	: III Year	Ext. Marks	: 35
Semester	: V/VI	Max.Marks	: 50
Sub. Code	: MSEC41	Hours / week	: 2
Title of the Paper	: **Theory of Numbers**	Credits	: 2

Course Outcome: On the successful completion of the course, students will be able to

1. Understand properties of natural numbers and divisibility of natural numbers.
2. Solve the system of linear congruences.

Unit - I **(15 Hours)**

Natural Numbers and the Principle of Induction – Equivalence relations – Divisibility in Z.

Unit – II **(15 Hours)**

Congruences – Linear Congruence – Simultaneous congruences – Euler's function.

Text Book:

Arumugam. S. and Thangapandi Issac. A., 2011, Algebra: Theory ofEquations Theory of Numbers and Trigonometry, New Gamma Publishing House,

Unit	Chapter/section
I	1 and 2
II	3(3.1 – 3.4)

Reference Books:

1) Manicavachagom Pillay. T.K., Natarajan. T. and Ganapathy. K.S., 2015, Algebra Volume II, S. Viswanathan(Printers and Publishers) PVT. Ltd., Chennai.
2) Martin Erickson and Anthony Vazzana, 2009, Introduction to Analytic Number Theory, Chapman and Hall /CRC publications.
3) George E. Andrews, 1992, Number Theory, Hindusthan Publishing Corporation (India).

Course designers:

1) Dr. G. Prabakaran
2) Mrs.R.Latha

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Course	: SEC	Int.Marks	: 15
Class	: III Year	Ext. Marks	: 35
Semester	: V/VI	Max.Marks	: 50
Sub.Code	: MSEC41	Hours / week	: 2
Title of the Paper	**: Statistical test of significance**	Credits	: 2

Course Outcome: On the successful completion of the course, students will be able to

1. Understand the various tests to estimate the parameters of samples.
2. Apply sampling tests and to infer decisions on hypothesis.

Unit - I **(15 Hours)**

Exact Sampling Distribution (Chi-Square Distribution):Chi-square Variate Applications of Chi-square Distribution – Chi-square Test as a Test for Population Variance – Chi-square Test of Goodness of Fit – Student's 't' (Definition) – Fisher's 't' (Definition) – Applications of t-distribution – Test for Single Mean – t-Test for Difference of Means – t-Test for Testing Significance of an Observed Sample Correlation Coefficient – F-statistic (Definition) –Applications of F-distribution – F-test for Equality of Population Variance.

Unit - II **(15 Hours)**

Analysis of Variance: Introduction – One-way Classification – Mathematical Analysis of the Model – Two-way Classification.

Text Book: Gupta.S.C. andKapoor.V.K., 2015, Elements of Mathematical Statistics, Third Edition, Sultan Chand& Sons, Educational Publishers, New Delhi.

Unit	Chapter/Section
I	13(13.1,13.5-13.5.2),14(14.2,14.2.2,14.2.5-14.3.2)
II	17(17.1-17.3)

Reference Books:

1. Vittal. P.R., 2013,Mathematical Statistics, Margham Publications, Chennai.
2. Arumugam. S.andThangapandi Isaac. A., Statistics, 2011, New Gamma Publishing House, Palayamkkottai.
3. Gupta. S.C. and Kapoor. V.K., 2007, Fundamentals of Mathematical Statistics, Eleventh edition, Sultan Chand & sons,New Delhi.

Course designers:

1) Mrs.R.Latha

2) Dr.M.Senthilkumaran

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Course	: SEC	Int.Marks	: 15
Class	: III Year	Ext. Marks	: 35
Semester	: V/VI	Max.Marks	: 50
Sub. Code	: MSEC61	Hours / week	: 2
Title of the Paper	**: Web Designing with HTML**	Credits	: 2

Course Outcome: On the successful completion of the course,students will be able to
1. Code programs in HTML to design static web page.
2. Develop advanced HTML programming for dynamic web pages.
3. Perform regular website maintenance.

List of Practicals

1. Creating Web Page Headings
2. Creating Web Page's body
3. Setting Web Page color
4. Creating Bold text, Italic text , Big text and Small text
5. Creating Subscripts and Superscripts
6. Making text blink
7. Displaying an address
8. Creating Horizontal Rules
9. Creating Columns
10. Controlling Horizontal and Vertical spacing
11. Creating a personal profile web page with a suitable background design, background color and a text color.
12. Creating a HTML document with menu using ordered and unordered list.
13. Creating tables in HTML with various options.
14. Designing a web page using Frames.
15. Developing a complete web page using Frames and Framesets which gives the information about an organization or an institution.

Course Designers:
1. Dr. B. Arivazhagan
2. Dr. M. Senthilkumaran

THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

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Course	: SEC	Int.Marks	: 15
Class	: III Year	Ext. Marks	: 35
Semester	: V/VI	Max.Marks	: 50
Sub. Code	: MSEC61	Hours / week	: 2
Title of the Paper	: **Theory of Lattices**	Credits	: 2

Course Outcome: On the successful completion of the course,students will be able to

1. Understand concept of Lattice and Boolean algebra.
2. Familiarize the applications of Boolean functions.

Unit – I **(15 Hours)**

Lattices – Some Properties of Lattices – New Lattices – Modular and Distributive Lattices.

Unit - II **(15 Hours)**

Boolean Algebras – Boolean Polynomials – Karnaugh Map.

Text Book:

Venkataraman. M.K., Sridharan. N. and Chandrasekaran. N, 2012,Discrete Mathematics, The National Publishing Company.

Unit	Chapter/section
I	X(1 – 4)
II	X(5 – 7)

Reference Books:

1) Trembley. J.P. and Manohar. R., 2001, Discrete Mathematical Structures with Applications to Compute Science, Tata McGraw –Hill Publishing Company Ltd.

2) Chandrasekhara Rao. K., 2012, Discrete Mathematic, Narosa Publishing company.

3) Kenneth H. Rosen, 1999, Discrete Mathematics and its Applications, Tata McGraw –Hill,1999.

Course Designers:

1) Dr. D. Pandiaraja
2) Dr. B. Arivazhagan

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

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Course	: NME	Int.Marks	: 15
Class	: II Year	Ext. Marks	: 35
Semester	: III	Max.Marks	: 50
Sub. Code	: MNME31	Hours / week	: 2
Title of the Paper	**: Mathematical Logic**	Credits	: 2

Course Outcome: On the successful completion of the course,students will be able to

1. Understand the basic principles of Mathematical Logic.
2. Analyze the concepts of Theory of inference.

Unit - I **(15 Hours)**

Introduction – TF Statements – Connectives – Atomic and Compound Statements – Well Formed (Statement) Formulae – Truth table of a formula.

Unit - II **(15 Hours)**

Tautology – Tautological implications and equivalence of formulae – Theory of Inference.

Text Book:

Venkatraman. M.K., Sridharan. N. andChandrasekaran. N., 2012, Discrete Mathematics, The National Publishing Company, Chennai.

Unit	Chapter/Section
I	IX(1-6)
II	IX (7,8 and 13)

Reference Books:

1. Veerarajan. T.,2007,Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw- Hill Publishing Company Limited, New Delhi.
2. Semyour Lipschutz and Marc Lars Lipson, 2006, Discrete Mathematics, Second Edition, Tata McGraw- Hill Publishing Company Limited, New Delhi
3. Trembley. J.P. and Manohar. R.,2001, Discrete Mathematical Structures with Applications to Computer Science,Tata McGraw – Hill Publishing Company Limited, New Delhi.

Course designers:

1. Dr. B. Arivazhagan
2. Dr. M. Senthilkumaran

THIAGARAJAR COLLEGE, MADURAI- 9
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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(For those who join in 2017 and after)

Course	: NME 2	Int.Marks	: 15
Class	: II Year	Ext. Marks	: 35
Semester	: V	Max.Marks	: 50
Sub. Code	: MNME51	Hours / week	: 2
Title of the Paper	**: Mathematical Aptitude for Competitive Examinations**		
		Credits	: 2

Course Outcome: On the successful completion of the course, students will be able to

1. Develop Mathematical Aptitude skills.
2. Succeed in the competitive examinations.

Unit - I **(15 Hours)**

H. C. F and L. C. M of Numbers – Decimal Fractions – Average – Percentage – Profit and Loss – Ratio and Proportion.

Unit - II

(15 Hours)

Time and Distance – Simple interest – Compound interest – True discount – Banker's discount.

Text Book:

Agarwal. R.S., 2013, Quantitative Aptitude, S. Chand and Co., Delhi.

Unit	Chapter/section
I	2, 3, 6, 10, 11, 12
II	17, 21, 22, 32, 33

Reference Books:

1) Arora. P.N. and Arora. S.,2009, Quantitative Aptitude Mathematics, Volume- 1 S Chand & Company Ltd.
2) Kothari. C.R., 1989, Quantitative Techniques,Vikas Publishing House Pvt. Ltd.
3) Srinivasan. T.M., Perumalswamy. S. and Gopala Krishnan. M.D., 1985,Elements of Quantitative Techniques, Emerald Publishers.

Course designers:

1) Mr. S. Sornavel
2) Dr. G. Prabakaran

THIAGARAJAR COLLEGE, MADURAI- 9
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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
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Course	: Core	Int. Marks	: 25
Class	: III Year	Ext. Marks	: 75
Semester	: V/VI	Max. Marks	: 100
Sub. Code	: EMM51	Hours / week	: 5
Title of the Paper	**: Mechanics**	Credits	: 2

Course Outcome: On the successful completion of the course, students will be able to

1) Understand the basic concepts and principles of statics and dynamics.
2) Analyze the mechanism of physical problems.
3) Introduce the postulates governing static anddynamic system.

Unit - I Forces acting at a point **(12 Hours)**

Definition – Resultant and components - Parallelogram of forces – Resultant of two forces – Triangle of forces – Perpendicular triangle of forces – Converse of triangle of forces - Polygon of forces – Lami's theorem – Extended form of the parallelogram law of forces – Components of a force along two given directions –Resultant of any number of forces – Resultant of any number of coplanar forces - Condition of equilibrium of any number of forces acting upon a particle.

Unit - II Friction **(12 Hours)**

Introduction – Experimental results – Statistical , dynamical and limiting friction – Laws of friction – Friction-a passive force – Coefficient of friction – Angle of friction – Cone of friction – Numerical values – Equilibrium of a particle on a rough inclined plane under a force parallel to the plane – Equilibrium of a body on a rough inclined plane under any force- Problems on friction(simple problems only).

Unit - III Projectiles **(12 Hours)**

Definitions – Two fundamental principles - Path of a projectile is a parabola – Characteristic of the motion of a projectile – Maximum horizontal range –Two possible directions to obtain a given range– Velocity at the end of time 't' – Two possible directions to reach a given point Range on the inclined plane – Motion on the surface of smooth inclined plane.

Unit - IV Collision of elastic bodies **(12 Hours)**

Introduction - Definition – Fundamental laws of impact – Impact of a smooth sphere on a fixed smooth plane – Direct impact of two smooth spheres - Loss of kinetic energy due to direct impact of two smooth spheres – Loss of kinetic energy due to oblique impact of two smooth spheres.

Unit - V Simple harmonic motion **(12 Hours)**

Introduction – Simple harmonic motion in a straight line – General solution of simple harmonic motion equation – Geometrical representation of SHM – Change of origin – Composition of two simple harmonic motion of same period in the same straight line – Composition of two simple harmonic motion of same period in the two perpendicular directions – Simple pendulum – Period of oscillation of a Simple pendulum – Equivalent Simple pendulum – The seconds Simple pendulum.

Text Books:

Venkataraman. M.K., 2012, Statics, Agasthiar publications.
Venkataraman. M.K., 2012, Dynamics, Agasthiar publications.

Unit	Book	Chapter/Section
I	1	2(1 – 16)
II	1	7(1 – 13)
III	2	6(6.1 – 6.16)
IV	2	8(8.1 – 8.8)
V	2	10(10.1 – 10.7, 10.12 – 10.15)

Reference books:

1) Khanna. M.L., 2008, Dynamics, Pragati Pragasam Ltd., U.P.
2) Khanna. M.L., 2008, Statics, Pragati Pragasam Ltd., U.P.
3) Duraipandian. P., Laxmi Duraipandian and Muthamizh Jeyapragasam, 2012,
Mechanics, S. Chand and Company Ltd., Chennai.
4) Manichavasagham pillay. T.K., 2009, Statics, National Publishing & Co.

Course designers:

1) Mr. S. Sornavel
2) Dr. G. Prabakarn

THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Core Elective	Int.Marks	: 25
Class	: III Year	Ext. Marks	: 75
Semester	: V/VI	Max.Marks	: 100
Sub. Code	: EMM61	Hours / week	:5
Title of the Paper	: **Stochastic Processes**	Credits	: 5

Course Outcome: On the successful completion of the course, students will be able to

1. Update the knowledge in probability.
2. Understand the examples of basic discrete and continuous-time stochastic processes.

Unit - I **(15 Hours)**

Generating Functions: Probability Generating functions: Mean and Variance – Sum of (a fixed number of) random variables – Sum of a random number of discrete variables(stochastic sum) – Generating function of Bivariate distribution – Stochastic Processes: An introduction – Specification of stochastic process.

Unit- II **(15 Hours)**

Markov Chains: Definition and Examples - Transition Matrix – Order of a Markov Chain – Markov chain as graphs – Higher transition probabilities – Generalization of Independent Bernoulli Trails: Sequence of Chain-Dependent Trails – Markov – Bernoulli Chain – Correlated Random walk -- Classification of States and Chains – Communication Relations – Class Property – Classification of Chains – Classification of States: transient and Persistent(Recurrent) States.

Unit- III **(15 Hours)**

Stability of a Markov system – Computation of the Equilibrium Probabilities – Graph theoretic Approach – Markov chain with Denumerable Number of States – Reducible Chains – Finite reducible chains with a single Closed class – chain with one single class of persistent Non-null Aperiodic States - Absorbing Markov Chains – extension : Reducible Chain with one closed class of Persistent Aperiodic States – Reducible Chains with more than one closed class – Markov chains with continuous State Space.

Unit- IV **(15 Hours)**

Poisson Process: Introduction - Postulates of Poisson process - properties of Poisson process – Poisson Process and Related Distributions – interarrival time – Interesting Properties of Poisson process.

Unit- V **(15 Hours)**

Generalization of Poisson Process: Poisson Process in Higher Dimensions – Poisson Cluster Process – Pure Birth Process:Yule-furry Process – Birth-Immigration Process – time dependent Poisson Processes – Random Variation of the Parameter lambda – Renewal Process – Birth and Death Process – Particular Cases – Markov Processes with Discrete State Space : Introduction – Chapman-Kolmogorov equations – Limiting Distribution – Graph theoretic Approach for Determining V.

Text Book:

Medhi. J., 2012, Stochastic Processes, New Age International Publishers, New Delhi.

Unit	Chapter/section
I	1 (1.1, 1.5)
II	2 (2.1 to 2.4)
III	2 (2.6 to 2.9.4, 2.11)
IV	3 (3.1 to 3.2)
V	3 (3.3 to 3.5)

Reference Books:

1) Basu. A.K., 2005, Introduction to Stochastic Processes, Narosa Publishing.

2) Bhat. B.R., 2000, Stochastic Models: Analysis and Applications, New Age International Publishers.

3) Karlin. S. and Taylor. H.M., 1975, A First Course in Stochastic Processes, Vol. I, Academic Press.

4) Jones. P.W. and Smith. P., 2001, Stochastic Processes: An Introduction, Arnold Press.

Course designers

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2. Dr. G. Prabakaran

THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

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Course	: Core Elective	Int.Marks	: 25
Class	: III Year	Ext.Marks	: 75
Semester	: V/VI	Max.Marks	: 100
Sub. Code	: EMM61	Hours / week	: 5
Title of the Paper	**:Fuzzy Sets**	Credits	: 5

Course Outcome: On the successful completion of the course,students will be able to

1. Understand the concept of uncertainty and fuzziness.
2. Analyze fuzzy relations.
3. Practice fuzzy arithmetic and construction of fuzzy sets.

Unit - I **(15 Hours)**

Fuzzy Set: Introduction- Visual basic types – basic concepts – Fuzzy sets verses crisp sets: - Additional properties of - Cuts – Representation of Fuzzy sets – Extension Principle for fuzzy sets.

Unit - II **(15 Hours)**

Operation on Fuzzy Sets: Types of Operations – Fuzzy Complements – Fuzzy intersections – fuzzy Unions – Combination of operations.

Unit –III **(15 Hours)**

Fuzzy arithmetic – Fuzzy numbers – linguistic variables – arithmetic operations on intervals – arithmetic operations on Fuzzy numbers – lattice of Fuzzy numbers – Fuzzy equations.

Unit - IV **(15 Hours)**

Fuzzy relations – binary Fuzzy relations – binary relation on a single set –Fuzzy equivalence relation - Fuzzy ordering relation.

Unit - V **(15 Hours)**

Constructing Fuzzy sets – method of construction – direct method with one expert - direct method with multiple expert – indirect method with one expert – constructions from sample data – Lagrange interpolation – least square cure fitting.

Text Book: George J. Klir and Bo Yuan, 2005,Fuzzy Sets and Fuzzy Logic Theory and Applications,Prentice-Hall of India.

Unit	Chapter/section
I	1(1.1 – 1.3), 2(2.1 – 2.3)
II	3(3.1 – 3.6)
III	4(4.1 – 4.6)
IV	5(5.3 – 5.5, 5.7)
V	10(10.2 – 10.7)

Reference Books:

1) Ganesh. M., 2015,Introduction to Fuzzy Sets and Fuzzy Logic, Prentice-Hall of India.

2) Hung T. Nguyen and Elbert A. Walker, Chapman and Hall/CRC,2006, A First Course in Fuzzy Logic.

3) Zimmermann. H.J., 1996, Fuzzy Set Theory and its Applications, Allied Publishers Ltd.

Course designers

1) Dr. D. Pandiaraja
2) Dr. M. Senthilkumaran

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
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Course	: Core Elective	Int.Marks	: 25
Class	: III Year	Ext.Marks	: 75
Semester	: V/VI	Max.Marks	: 100
Sub. Code	: EMM51	Hours / week	: 5
Title of the Paper	:**Combinatorics**	Credits	: 2

Course Outcome: On the successful completion of the course,students will be able to

1. Understand the important concepts of contemporary Combinatorics.
2. Find the way to countthe number of ways in more than one way.
3. Solve enumeration problems using combinatorial techniques.

Unit – I **(17 Hours)**

The Sum Rule and the Product Rule – The Pigeonhole Principle - Solved Problems on The Sum Rule and the Product Rule - Solved Problems on The Pigeonhole Principle.

Unit – II **(17 Hours)**

Permutations and Combinations -Solved Problems on Permutations and Combinations.

Unit – III **(13 Hours)**

Generalized Permutations and Combinations –The Inclusion-Exclusion Principle - Solved Problems on Generalized Permutations and Combinations - Solved Problems on The Inclusion-Exclusion Principle - Solved Problems on Generalized Inclusion-Exclusion Principle.

Unit – IV **(15 Hours)**

Ordinary and Exponential Generating Functions - Solved Problems on Ordinary Generating Functions - Solved Problems on Exponential Generating Functions.

Unit – V **(13 Hours)**

Recurrence Relations- Solved Problems on Recurrence Relations and Associated Generating Functions.

Text book:

Balakrishnan. V.K., 1995, Theory and Problems of Combinatorics, Schaum's Outline Series, McGraw-Hill, Inc.

Unit	Chapter/Sections
I	Chapter 1 (1.1,1.3)
II	Chapter 1(1.2)
III	Chapter 2 (2.1, 2.3)
IV	Chapter 3 (3.1)
V	Chapter 3 (3.3)

Reference books:

1. Alan Tucker, 2012, Applied Combinatorics, 6th Edition, Wiley.
2. Ralph P. Grimaldi, and Ramana. B.V., 2004, Discrete and Combinatorial Mathematics, Pearson Education, Inc., Copyright 2007, Dorling Kindersley (India) Pvt. Ltd.
3. Krishnamurthy. V., 1985, Combinatorics Theory and Applications, East- West Press Pvt. Ltd.

Course designers:

1. Dr. K. Kayathri
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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
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Course	: Core Elective	Int.Marks	: 25
Class	: III Year	Ext.Marks	: 75
Semester	: V/VI	Max.Marks	: 100
Sub. Code	: EMM51	Hours / week	: 4
Title of the Paper	**: Cryptography**	Credits	: 2

Course Outcome: On the successful completion of the course,students will be able to

1. Understand basic principles of Cryptography and Cryptographic Algorithms.
2. Know Cryptography techniques in internet security.

Unit - I **(15 Hours)**

Introduction: Security goals – Cryptographic attacks – Services and mechanism – Techniques.

Mathematics of Cryptography: Integer arithmetic – Modular arithmetic – Matrices – Linear congruence.

Unit - II **(15 Hours)**

Traditional symmetric – Key ciphers:Introduction – Substitution ciphers- Transposition ciphers – Stream and block ciphers.

Unit - III **(15 Hours)**

Mathematics of symmetric – Key cryptography: Algebraic structures - GF(2^n) Fields Introduction to modern symmetric – Key ciphers: Modern block ciphers – Modern stream ciphers.

Unit - IV **(15 Hours)**

Data Encryption Standard (DES): Introduction – DES structure – DES analysis – Security of DES – Multiple DES (Conventional Encryption Algorithms) – Examples of block ciphers influenced by DES.

Unit - V **(15 Hours)**

Advanced Encryption Standard (AES): Introduction – Transformations – Key expansion – The AES Ciphers – Examples – Analysis of AES.

Text Book: Behrouz A. Forouzan and Debdeep Mukhopadhyay, 2013, Cryptography and Network Security, 2nd Edition, McGraw Hill Education (India) Private Limited , New Delhi.

Units	Chapters / Sections
I	1(1.1-1.4) & 2(2.1 – 2.4)
II	3 (3.1 – 3.4)
III	4 (4.1 – 4.2) & 5(5.1- 5.2)
IV	6 (6.1 – 6.6)
V	7 (7.1 – 7.6)

Reference Books:

1) Atul Kahate, 2014, Cryptography and Network Security, Third Edition, McGraw Hill Education(India) Private Limited, New Delhi
2) Bruce Schneier, 2012, Applied Cryptography:Protocols, Algorithms and Source code in C, 2nd Edition, Wiley India New Delhi
3) Stallings, 2013, Cryptography and Network Security,: Principles and Practice, Sixth Edition, Pearson Education India.

Course Designers:

1. Dr. B. Arivazhagan
2. Dr. M. Senthilkumaran

THIAGARAJAR COLLEGE, MADURAI- 9
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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(For those who join in 2017 and after)

Course	: Core Elective	Int.Marks	: 25
Class	: III Year	Ext.Marks	: 75
Semester	: V/VI	Max.Marks	: 100
Sub. Code	: EMM61	Hours / week	: 5
Title of the Paper	**: Fundamentals of Computer Algorithms**	Credits	: 5

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand various algorithmic design techniques.
2. Analyze the space and time complexity of computer algorithms.

Unit– I **(15 Hours)**

Introduction: What is an algorithm? – Algorithm specification – Performance analysis – Randomized algorithms.

Unit -II **(15 Hours)**

Divide – and – Conquer: General method – Binary search – Finding the maximum and minimum – Merge sort – Quicksort – Selection – Strassen's Matrix multiplication.

Unit - III **(15 Hours)**

Greedy Method:The General method – Knapsack problem – Tree vertex splitting – Job sequencing with deadlines – Minimum cost spanning trees.

Unit - IV **(15 Hours)**

Dynamic Programming: The General method – Multistage graphs – All pairs shortest paths – Single source shortest paths: General weights.

Unit– V **(15 Hours)**

Backtracking: The General method – The 8 – queens problem – Sum of subsets - Graph coloring.

Text Book:

Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran,2010, Fundamentals of Computer Algorithms, Galgotia Publications Ltd , New Delhi.

Units	Chapters/ Sections
I	1 (1.1- 1.4)
II	3(3.1-3.7)
III	4(4.1- 4.5)
IV	5(5.1-5.4)
V	7(7.1-7.4)

Reference Books:

1. Lee. R.C.T., Tseng. S.S. and Chang, Tsai. Y.T., 2013, Introduction to Design and Analysis of Algorithms A Strategic Approach, McGraw Hill Education (India) Private Limited, New Delhi.
2. Vijayalakshmi Pai. G.A, 2008, Data Structures and Algorithms Concepts, Techniques and Applications , Tata McGraw- Hill Publishing Company Limited, New Delhi.
3. Sara Baase, Allen Van Gelder, 2003, Computer Algorithms Introduction to Design and Analysis, Third Edition , Pearson Education , Delhi.

Course designers:1)Dr. B. Arivazhagan 2)Dr. M. Senthilkumaran

ALLIED PAPERS

THIAGARAJAR COLLEGE, MADURAI- 9
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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(For those who join in 2017 and after)

Course	: Generic Elective	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: III	Max. Marks	: 100
Sub. Code	: AP31	Hours / week	: 6
Title of the Paper	: **Allied Mathematics – I for Physics**	Credits	:2

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand the basic concepts of equations, differentiation, integration and matrices.
2. Know the Fourier series expansion of any periodic function.

Unit – I **(18 Hours)**

Introduction – General properties – Transformation of Equations – Reciprocal equations – Solution of cubic equations : Cardan's method.

Unit - II **(18 Hours)**

Eigenvalues – Properties of eigenvalues – Cayley-Hamilton theorem – Reduction to diagonal form.

Unit - III **(18 Hours)**

Curvature – Radius of curvature for Cartesian curve $y = f(x)$ – Centre of curvature – Envelope.

Unit – IV **(18 Hours)**

Reduction formulae – Definite integrals – Integral as the limit of a sum.

Unit – V **(18 Hours)**

Fourier series : Introduction – Euler's formulae – Even and odd functions – Half range series.

Text Book:

Grewal. B.S. 2015, Higher Engineering Mathematics, Khanna Publications.

Unit	Chapter/Section
I	1(1.1 – 1.5)
II	2(2.13 – 2.16)
III	4(4.10 – 4.13)
IV	6(6.1 – 6.9)
V	10(10.1, 10.2, 10.6, 10.7)

Reference Books:

1) Erwin Kreyszig, 2016, Advanced Engineering Mathematics-, Wiley, 10th Edition.

2) Arumugm. S. and Isaac, 2014, Calculus, New Gamma Publishing House.

3) Arumugm. S. and Isaac, 2011, Algebra, Theory of Equations, Theory of Numbers and Trigonometry, New Gamma Publishing House.

Course designers: 1) Mr. M. Madhavan 2) Ms. K. Ponmari

THIAGARAJAR COLLEGE, MADURAI- 9
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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(For those who join in 2017 and after)

Course	: Generic Elective	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: IV	Max. Marks	: 100
Sub. Code	: AP41	Hours / week	: 6
Title of the Paper	**: Allied Mathematics – II for Physics**	Credits	: 2

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand double and triple integrals and their applications.
2. Solve the differential equations.

Unit – I **(18 Hours)**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves.

Unit - II **(18 Hours)**

Triple integrals – Volumes of solids – Change of variables – Area of a curved surface.

Unit – III **(18 Hours)**

Exact differential equations – Equations reducible to exact equations – Definitions – Theorems – Operator D – Rules for finding the complementary functions – Inverse operator – Rules for finding the particular integrals – Working procedure to solve the equation – Two other methods for finding P.I.

Unit – IV **(18 Hours)**

Introduction – Formation of partial differential equations – Solutions of a partial differential equation – Equations solvable by direct integration – Linear equations of the first order – Non-linear equations of the first order – Charpit's method.

Unit – V **(18 Hours)**

Calculation of mass – Centre of gravity – Moment of inertia.

Text Book:

Grewal. B.S. 2015, Higher Engineering Mathematics, Khanna Publishers

Unit	Chapter/Section
I	7(7.1 – 7.4)
II	7(7.5 – 7.8)
III	11(11.11, 11.12) 13(13.1 – 13.8)
IV	17(17.1 – 17.7)
V	7(7.9, 7.10, 7.12)

Reference Books:

1) Erwin Kreyszig, 2016, Advanced Engineering Mathematics-, Wiley, 10th Edition.
2) Raisinghania. M.D., 2016, Advanced Differential Equations, S. Chand.
3) Arumugam. S. and Isaac, 2014, Calculus, New Gamma Publishing House.

Course designers

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2) Ms. K. Ponmari

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(For those who join in 2017 and after)

Course	: Generic Elective	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: I	Max. Marks	: 100
Sub. Code	: AC11	Hours / week	: 6
Title of the Paper	**: Allied Mathematics – I for Chemistry**	Credits	: 2

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand the basic concepts of equations, differentiation, integration and matrices.
2. Solve the algebraic equations numerically.

Unit – I **(18 Hours)**

Introduction – General properties – Transformation of Equations – Reciprocal equations – Solution of cubic equations : Cardan's method.

Unit - II **(18 Hours)**

Eigenvalues – Properties of eigenvalues – Cayley-Hamilton theorem – Reduction to diagonal form.

Unit - III **(18 Hours)**

Curvature – Radius of curvature for Cartesian curve y = f(x) – Centre of curvature – Envelope.

Unit – IV **(18 Hours)**

Reduction formulae – Definite integrals – Integral as the limit of a sum.

Unit – V **(18 Hours)**

Introduction – Solution of algebraic and transcendental equations – Useful deductions from the Newton-Raphson formula – Approximate solution of equation: Horner's method.

Text Book:

Grewal. B.S., 2015, Higher Engineering Mathematics, Khanna Publishers

Unit	Chapter/Section
I	1(1.1 – 1.5)
II	2(2.13 – 2.16)
III	4(4.10 – 4.13)
IV	6(6.1 – 6.9)
V	28(28.1 – 28.4)

Reference Books:

1) Erwin Kreyszig, 2016, Advanced Engineering Mathematics-, Wiley, 10th Edition.
2) Arumugm. S. and Isaac, 2014, Calculus, New Gamma Publishing House.
3) Arumugm. S. and Isaac, 2011, Algebra, Theory of Equations, Theory of Numbers and Trigonometry, New Gamma Publishing House.

Course designers:

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2) Ms. K. Ponmari

THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Generic Elective	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: II	Max. Marks	: 100
Sub. Code	: AC21	Hours / week	: 6
Title of the Paper	**: Allied Mathematics – II for Chemistry**	Credits	: 2

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand double and triple integrals and their applications.
2. Solve the differential equations.

Unit – I **(18 Hours)**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves.

Unit - II **(18 Hours)**

Triple integrals – Volumes of solids – Change of variables – Area of a curved surface.

Unit – III **(18 Hours)**

Exact differential equations – Equations reducible to exact equations – Definitions – Theorems – Operator D – Rules for finding the complementary functions – Inverse operator – Rules for finding the particular integrals – Working procedure to solve the equation – Two other methods for finding P.I.

Unit – IV **(18 Hours)**

Introduction – Formation of partial differential equations – Solutions of a partial differential equation – Equations solvable by direct integration – Linear equations of the first order – Non-linear equations of the first order – Charpit's method.

Unit – V **(18 Hours)**

Coefficient of correlation – Lines of regression – Rank correlation.

Text Book:

Grewal. B.S., 2015, Higher Engineering Mathematics, Khanna Publishers.

Unit	Chapter/Section
I	7(7.1 – 7.4)
II	7(7.5 – 7.8)
III	11(11.11, 11.12) 13(13.1 – 13.8)
IV	17(17.1 – 17.7)
V	25(25.13, 25.14, 25.16)

Reference Books:

1) Erwin Kreyszig, 2016, Advanced Engineering Mathematics-, Wiley, 10th Edition.

2) Raisinghania. M.D., 2016, Advanced Differential Equations, S. Chand.

3) Arumugam. S. and Isaac, 2011, Statistics, New Gamma Publishing House.

Course designers:

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THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)

POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

(For those joined B.Sc. Computer Science / B.Sc. Computer Science(S.F.) / B.C.A./ B.Sc.(I.T.) on or after June 2017)

Course	:	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: I	Max. Marks	: 100
Sub. Code	: SA111/SAM11/AS11	Hours / week	: 5
Title of the Paper	**: Discrete Mathematics**	Credits	: 5

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand the concepts of Relations, Functions and logic.
2. Study the concepts of Matrices, Graph Theory, lattices and types of lattices.

Unit – I **(15 Hours)**

Relations and Functions :Cartesian Product of Two sets – Relations – Representations of a Relation – Operations on Relations – Equivalence Relations – Closures and Warshall's Algorithm – Partitions and Equivalence Classes.

Functions and operators – One – to – one , Onto functions – Special Types of Functions – Invertible Functions – Composition of Functions.(Proofs of the Theorems are not included – Problems only)

Unit – II **(15 Hours)**

Matrix Algebra : Introduction - Matrix operations – Inverse of a Square Matrix – Elementary operations and Rank of a Matrix – Simultaneous Linear Equations – Inverse by Partitioning - Eigen values and Eigen vectors.(Proofs of the Theorems are not included – Problems only)

Unit – III **(15 Hours)**

Logic :Introduction – TF-statements – Connectives – Atomic and compound statements – Well Formed (Statement) Formulae – Truth table of a Formula – Tautology – Tautological Implications and Equivalence of Formulae – Replacement Process – Functionally complete sets of connectives and Duality law – Normal Forms – Principal Normal Forms-Theory of Inference – Open statements – Quantifiers – Valid Formulae and Equivalence – Theory of Inference for Predicate Calculus – Statements involving more than one Quantifier.

Unit – IV **(15 Hours)**

Lattices and Boolean Algebra : Lattices – Some properties of Lattices – New Lattices – Modular and Distributive Lattices.(Proofs of the Theorems are not included – Simple problems only)

Unit – V **(15 Hours)**

Graph Theory : Basic concepts – Matrix Representation of Graphs **(Proofs of the Theorems are not included)**

Text Book:

Venkataraman. M.K., Sridharan. N. and Chandrasekaran. N., 2009, Discrete Mathematics, The National Publishing Company.

Unit	Chapter/Section
I	II(1 – 7) III(1 – 5)
II	VI(1 – 7)
III	IX(1 – 18)
IV	X(1- 4)
V	XI(1 and 2)

Reference Books:

1)Trembley. J.P. and Manohar. R., 2001, Discrete Mathematical Structures with Applications to Compute Science, Tata McGraw –Hill Publishing Company Ltd, New Delhi.

2) Seymour Lipschutz and Marc Lars Lipson, 2002, Discrete Mathematics, Tata McGraw Hill Publishing Company Ltd.

Course designers:

1) Dr. B. Arivazhagan
2) Dr. R. Angeline Chella Rajathi

THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)

POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

(For those joined B.Sc. Computer Science / B.Sc. Computer Science(S.F.) on or after June 2017)

Course	: Ancillary	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: II	Max. Marks	: 100
Sub. Code	: AS21	Hours / week	: 5
Title of the Paper	**: Statistics**	Credits	: 5

Course Outcomes: On the successful completion of the course, students will be able to

1. Acquire various skills about basic statistical concepts.
2. Fit statistical data in various distributions.

Unit – I **(15 Hours)**

Central Tendencies: Introduction – Arithmetic Mean.

Measures of Dispersion: Introduction – Measures of Dispersion.

Unit - II **(15 Hours)**

Correlation and Regression: Introduction – Correlation – Rank Correlation – Regression.

Unit - III **(15 Hours)**

Random Variables:Mathematical Expectations – Mathematical Expectation of Continuous Random Variable – Moment Generating Function – Characteristic Function.

Unit – IV **15 Hours)**

Some Special Distributions**:** Introduction – Binomial Distribution – Poisson Distribution.

Unit - V **(15 Hours)**

Normal Distribution, Some more continuous distribution (Gamma distribution, Chi-square distribution, Student's t -distribution, Snedecor's F- distribution, Fischer's Z – distribution).

Note: Formula Derivations are not required. Only problems need be dealt with.

Text Book :

Arumugam. S. and Thangapandi Isaac. A., 2011, Statistics, New Gamma Publishing House.

Unit	Chapter/Section
I	2(2.0 - 2.1), 3(3.0, 3.1)
II	6(6.0 – 6.3)
III	12(12.4 – 12.6)
IV	13(13.0 – 13.2)
V	13(13.3, 13.4)

Reference Books:

1 Vittal. P.R., 2013, Mathematical Statistics, Margham Publications, Chennai.

2 Gupta. S.C. and Kapoor. V.K.,2007, Fundamentals of Mathematical Statistics, Eleventh edition, Sultan Chand & sons, New Delhi.

3 Gupta. S.C., Kapoor, V.K., 2015, Elements of Mathematical Statistics, Third Edition, Sultan Chand & Sons, Educational Publishers, New Delhi.

Course Designers:

1) Dr. G. Prabakaran 2) Dr. R. Angeline Chella Rajathi

THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

(For those joined B.Sc. Computer Science / B.Sc. Computer Science(S.F.) / B.C.A./ B.Sc.(I.T.) on or after June 2017)

Course	: Generic Elective	Int.Marks	: 25
Class	: II Year	Ext.Marks	: 75
Semester	: III	Max.Marks	: 100
Sub. Code	: SA131/SAM31/AS31	Hours / week	: 5
Title of the Paper	: **Numerical Methods**	Credits	: 5

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand the methods of solving algebraic and transcendental equations numerically.
2. Solve problems involving differentiation and integration numerically.
3. Interpolate and extrapolate given statistical data.

Unit – I **(15 Hours)**

The Solution of Numerical Algebraic and Transcendental Equations : Introduction - The Bisection Method – Method of Successive Approximations – The Method of False Position – Newton-Raphson method – Horner's method (Problems only).

Unit – II **(15 Hours)**

Simultaneous Linear Algebraic Equations : Introduction - Gauss Elimination Method – Computation of the Inverse of a Matrix using Gauss's Elimination Method - Method of Triangularisation –Iterative Methods (problems only).

Unit – III **(15 Hours)**

Interpolation:Introduction – Linear interpolation –Gregory-Newton Forward Interpolation Formula – Gregory-Newton Backward Interpolation Formula – Equidistant terms with one or more missing values. Interpolation with Unequal Intervals: Divided differences – Newton's interpolation formula for unequal intervals – Lagrange's interpolation formula – Inverse interpolation (problems only).

Unit – IV **(15 Hours)**

Numerical differentiation and Integration: Introduction - Newton's forward difference formula to compute the derivatives - Newton's Backward difference formula to compute the derivatives. Numerical Integration -Trapezoidal rule – Truncation Error in the Trapezoidal Formula – Romberg's Method - Simpson's Rule(problems only).

Unit – V **(15 Hours)**

Numerical solution of Ordinary Differential Equations : Solution by Taylor series – Euler's method – Improved Euler's Method – Modified Euler's Method – Runge - Kutta methods – Second order Runge -Kutta method – Higher order Runge - Kutta methods – Predictor - Corrector methods – Milnes's Predictor - Corrector formulae(problems only).

Text Book:

Venkataraman. M.K., 2009, Numerical Methods in Science and Engineering, Fifth edition The National publishing company, Chennai.

Unit	**Chapter/Section**
I	III (1 to 5 and 8 (Horner's method))
II	IV (1 to 4 and 6)
III	VI (1 to 5) VIII (1, 3, 4 and 5(Inverse interpolation))
IV	IX (1 to 3, 7 to 10)
V	XI (6, 10 to 15, 19 and 20)

Reference Books:

1) Arumugam. S., ThangapandiIssac. A. and Somasundaram. A., 2014,Numerical methods, Second Edition, SciTech Publications(India) Pvt. Ltd., Chennai.
1) Kandasamy. P., Thilgavathy. K. and Gunavathy. S., 2007, Numerical methods, Chand and Co.
2) Balagurusamy. E., 2002, Numerical methods, Tata McGraw Hill Publishing Company Ltd., India

Course Designers:

1.Mrs. S.Shanavas Parvin
2.Ms. K. Ponmari

THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)

POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

(For those joined B.Sc. Computer Science / B.Sc. Computer Science(S.F.) / B.C.A./ B.Sc.(I.T.) on or after June 2017)

Course	: Generic Elective	Int.Marks	: 25
Class	: I &II Year	Ext.Marks	: 75
Semester	: II & IV	Max.Marks	: 100
Sub. Code	: SA121/SAM21/AS41	Hours / week	:5
Title of the Paper	**: Operations Research**	Credits	: 5

Course Outcomes: On the successful completion of the course, students will be able to

1. Know the origin and development of Operations Research.
2. Develop the skills of formulation of LPP and different techniques to solve it.
3. Know the application of Transportation and Assignment problems.

Unit – I **(15Hours)**

Operations Research(OR) - anoverview : Introduction- Origin and development of OR – Applications of OR – Opportunities and shortcomings of OR - Linear Programming Problem(LPP**)-** Mathematical formulation: Introduction – LPP - Mathematical Formulation of the problem – Illustration of MathematicalFormulation of LPP's **–** LPP**:** Graphical Solution and extension:Introduction - Graphical Solution method - Some exceptional cases - General LPP – Canonical and Standard Forms of LPP.

Unit – II **(15 Hours)**

LPP Simplex Method: Introduction - Fundamental properties of solutions– The Computational Procedure – Use of Artificial Variables (Problems only).

Unit – III **(15Hours)**

Duality inLPP**:** Introduction – General primal-dual Pair - Formulating a dual Problem – Primal dual pair in matrix form – Duality and simplex method - Dual simplex method (Problems only).

Unit – IV **(15 Hours)**

Transportation Problem (TP): Introduction –LP formulation of the transportation problem – The Transportation Table – Loops in transportation tables – Triangular basis in a TP - Solution of a TP– Finding an initial basic feasible Solution – Test for optimality – Transportation algorithm (MODI Method) – Some exceptional cases.

Unit – V **(15 Hours)**

Assignment Problem: Introduction – Mathematical formulation of the problem – Solution methods of Assignment problem – Special cases in Assignment Problems.

Text Book:

Kanti Swarup, Gupta. P.K., and Man Mohan, 2014, Operations Research, Seventeenth Edition, Sultan Chand & Sons.,New Delhi.

Unit	Chapter/Section
I	1 (1.1, 1.2,1.10 , 1.11), 2 and 3(3.1 to 3.5)
II	4 (4.1 to 4.4)
III	5 (5.1 to 5.4 , 5.7 ,5.9)
IV	10(10.1, 10.2, 10.5 to 10.10,10.13, 10.15)
V	11(11 .1 to 11.4)

Reference Books:

1) Sharma. J.K.,2013,Operations Research: Theory and Applications, Fourth edition, Macmillan Publishers India Ltd.

2) Kalavathy. S., 2013, Operations Research, Fourth edition, Vikas Publishing House Pvt. Ltd, New Delhi.

3) Arumugam. S., ThangapandiIssac, A., 2010, Topics in Operations Research,New Gamma Publishing House,Palayamkottai.

Course Designers:

1. Mrs. S.Shanavas Parvin
2. Ms. K. Ponmari

THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: AECC	Int. Marks	: 15
Class	: I Year	Ext. Marks	: 35
Semester	: II	Max. Marks	: 50
Sub. Code	: MAEC21	Hours / week	: 2
Title of the Paper	**: Quantitative Aptitude**	Credits	: 2

Course Outcome: On the successful completion of the course, students will be able to

1. Develop Mathematical Aptitude skills.
2. Succeed in the competitive examinations.

Unit - I **(15 Hours)**

H.C.F. and L.C.M. of Numbers – Decimal Fractions – Average – Percentage – Profit and Loss – Ratio and Proportion.

Unit - II

(15 Hours)

Time and Distance – Simple interest – Compound interest – True discount – Banker's discount.

Text Book:

Agarwal. R.S., 2013, Quantitative Aptitude S.Chand and Co., Delhi.

Unit	Chapter/section
I	2, 3, 6, 10, 11, 12
II	17, 21, 22, 32, 33

Reference Books:

1) Arora. P.N. and Arora. S., 2009, Quantitative Aptitude Mathematics : Volume- 1, S. Chand & Company Ltd.
2) Kothari. C.R., 1989, Quantitative Techniques,Vikas Publishing House Pvt. Ltd.
3) Srinivasan. T.M., Perumalswamy. S. and Gopala Krishnan. M.D.,1985, Elementsof Quantitative Techniques, Emerald Publishers.

Course designers:

1) Mr. S. Sornavel
2) Dr. G. Prabakaran

M.Sc. Mathematics
(Aided & SF)

THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)

POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

M.Sc. MATHEMATICS

COURSE STRUCTURE (w.e.f. 2017 – 2019 batch onwards)

Semester – I

Code No.	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks		Total
					CA	SE	
1PM1	Groups and Rings	6	5	90	25	75	100
1PM2	Real Analysis	6	5	90	25	75	100
1PM3	Ordinary Differential Equations	6	5	90	25	75	100
1PM4	Number Theory	6	5	90	25	75	100
1PML1	Java Practical	6	4	90	40	60	100
Total		30	24				

Semester – II

Code No.	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks		Total
					CA	SE	
2PM1	Theory of Fields	6	5	90	25	75	100
2PM2	Complex Analysis	6	5	90	25	75	100
2PM3	Topology	6	5	90	25	75	100
2PM4	Partial Differential Equations	6	4	90	25	75	100
2PM5	Graph Theory	6	4	90	25	75	100
Total		30	23				

Semester – III

Code No.	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max. Marks		Total
					CA	SE	
3PM1	Linear Algebra	6	4	90	25	75	100
3PM2	Mechanics	6	5	90	25	75	100
3PM3	Functional Analysis	6	4	90	25	75	100
3PME1	Elective – I	6	4	90	25	75	100
3PME2	Elective – II	6	4	90	25	75	100
Total		30	21				

Semester – IV

Code No.	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks		Total
					CA	SE	
4PM1	Statistics	6	4	90	25	75	100
4PM2	Measure and Integration	6	5	90	25	75	100
4PM3	Optimization Techniques	6	4	90	25	75	100
4PME1	Elective – III	6	4	90	25	75	100
PJ	Project work	6	5	90	40	60	100
Total		30	22				

Major Electives I and II to be chosen from the following

1) Combinatorics
2) Fluid Dynamics
3) Differential Geometry
4) Theory of Computation
5) Non linear differential equations

Major Elective III to be chosen from the following

1) Numerical Analysis
2) Algorithmic Graph Theory
3) Differential Equations and Dynamical Systems

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
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Course	: Core	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: I	Max. Marks	:100
Sub. Code	: 1PM1	Hours / week	: 6
Title of the Paper	**: Groups and Rings**	Credits	: 5

Course Outcome: On the successful completion of the course, students will be able to

1. study the advance ideas in Group theory
2. understand the concept of polynomial rings, Noetherian rings and Artinian Rings.

Unit - I **(18 Hours)**

A counting principle - Normal subgroups and Quotient groups - Homomorphisms - Automorphisms - Cayley's theorem - Permutation groups.

Unit - II **(18 Hours)**

Another counting principle - Sylow's theorem - Direct products - Finite Abelian groups.

Unit - III **(18 Hours)**

Euclidean Ring – A particular Euclidean Ring - Polynomial Rings - Polynomials over the Rational field.

Unit - IV **(18 Hours)**

Generators of a subgroup – Derived subgroups – Normal series – Solvable groups – Composition series – Zassenhaus lemma - Schrier's Refinement theorem – Jordan-Holder theorem.

Unit - V **(18 Hours)**

Noetherian Rings - Artinian Rings.

Text Books:

1) Herstein. I.N., 2014, Topics in Algebra, Wiley Student Edition
2) Surjeet Singh and Qazi Zameeruddin, 2015, Modern Algebra, Vikas Publishing House Pvt. Ltd.

Unit	Book	Chapter/Section
I	1	2.5 – 2.10
II	1	2.11 – 2.14
III	1	3.7 – 3.11
IV	2	5
V	2	15

Reference Books:

1) Vijay K Khanna and S.K. Bhambri , 2015, A course in Abstract Algebra, Vikas Publishing House Pvt. Ltd.,
2) Richard M. Foote and David S. Dummit , 2011, Abstract Algebra, John Wiley Publications
3) Joseph A Gallian, 1999, Contemporary Abstract Algebra, Narosa Publication, 1999

Course designers:

1) Dr. G. Prabakaran
2) Dr. M. Senthilkumaran

THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Core	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: I	Max. Marks	: 100
Sub. Code	: 1PM2	Hours / week	: 6
Title of the Paper	**: Real Analysis**	Credits	: 5

Course Outcome: On the successful completion of the course, students will be able to

1. Understand the Riemann Stieltjes integral of real valued functions on intervals and its properties.
2. Acquire knowledge in uniform convergence and differentiation and in uniform convergence and integration.
3. Know the structure of the exponential, the logarithmic, the trigonometric, the gamma and beta functions**.**

Unit – I **(18 Hours)**

Continuity : Limits of functions – Continuous Functions – Continuity and Compactness – Continuity and Connectedness – Discontinuities – Monotonic Functions – Infinite Limits and Limits at Infinity.

Unit – II **(18 Hours)**

Differentiation : The Derivative of a Real Function – Mean Value Theorems – The Continuity of Derivatives– L' Hospital's Rule - Derivatives of Higher Order – Taylor's Theorem – Differentiation of vector -valued functions.

Unit – III **(18 Hours)**

The Riemann – Stieltjes Integral : Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation – Integration of Vector - Valued Functions – Rectifiable Curves.

Unit – IV **(18 Hours)**

Sequences and Series of Functions : Discussion of Main Problem – Uniform Convergence – Uniform Convergence and Continuity – Uniform Convergence and Integration – Uniform Convergence and Differentiation.

Unit – V **(18 Hours)**

Equicontinuous Families of Functions – The Stone – Weierstrass Theorem –
Some Special Functions: Power Series – The Exponential and Logarithmic Functions – The Trigonometric functions – The Algebraic Completeness of the Complex Field – The Gamma Function.

Text Book : Walter Rudin, 2013, Principles of Mathematical Analysis, Third Edition McGraw - Hill Education (India) Pvt. Ltd.

Unit	Chapter/Page
I	4 (Full)
II	5 (Full)
III	6 (Full)
IV	7 (Pages 143 – 154)
V	7 (Pages 155 – 161), 8 (Pages 172 – 185 and 192 -195)

Reference Book :

1) Karunakaran. V, 2012, Real Analysis, Pearson.
2) Stephen Abbott, 2010, Understanding Analysis, Springer.
3) Tom M. Apostol,1969, Mathematical Analysis , A Modern Approach to Advanced Calculus, Addison-Wesley Publishing Company,

Course designers:

1) Mrs R. Latha
2) Dr. G. Prabakaran

THIAGARAJAR COLLEGE, MADURAI- 9
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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(For those who join in 2017 and after)

Course	: Core	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: I	Max. Marks	: 100
Sub. Code	: 1PM3	Hours / week	: 6
Title of the Paper	**: Ordinary Differential Equations**	Credits	: 5

Course Outcome: On the successful completion of the course, students will be able to

1. learn mathematical methods to solve higher order differential equations.
2. understand the concept of power series solution, special function, existence and uniqueness of solutions of ODE's.
3. acquire the knowledge in Nonlinear differential equations and stability by Liapunov's Direct Method.

Unit – I **(18 Hours)**

Second Order Linear Equations: Introduction – The General Solution of the Homogeneous Equation – The use of a known solution to find another – The Homogeneous Equation with constant co-efficients – The method of Undetermined co-efficients – The method of variation of Parameters.

Unit – II **(18 Hours)**

Power Series solutions and Special functions: Introduction – A Review of Power series- Series solutions of First Order Equations – Second Order Linear Equations (Ordinary Points) – Regular Singular Points - Regular Singular Points (Continued) – Gauss's Hypergeometric Equation – The point at Infinity.

Unit – III **(18 Hours)**

Some Special Functions of Mathematical Physics: Legendre Polynomials – Properties of Legendre Polynomials – Bessel Functions (The Gamma Function) – Properties of Bessel functions.

Unit – IV **(18 Hours)**

Systems of First Order Equations: General Remarks on systems – Linear systems – Homogeneous Linear systems with constant co-efficients – The Existence and Uniqueness of solutions: The method of Successive Approximations – Picard's Theorem.

Unit – V **(18 Hours)**

Nonlinear Equations: Autonomous Systems (The Phase Plane and its phenomena) – Types of Critical Points (Stability) – Critical Points and stability of Linear Systems – Stability by Liapunov's Direct Method – Simple Critical Points of Nonlinear Systems.

Text Book:

George F. Simmons, 2008, Differential Equations with Applications and Historical Notes, Tata McGraw-Hill Publishing Company Limited, Second Edition.

Unit	**Chapter/Section**
I	3(14 - 19)
II	5(26 - 32)
III	8(44 - 47)
IV	10(54 - 56) 13(68,69)
V	11(58 - 62)

Reference Books :

1) Earl A. Coddington, 2010, An Introduction to Ordinary Differential Equations PHI Learning Private Limited.
2) Somasundaram. D., Ordinary Differential Equations : A First Course, 2001, Narosa Publishing House.
3) Deo. S.G., V. Lakshmikantham and V. Raghavendra, 2010, Text Book of Ordinary Differential Equations, Tata McGraw Hill Education Private Limited.

Course designers:

1) Dr. M. Senthilkumaran
2) Dr. D. Pandiaraja

THIAGARAJAR COLLEGE, MADURAI- 9
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Course	: Core	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: I	Max. Marks	: 100
Sub. Code	: 1PM4	Hours / week	: 6
Title of the Paper	**: Number Theory**	Credits	: 5

Course Outcome: On the successful completion of the course, students will be able to

1. understand some importance tools in number theory and study of distributions of primes
2. acquire knowledge in Diophantine equations

Unit – I : Divisibility **(18 Hours)**

Introduction – Divisibility - Primes

Unit - II : Congruences **(18 Hours)**

Congruences – Solutions of congruences – The Chinese remainder theorem

Unit - III : Quadratic reciprocity **(18 Hours)**

Quadratic residues – Quadratic reciprocity – The Jacobian symbol

Unit - IV : Some functions of Number Theory **(18 Hours)**

Greatest integer function – Arithmetic functions – The Mobius inversion formula.

Unit - V : Diophantine equations **(18 Hours)**

The equation ax + by = c – Simultaneous linear equations – Pythagorean triangles

Text Book:

Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, 2013,
An introduction to The Theory of Numbers, Wiley India Pvt. Ltd., Fifth Edition

Unit	Chapter/Section
I	1.1 – 1.3
II	2.1 – 2.3
III	3.1 – 3.3
IV	4.1 – 4.3
V	5.1 – 5.3

Reference books:

1) David M. Burton, 2010, Elementary Number Theory, Tata McGraw-Hill Education Pvt. Ltd., Sixth Edition

2) Martin Erickson and Anthony Vazzana, 2009, Introduction to Analytic Number Theory, Chapman and Hall /CRC publications

3) George E. Andrews , 1992, Number Theory, Hindustan Publishing Corporation, India

Course designers:

1) Dr. G. Prabakaran
2) Dr. K. Kayathri

THIAGARAJAR COLLEGE, MADURAI- 9
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Course	: Core	Int. Marks	: 40
Class	: I Year	Ext. Marks	: 60
Semester	: I	Max. Marks	: 100
Sub. Code	: 1PML1	Hours / week	: 6
Title of the Paper	**: Lab in Java Programming**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. Remember basic programming concepts.
2. Understand java programming fundamentals.
3. Write some simple java programs and java graphics programs.

List of Programs

1. Program to find sinx and cosx in desired accuracy.
2. Program to sort the given n numbers and Names.
3. Program to solve the quadratic equation using switch..case statement.
4. Program to add two given matrices.
5. Program to multiply two given matrices.
6. Program to find the transpose of a given matrix.
7. Program to print multiplication table
8. Program to implement multiple inheritance
9. Program to create a Package to check whether the given number is odd or even, prime and to find its divisors.
10. Program to use priority in threads.
11. Program to create simple applets.
12. Program to implement interactive input to an applet.
13. Program in java to handle exceptions.
14. Program to draw a human face.
15. Program to draw bar charts.

Course Designers
1) Dr. B. Arivazhagan
2) Dr. D. Pandiaraja

THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Core	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: II	Max. Marks	: 100
Sub. Code	: 2PM1	Hours / week	: 6
Title of the Paper	**: Theory of Fields**	Credits	: 5

Course Outcome: On the successful completion of the course, students will be able to

1. learn field theory and its extension.
2. identify the idea connected to Galois theory and its application in solvability by radicals and some concepts in linear transformations.

Unit - I **(20 Hours)**

Extension Fields – Roots of polynomials

Unit - II **(16 Hours)**

Construction with straight edge and compass – More about roots

Unit – III **(20 Hours)**

The elements of Galois theory - Solvability by radicals – Galois group over the rationals.

Unit – IV **(16 Hours)**

Finite fields – Wedderburn's theorem on finite division rings.

Unit – V **(18 Hours)**

A theorem of Frobenius – Integral Quaternions and the Four-Square theorem.

Text Book:

Herstein. I.N., 2014, Topics in Algebra, Wiley Student Edition

Unit	Chapter/Section
I	5.1, 5.3
II	5.4, 5.5
III	5.6, 5.7, 5.8
IV	7.1, 7.2
V	7.3, 7.4

Reference Books:

1) Vijay K Khanna and S.K. Bhambri , 2015, A course in Abstract Algebra, Vikas Publishing House Pvt. Ltd.,
2) Richard M. Foote and David S. Dummit , 2011, Abstract Algebra, John Wiley Publications
3) Joseph A Gallian, 1999, Contemporary Abstract Algebra, Narosa Publication, 1999

Course designers:

1) Dr. G. Prabakaran
2) Dr. M. Senthilkumaran

THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Core	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: II	Max. Marks	: 100
Sub. Code	: 2PM2	Hours / week	: 6
Title of the Paper	**: Complex Analysis**	Credits	: 5

Course Outcome: On the successful completion of the course, students will be able to

1) lay the foundation for topics in Advanced Complex Analysis.
2) analyze the Taylor series, Laurent series and elliptic functions.
3) develop clear thinking and analyzing capacity for research.

Unit - I **(18 Hours)**

Complex Functions: Introduction to the concept of analytic functions – Limits and Continuity – Analytic functions – Polynomials – Rational functions. Elementary theory of Power series – Sequences, Series, Uniform Convergence, Power Series, Abel's Limit theorem – The Exponential and Trigonometric Functions : The Exponential, the Trigonometric Functions – The Periodicity – The Logarithm.

Unit - II **(18Hours)**

Complex Integration: Fundamental Theorems – Line Integrals, Rectifiable arcs – Line Integrals as Functions of arcs – Cauchy's theorem for a rectangle – Cauchy's theorem in a disk – Cauchy's Integral formula – Index of a point – Integral Formula – Higher derivatives – Local Properties of Analytical Functions – Removable singularities – Taylor's theorem – Zeros and poles – The Local mapping – The Maximum Principle.

Unit – III **(18 Hours)**

Complex Integration: Calculus of Residues- Residue theorem, Argument Principle, Evaluation of definite Integrals. Harmonic Functions- Definition and Basic properties, the Mean- value Property, Poisson's Formula.

Unit – IV **(18 Hours)**

Series and Product Development : Power Series Expansions: Weierstrass's Theorem – The Taylor Series – The Laurent Series – Partial Fractions and Factorization: Partial Fractions – Infinite Products – Canonical Products – The Gamma Function – Entire functions : Jensen's Formula – Hadamard's theorem.

Unit – V **(18 Hours)**

Elliptic functions: Doubly Periodic Functions – The Period Module – Unimodular Transformations – The Canonical basis – General Properties of Elliptic Functions – Weierstrass Theory – Weierstrass ρ function – The function $\varsigma(z)$ and $\sigma(z)$ – The Differential Equation.

Text Book : Ahlfors, V., 2013, Complex Analysis, Third Edition, McGraw-Hill Education (India)

Unit	Chapter/Section
I	2
II	4 (1, 2 and 3)
III	4 (5.1, 5.2, 5.3, 6.1, 6.2, 6.3)
IV	5 (1.1, 1.2, 1.3 , 2.1, 2.2, 2.3, 2.4, 3.1,3.2)
V	7(2.1, 2.2, 2.3, 2.4, 3.1, 3.2 , 3.3)

Reference Books:

1) Roopkumar. R., 2015, Complex analysis, Dorling Kinderley Pvt. Ltd., New Delhi.

2**)** Ponnusamy. S., 2013, Foundation of Complex Analysis, Narosa Publishing House. New Delhi.

3) Karunakaran, V., 2006, Complex Analysis, Narosa Publishing House Pvt. Ltd. Second Edition, New Delhi.

Course Designers:

1. Mrs. S. Shanavas Parvin
2. Mrs. R. Latha

THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)

POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Core	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: II	Max. Marks	: 100
Sub. Code	: 2PM3	Hours / week	: 6
Title of the Paper	**: Topology**	Credits	: 5

Course Outcome: On the successful completion of the course, students will be able to

1. have a clear understanding on the concept of topological spaces, continuous functions, connectedness, countability and separation axioms.
2. aware of the weierstrass approximation theorem and the stone-weierstrass theorem.

Unit – I **(22 Hours)**

Topological Spaces – Basis for a topology – The order topology – The product topology on X x Y – The subspace topology – Closed sets and limit points – Continuous functions – The product topology – The metric topology.

Unit – II **(17 Hours)**

Connected Spaces – Connected Subspaces of the Real line – Components and local connectedness.

Unit – III **(17 Hours)**

Compact Spaces – Compact Subspaces of the Real line – Limit point compactness.

Unit – IV **(17 Hours)**

The Countability axioms – The Separation axioms – Normal spaces – The Urysohn lemma.

Unit – V **(17 Hours)**

The Urysohn Metrization theorem – The Tietze extension theorem – The Tychonoff theorem. **Text Book:**

James R. Munkres, 2016, Topology**,** PHI Learning Private limited, Second Edition.

Unit	Chapter/Section
I	2(12 – 20)
II	3(23 – 25)
III	3(26 – 28)
IV	4(30 – 33)
V	4(34, 35), 5(37)

Reference Books :

1 George F. Simmons, 2012, Introduction to Topology and Modern Analysis, Eighteenth Reprint, Tata McGraw-Hill Education Private Limited.

2 Chandrasekhara Rao. K.,Topology, 2012, Narosa Publishing House

3 Chatterjee. D., 2007, Topology General & Algebraic, New Age International.

4 Deshpande. J.V., 1998, Introduction to Topology, Tata McGraw-Hill.

Course Designers:

1) Dr. G. Prabakaran

2) Ms. K. Ponmari

THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)

POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Core	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: II	Max. Marks	: 100
Sub. Code	: 2PM4	Hours / week	: 6
Title of the Paper	**: Partial Differential Equations**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. understand various methods of solving different kinds of Partial differential equations.
2. have a clear understanding on the concept of elliptic, parabolic and hyperbolic equations.

Unit – I **(18 Hours)**

Partial Differential Equations of First Order: Formation of Partial Differential Equation – Solution of Partial Differential Equations of First Order – Integral Surfaces Passing Through a Given Curve – The Cauchy Problem for First Order Equations – Surfaces Orthogonal to a Given System of Surfaces – First Order Non-linear Equation – Compatible Systems of First Order Equations – Charpit's Method.

Unit – II **(18 Hours)**

Fundamental Concepts: Introduction – Classification of Second Order PDE – Canonical Forms – Adjoint Operators – Linear Partial Differential Equations with Constant Coefficients – Homogeneous Linear PDE with Constant Coefficients.

Unit – III **(18 Hours)**

Elliptic Differential Equations: Occurrence of the Laplace and Poisson Equations – Boundary Value Problems (BVPs) – Separation of Variables – Dirichlet Problem for a Rectangle – The Neumann Problem for a Rectangle – Interior Dirichlet Problem for a Circle – Exterior Dirichlet Problem for a Circle – Interior Neumann Problem for a Circle – Solution of Laplace Equation in Cylindrical Coordinated – Solution of Laplace Equation in Spherical Coordinates.

Unit – IV **(18 Hours)**

Parabolic Differential Equations: Occurrence of the Diffusion Equation – Boundary Conditions – Elementary Solutions of the Diffusion Equation – Dirac Delta Function – Separation of Variables Method – Solution of Diffusion Equation in Cylindrical Coordinates – Solution of Diffusion Equation in Spherical Coordinates.

Unit – V **(18 Hours)**

Hyperbolic Differential Equations: Occurrence of the Wave Equation – Derivation of One-dimensional Wave Equation – Solution of One-dimensional Wave Equation by Canonical Reduction – The Initial Value Problem; D'Alembert's Solution – Vibrating String – Variables Separable Solution – Forced Vibrations – Solution of Non-homogeneous Equation – Boundary and Initial Value Problem for Two-dimensional Wave Equations – Method of Eigenfunction – Periodic Solution of One-dimensional Wave Equation in

Cylindrical Coordinates – Periodic Solution of One-dimensional Wave Equation in Spherical Polar Coordinates.

Text Book:

Sankara Rao. K., 2016, Introduction to Partial Differential Equations, PHI Learning Private Limited

Unit	Chapter/ Section
I	0(0.4 – 0.11)
II	1(1.1 – 1.4, 1.6, 1.7)
III	2(2.1 – 2.2, 2.5 – 2.12)
IV	3(3.1 – 3.7)
V	4(4.1 – 4.9)

Reference Books :

1) Elements of Partial Differential Equations – I. N. Sneddon, McGraw-Hill, 1957.
2) Introduction to Partial Differential Equations : A Computational Approach - Aslak Tveito & Ragnar Winther, Springer – Verleg, 2010.
3) Partial Differential Equations: An Introductory Treatment with Applications, - K. S. Bhamra, PHI Learning Private Limited, 2010.

Course Designers:

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2) Dr. D. Pandiaraja

THIAGARAJAR COLLEGE, MADURAI- 9
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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(For those who join in 2017 and after)

Course	: Core	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: II	Max. Marks	: 100
Sub. Code	: 2PM5	Hours / week	: 6
Title of the Paper	**: Graph Theory**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. Understand the basic concepts in Graph Theory.
2. Apply the graph theoretical concepts to model real life situations.

Unit – I **(18 Hours)**

Connectivity: Cut–Vertices – Blocks – Connectivity – Menger's Theorem.

Unit – II **(18 Hours)**

Matchings and Factorization: Matchings – Factorization – Decompositions and Graceful Labelings.

Unit – III **(18 Hours)**

Planarity: Planar Graphs – Embedding Graphs on Surfaces.

Unit – IV **(18 Hours)**

Coloring: The Four Color Problem – Vertex Coloring – Edge Coloring.

Unit – V **(18 Hours)**

Distance: The Center of a Graph – Distant Vertices – Channel Assignment.
Domination: The domination number of a graph.

Text Book:

Gary Chartrand and Ping Zhang, 2006. Introduction to Graph Theory,
Tata McGraw – Hill.

Unit	Chapter/Section
I	5(5.1 – 5.4)
II	8(8.1 – 8.3)
III	9(9.1, 9.2)
IV	10(10.1 – 10.3)
V	12(12.1,12.2,12.5) 13(13.1)

Reference Books:

1) Balakrishnan, R. and Ranganathan, K., 2012, A Textbook of Graph Theory, 2nd Edition, Springer-Verlag New York, Inc.
2) Bondy, J.A. and Murthy, U.S.R., 2008, Graph Theory, Springer-Verlag London.
3) Douglas B. West, 2001, Introduction to Graph Theory –Prentice – Hall of India.
4) Harary, 1989, Graph Theory, Narosa Publishing House.
5) http://diestel-graph-theory.com/basic.html
6) http://www.maths.lse.ac.uk/Personal/jozef/LTCC/Graph_Theory_Bondy_Murty.pdf
http://www.freetechbooks.com/graph-theory-f67.html

Course Designer

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THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(For those who join in 2017 and after)

Course	: Core	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: III	Max. Marks	: 100
Sub. Code	: 3PM1	Hours / week	: 6
Title of the Paper	**: Linear Algebra**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. learn the basic concepts and methods in the study of Linear transformation of finite dimensional vector spaces and their Matrix forms.
2. have a clear understanding on the concept of dual spaces and modules.

Unit - I **(18 Hours)**

Elementary Basic Concepts – Linear independence and bases– Inner product spaces

Unit - II **(16 Hours)**

Dual spaces - Modules

Unit - III **(18 Hours)**

The algebra of linear transformations - Characteristic roots

Unit - IV **(20 Hours)**

Matrices - Canonical forms - Triangular forms – Nilpotent transformations

Unit - V **(18 Hours)**

Hermitian, Unitary and Normal transformations – Real Quadratic forms

Text Book:

- I.N. Herstein, 2014, Topics in Algebra Wiely India Pvt. Ltd.

Unit	Chapter/Section
I	4.1, 4.2, 4.4
II	4.3, 4.5
III	6.1, 6.2
IV	6.3, 6.4, 6.5
V	6.10, 6.11

Reference books :

1) Joseph A Gallian, 1999, Contemporary Abstract Algebra, Narosa Publication.
2) Kenneth Hoffman and Ray Kunze Linear Algebra, 2009, PHI Learning Pvt. Ltd.
3) Vijay K Khanna and S.K. Bhambri, 2012, A course in Abstract Algebra Vikas Publishing House Pvt. Ltd.

Course designers:

1) Dr. G. Prabakaran
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THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)

POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Core	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: III	Max. Marks	: 100
Sub. Code	: 3PM2	Hours / week	: 6
Title of the Paper	**: Mechanics**	Credits	: 5

Course Outcome: On the successful completion of the course, students will be able to

1. Understand the basic concepts and principles of Lagrangian and Hamiltonion.
2. Analyze the mechanism of solving the problem.
3. Remember the postulates governing static and dynamic system and to study difference application of these concepts.

Unit – I **(18 Hours)**

Survey of Elementary Principles : Mechanics of a particle - Mechanics of a system of particles – D'Alembert's Principle and Lagrange's equation – Velocity-dependent potential and dissipation function – Simple application of the Lagrangian formulation.

Unit – II **(18 Hours)**

Variational Principle and Lagrange's Equations : Hamilton's Principle – Some Techniques of the calculus of variation – Derivation of Lagrange's Equation from Hamilton's principle – Extension of Hamilton's principle through nonholonomic systems – Conservation theorems and symmetry Properties.

Unit – III **(18 Hours)**

Two Body Central Force Problem : Reduction to one body Problem – The equations of motion and first integrals – The equivalent one-dimensional problem – The virial theorem – The differential equation for the orbit, and integrable power-law potentials – Conditions for closed orbits – The Kepler problem: Inverse square law of force – The motion in time in the Kepler problem – The Laplace- Runge- Lenz vector

Unit – IV **(18 Hours)**

The Hamilton equations of motion : Legendre transformations and the Hamilton equations of motion – Cyclic co-ordinates and conservation theorem – Derivation of Hamilton's equations from a variational principle – The principle of least action.

Unit – V **(18 Hours)**

Canonical transformations: The equations of canonical transformation – Examples of canonical transformations – Poisson brackets and other canonical invariants.

Text Book:

Herbert Goldstein, 2002, Classical Mechanics, Second Edition, Narosa Publishing House.

Unit	Chapter/Section
I	1
II	2(2.1 – 2.4)
III	3(3.1 – 3.9)
IV	8(8.1, 8.2, 8.5, 8.6)
V	9(9.1, 9.2, 9.4)

Reference Books :

1) V.B. Bhatia, 2001, Classical Mechanics, Narosa Publishing House.
2) Mondal. C.R., Classical Mechanics, 2004, PHI Learning Pvt. Ltd.
3) John Robert Taylor, Classical Mechanics, 2005, University Science Books.

Course designers:

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THIAGARAJAR COLLEGE, MADURAI- 9
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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(For those who join in 2017 and after)

Course	: Core	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: III	Max. Marks	: 100
Sub. Code	: 3PM3	Hours / week	: 6
Title of the Paper	**: Functional Analysis**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to
1. develop the skills in analyzing the basic structure of normed spaces and
2. understand the concept of Banach spaces, Hilbert spaces and Banach algebra.

Unit – I **(18 Hours)**

Fundamentals of Normed Linear Spaces : Normed Linear Spaces – Continuity of Linear Maps.

Unit – II **(18 Hours)**

Hahn-Banach Theorems – Banach Spaces- Bounded Linear Maps on Banach Spaces : Uniform Boundedness Principle.

Unit – III **(18 Hours)**

Closed Graph Theorem – Open Mapping Theorem. Spaces of Bounded Linear Functionals : Duals and Transposes.

Unit – IV **(18 Hours)**

Geometry of Hilbert Spaces : Inner Product Spaces – Orthonormal Sets – Projection and Riesz Representation Theorems

Unit – V **(18 Hours)**

Bounded Operators on Hilbert Spaces: Bounded Operators and Adjoints – Normal, Unitary and Self – Adjoint Operators.

Text Book :

Balmohan Vishnu Limaye, 2012, Functional Analysis, 2nd Edition, New Age International.

Unit	Chapter/Section
I	Chapter II – 5, 6
II	Chapter II- 7 (pages: 104 to 118), 8. Chapter III-9 (pages: 138 to 144)
III	Chapter III-10, Chapter IV- 13
IV	Chapter VI – 21, 22, 24(pages: 420 to 431)
V	Chapter VII-25, 26

Reference Books :

1) Erwin Kreyszig, 2007, Introductory Functional Analysis with Applications, John Wiley & Sons.
2) Simmons. G.F., 2012, Introduction to Topology and Modern Analysis, 2012, Tata McGraw-Hill.
3) Ponnusamy. S., 2009, Foundations of Functional Analysis, Narosa Publishing House.

Course designers:

1) Dr. G. Prabakaran 2)Mrs. R. Latha

THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Core	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: IV	Max. Marks	: 100
Sub. Code	: 4PM1	Hours / week	: 6
Title of the Paper	**: Mathematical Statistics**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1) Understand the Basic concepts and principles of Distributions
2) Remember the nature and the importance of theoretical approach in statistical methods.
3) analyze the mechanism of solving the problems.

Unit – I : Some special distributions **(18 Hours)**

The Binomial and related distributions - Poisson distribution – The Gamma, Chi-square and Beta distributions – The Normal distribution – The multivariate normal distribution.

Unit – II : Some special distribution, unbiasedness, consistency and limiting distribution **(18 Hours)**

The t and F distributions – Expectations of functions – Convergence in probability – Convergence in distributions – Central limit theorem.

Unit – III : Some elementary statistical inferences **(18 Hours)**

Sampling and statistics – Order statistics – More on confidence interval – Introduction to hypothesis testing – Additional comments about statistical tests.

Unit – IV: Maximum likelihood methods, sufficiency **(18 Hours)**

Maximum likelihood estimation – Rao-Cramer lower bound and efficiency – Maximum likelihood tests – Measures of quality of estimators – A sufficient statistics for a parameter – Properties of a sufficient statistic.

Unit – V : Optimal test of Hypotheses **(18 Hours)**

Most powerful tests – Uniformly most powerful tests – Likelihood Ratio tests – The sequential probability ratio test.

Text Book :

Hogg. R.V., Craig. A.T. and J.W. Mckean, 2005, Introduction to Mathematical Statistics, Pearson Education.

Unit	Chapter/Section
I	3(3.1 – 3.5)
II	3(3.6), 4(4.1 – 4.4)

III	5(5.1, 5.2, 5.4 – 5.6)
IV	6(6.1 – 6.3), 7(7.1 – 7.3)
V	8(8.1 – 8.4)

Reference Books :

1) Gupta. S.C. and Kapoor. V.K., Mathematical Statistics, 2000, Sultan and Chand sons publishers.
2) Kapoor. J.N. and Saxena. H.C., 2009, Mathematical Statistics, 25th Edition, S. Chand & Co.,
3) Irwin Miller & Maryless Miller, 2004, John's Freund's Mathematical Statistics, 2004, Pearson Education.

Course designers:

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2) Dr. G. Prabakaran

THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Core	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: IV	Max. Marks	: 100
Sub. Code	: 4PM2	Hours / week	: 6
Title of the Paper	**: Measure and Integration**	Credits	: 5

Course Outcome: On the successful completion of the course, students will be able to

1) Understand the concepts of Lebesgue measure,measureable sets, measureable functions and Lebesque integration.
2) Acquire knowledge in singned measures and the Hahn and Jordan decompositions.

Unit – I **(18 Hours)**

Lebesgue Measure **:** Introduction – Lebesgue Outer Measure – The σ algebra of Lebesgue Measurable Sets- Outer and inner approxjmation of Lebesgue Measurable sets – Countable additivity, Continuity and the Borel Cantelli lemma-Nonmeasurable Sets – The antor set and the Cantor Lebesgue function

Unit – II **(18 Hours)**

Lebesgue Measurable Functions:Sums,Products and compositions – Sequential Pointwise limits and simple approximation - Littlewood's three principles,Egonoff's theorem and Lusin's theorem.

Unit - III **(18 Hours)**

Lebesgue Integration: The Riemann Integral – The Lebesgue Integral of a Bounded measurable function over a set of finite measure – The Lebesgue Integral of a nonnegative function – The general Lebesgue Integral- Countable additivity and continuity of integration – Uniform integrability: The Vitali convergence theorem.

Unit - IV

Differentiation and Integration **:** Continuity of monotone functions **-** Differentiability of Monotone functions: Lebesgue theorem - Functions of Bounded Variation: Jordan theorem – Absolutely continuous function: Intergrating derivatives: Differentiating indefinity integrals : Convex functions.

Unit – V **(18 Hours)**

General Measure spaces: Their properties and construction**:** Measures and Measurable Sets **-** Signed Measures:The Hahn and Jordan decompositions **–** The Caratheodory measure induced by an outer measure -.The construction of Outer Measures - The Caratheodory-Hahn theorem: The Extension of a premeasured to a measure.

Text Book :

Royden H.L., Fitzpatrick P.M., 2014, Real Analysis, Fourth Edition - PHI Learning Private Limited, Delhi,

Unit	Chapter
I	2 (full)
II	3 (full)
III	4(full)
IV	6 (full)
V	17 (full)

Reference Book :

1) Robert G.Bartle, 2014, The Elements of Integration and Lebesque Measure, John Wiley & Sons.

2)de Bara. G, 2013, Measure and Integration, Second Edition, Ellis Horwood Ltd.

3)Kumar Jain, Pawan Gupta V.P., Pankaj Jain, 2012, Lebesque Measure and Integration, Anshan.

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THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Core	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: IV	Max. Marks	: 100
Sub. Code	: 4PM3	Hours / week	: 6
Title of the Paper	**: Optimization Techniques**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. Understand shortest route and shortest distance algorithms, Inventory models, Game theory concepts and Queuing Models.
2. Solve some practical decision making problems and Non-linear programming problems
3. Analyze some managerial decision making problems.

Unit – I **(18 Hours)**

Network Models: Scope and Definition of Network models – Minimal spanning tree algorithm – Shortest route problem - Maximal flow model - CPM and PERT

Unit – II **(18 Hours)**

Deterministic Inventory Models: General Inventory model – Role of demand in the development of inventory models – Static economic order quantity (EOQ) models – Dynamic EOQ models. Probabilistic Inventory Models: Continuous review models – Single- period models – Multiperiod model

Unit – III **(18 Hours)**

Decision Analysis and Games: Decision making under certainty – Decision making under risk – Decision under uncertainty – Game theory

Unit – IV **(18 Hours)**

Queuing Systems: Why study queues? – Elements of a Queuing model – Role of exponential distribution – Pure birth and death models - Generalized Poisson Queuing model – Specialized Poisson Queues – (M/G/1):$(GD/\infty/\infty)$ - Pollaczek –Khintchine (P-K) formula – Other Queuing models – Queuing decision models

Unit – V

Nonlinear Programming Algorithms: Unconstrained Algorithms: Direct search method – Gradient method Constrained Algorithms: Separable programming - Quadratic programming- Chance – Constrained programming

Text Book:

Hamdy A. Taha, 2012 , Operations Research , Ninth edition , Pearson education , New Delhi.

Unit	Chapter / Section
I	6 (6.1 – 6.5)
II	13 & 16
III	15
IV	18
V	21

Reference Books :

1. Kanti swarup , P.K.Gupta and Man Mohan , 2014 , Operations Research , Sultan Chand & Sons , New Delhi.
2. Wayne L.Winston , 2010 , Operations Research Applications and Algorithms , Fourth Edition , Cengage Learning India private Limited , New Delhi
3. J.K.Sharma , 2009 , Operations Research Theory and Applications , Third Edition , Macmillan India Limited , Chennai

Course Designers :

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THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Elective	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: III	Max. Marks	: 100
Sub. Code	: 3PME1/3PME2(A)	Hours / week	: 6
Title of the Paper	**: Combinatorics**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. Understand the basic problems of Combinatorics: counting, existence, and optimization problems.
2. Apply advance tools of Combinatorics to solve enumeration problems.
3. Develop the combinatorial reasoning skills.

Unit - I **(18 Hours)**

General counting methods for arrangements and selections: Two basic counting principles – Simple arrangements and selections – Arrangements and selections with repetitions - Distributions – Binomial identities.

Unit – II **(18 Hours)**

Generating functions**:** Generating function models – Calculating Coefficients of Generating Functions – Partitions – Exponential Generating functions – A Summation Method.

Unit – III **(18 Hours)**

Recurrence Relations: Recurrence Relation Models – Divide-and-Conquer Relations – Solution of Linear Recurrence Relations – Solution of Inhomogeneous Recurrence Relations – Solutions with Generating Functions.

Unit – IV **(18 Hours)**

Inclusion-Exclusion: Counting with Venn diagrams – Inclusion-Exclusion Formula – Restricted Positions and Rook Polynomials.

Unit – V **(18 Hours)**

Polya's Enumeration Formula: Equivalence and Symmetry Groups – Burnside's Theorem – The Cycle Index – Polya's Formula.

Text Book: Alan Tucker, 2012. Applied Combinatorics, VI Edition, John Wiley & Sons, Inc.

Unit	Chapter/Section
I	5(5.1 – 5.5)
II	6(6.1 – 6.5)
III	7(7.1 – 7.5)
IV	8(8.1 – 8.3)
V	9(9.1 – 9.4)

Reference Books:

1. Richard A. Brualdi, 2010. Introductory Combinatorics, 5th Edition, Pearson Education Inc.
2. V. Krishnamurthy, 2000. Combinatorics – Theory and Applications, East-West Press.
3. Peter J. Cameron, 1995. Combinatorics: Topics, Techniques, Algorithms, 1st Edition, Cambridge University Press.
4. C.L. Liu, 1968. Introduction to Combinatorial Mathematics, McGraw Hill..
5. https://people.math.gatech.edu/~trotter/book.pdf
6. http://jwilson.coe.uga.edu/emt725/References/Polya_HowToSolveIt.pdf
7. http://www.freetechbooks.com/discrete-structures-for-computer-science- counting-recursion-and-probability-t967.html

Course designers: 1. Dr. K. Kayathri 2. Dr. G. Prabakaran

THIAGARAJAR COLLEGE, MADURAI- 9
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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(For those who join in 2017 and after)

Course	: Elective	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: III	Max. Marks	: 100
Sub. Code	: 3PME1/3PME2(B)	Hours / week	: 6
Title of the Paper	**: Fluid Dynamics**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. understand abstract theory about fluids through vector concepts.
2. learn equations of motion of a fluid , two dimensional flows and three dimensional flows.

Unit – I **(18 Hours)**

Vector Analysis : General orthogonal curvilinear coordinates – Arc length in Orthogonal coordinates – Gradient in orthogonal coordinates – Divergence in orghogonal coordinates – laplacian in orthogonal coordinates – Curl of a vector function in orthogonal coordinates – worked examples – Some cartesian tensor notation.

Unit – II **(18 Hours)**

Kinematics of fluids in Motion : Real fluids and Ideal fluids – Velocity of a fluid at a point – Streamlines and Pathlines , steady and unsteady flows – The velocity potential – The vorticity vector – Local and particle rates of change – The equation of continuity – worked examples – Acceleration of a fluid – Conditions at a rigid boundary.

Unit – III **(18 Hours)**

Equations of Motion of a Fluid : Pressure at a point in a fluid at rest – Pressure at a point in a moving fluid – Conditions at a boundary of two inviscid Immiscible fluids – Euler's equations of motion – Bernoulli's equation – worked examples – discussion of the case of steady motion under conservative body forces– some flows involving axial symmetry – Some special two-dimensional flows – Impulsive motion.

Unit – IV **(18 Hours)**

Some Three-Dimensional flows : Introduction – Sources, Sinks and doublets – Images in a rigid infinite plane – Images in solid spheres – Axi-Symmetric flows, Stoke's Stream function.

Unit – V **(18 Hours)**

Some Two-Dimensional flows : Meaning of Two-Dimensional Flow – Use of Cylindrical Polar coordinates – The stream function – The complex potential for Two – Dimensional Irrotational, Incompressible flow – Complex velocity potentials for standard two-dimensional flows – Some worked examples – Two-Dimensional image systems - The Milne-Thomson circle theorem.

Text Book :

Frank Chorlton, 2004, Textbook of Fluid Dynamics, CBS Publishers and Distributors Pvt. Ltd. New Delhi.

Unit	Chapter/Section
I	Chapter 1(Section 1.19 to 1.20)
II	Chapter 2(Section 2.1 to 2.10)
III	Chapter 3(Section 3.1 to 3.7, 3.9 to 3.11)
IV	Chapter 4(Section 4.1 to 4.5)
V	Chapter 5(Section 5.1 to 5.8)

Reference Books :

1) Raisinghania, M. D., 2006, Fluid Dynamics, S. Chand & Company Ltd, New Delhi.

2) Goyal, J.K. and Gupta,K. P.,1998, Fluid Dynamics, Seventh Edition, PragatiPrakashanPublications.

3) Paterson, A. R.,1977, A First Course in Fluid Dynamics, Cambridge University Press.

Course Designers:

1. Mrs. S.SHANAVAS PARVIN
2. Dr. M. SENTHILKUMARAN

THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)

POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Elective	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: III	Max. Marks	: 100
Sub. Code	: 3PME1/3PME2(C)	Hours / week	: 6
Title of the Paper	**: Differential Geometry**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. acquire knowledge in curves in space, geodesics curvature, torsion of a curve.
2. understand some applications of abstract algebra and analysis to geometrical problems and facts.

Unit – I **(18 Hours)**

The Theory of space curves : Definitions - Arc length – Tangent, normal and binormal – Curvature and Torsion of a curve – Contact between curves and surfaces – Tangent surface, involutes and evolutes – Intrinsic equations – Helices.

Unit – II **(18 Hours)**

The metric : Local intrinsic properties of a surface : Definition – Curves on a surfaces –Surface of revolution – Helicoids – Metric – Families of curves – Isometric correspondence – Intrinsic properties – Geodesics – Canonical geodesic equations – Existence theorem – Geodesic parallel – Geodesic curvature – Gauss–Bonnet theorem.

Unit - III **(18 Hours)**

The second fundamental form : Definition – Principal curvatures - Lines of curvature - Developables – Developable associated with space curves - Minimal surface – Ruled surface –Fundamental existence theorem for surfaces.

Unit - IV **(18 Hours)**

Differential geometry of surfaces in the large : Introduction - Compact surfaces whose points are umbilics – Hilbert's Lemma – Complete surfaces of constant Gaussian curvature – Complete surfaces – Hilberts theorem – Conjugate points on geodesics.

Unit - V **(18 Hours)**

Tensor algebra: Vector space – Dual spaces – Tensor product of vector spaces – Transformation formulae – Contraction – Special tensors – Inner product

Text Book:

Willmore. T.J., 2010, An introduction to Differential Geometry, Oxford university press.

Unit	Chapter/Section
I	I(I.2 – I.5, I.7 – I.9)
II	II(II.1 – II.5, II.7 –II.11, II.13 – II.16)
III	III(III.1 – III.5, III.7. III.8, III.11)
IV	IV(IV.1 – IV.5, IV.7, IV.8)
V	V(V.1 – V.5, V.7)

Reference Books :

1) Mittal and Agarwal, 1998, Differential Geometry Krishna prakasam Publishers.

2) Somasundaram. D., 2014, Differential Geometry Narosa Publishing House.

3) Thierry Aubin, 2001, Differential Geometry, American Mathematical Society.

Course designers:

1) Mr. S. Sornavel
2) Dr. G. Prabakaran

THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)

POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Elective	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: III	Max. Marks	: 100
Sub. Code	: 3PME1/3PME2(D)	Hours / week	: 6
Title of the Paper	**: Theory of Computation**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. provide an insight to theoretical computer science.
2. understand the notion of effective computability by studying Finite Automata, Grammars, Push Down Automata and Turing Machine.

Unit - I **(18 Hours)**

Finite Automata and Regular Expressions: Finite state systems – Basic definitions – Nondeterministic finite automata – Finite automata with Є moves – Regular expressions – Finite Automata with output.

Unit - II **(18 Hours)**

Properties of Regular Sets: The pumping lemma for regular sets – Closure properties of regular sets – Decision algorithm for regular sets – The Myhill-Nerode theorem and minimization of finite automata.

Unit –III **(18 Hours)**

Context-Free grammars: Context free grammars – Derivation trees – Simplification of context free grammars – Chomsky normal form – Greibach normal form.

Unit - IV **(18 Hours)**

Pushdown Automata: Definitions – pushdown automata and context free languages – The pumping lemma for CFL's – Closure properties of CFL's.

Unit – V **(18 Hours)**

Turing Machines: Introduction – The Turing machine model – Computable languages and functions. Undeeidability- Problems, properties of recursive and recursively enumerable languages, Universal Turing Machines and an undecidable problem, Rice's theorem and some more undecidable problems.

Text Book: John E. Hopcroft and Jeffery D. Ullman, 2002, Introduction to Automata Theory, Languages, and Computation, Narosa.

Unit	Chapter/Section
I	Chapter 2 : 2.1 to 2.5 , 2.7
II	Chapter 3 : 3.1 to 3.4
III	Chapter 4 : 4.2 to 4.6
IV	Chapter 5 : 5.2,5.3 Chapter 6: 6.1,6.2
V	Chapter 7 : 7.1,7.2,7.3 Chapter 8: 8.1 to 8.4

Reference Books :

1. Peter Linz, Jones and Bartlett, 2006, An Introduction to Formal Languages and Automata.
2. Raymond Greenlaw and H. James Hoover, 2009, Fundamentals of the Theory of Computation: Principles and Practice, Morgan Kaufmann Publishers.
3. Acharjya. D.P.,2010, Theory of Computation, MJP Publishers.

Course designers: 1) Dr. D. Pandiaraja 2) Dr. B. Arivazhagan

THIAGARAJAR COLLEGE, MADURAI- 9
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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(For those who join in 2017 and after)

Course	: Elective	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: III	Max. Marks	: 100
Sub. Code	: 3PME1/3PME2(E)	Hours / week	: 6
Title of the Paper	**: Nonlinear Differential Equations**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. learn plane autonomous systems, averaging methods and perturbation methods.
2. understand fundamental concepts and techniques for studying the stability analysis of differential equations

Unit –I

Plane autonomous systems and linearization: The general phase plane-some population models – Linear approximation at equilibrium points – The general solution of linear autonomous plane systems.

Unit – II

Averaging Methods: An energy balance method for limit cycles – Amplitude and frequency estimates:Polar Coordinates – An averaging method for spiral phase paths - Periodic solutions: harmonic– The equivalent linear equation by harmonic balance problems.

Unit – III

Perturbation Methods: Non autonomous systems: forced oscillations - The direct perturbation method for the undamped Duffing's equation - Forced oscillations far from resonance - Forced oscillations near resonance with weak excitation - The amplitude equation for the undamped pendulum - The amplitude equation for a damped pendulum - Periodic solutions of autonomous equations (Lindstedt's method) - Forced oscillation of a self-excited equation - The perturbation method and Fourier series.

Unit – IV

Stability : Poincaré stability (stability of paths) - Paths and solution curves for general systems - Stability of time solutions: Liapunov stability - Liapunov stability of plane autonomous linear systems - Structure of the solutions of *n*-dimensional linear systems.

Unit – V

Structure of *n*-dimensional inhomogeneous linear systems - Stability and boundedness for linear systems - Stability of linear systems with constant coefficients - Linear approximation at equilibrium points for first-order systems in *n* variables - Stability of a class of non-autonomous linear systems in *n* dimensions - Stability of the zero solutions of nearly linear systems - Problems.

Text Book:

Jordan. D.W. and Smith. P., 2007, Nonlinear Ordinary Differential Equations**:** An Introduction for Scientists and Engineers, Oxford University Press.

Unit	**Chapter/Section**
I	Chapter 2(Section 2.1 to 2.4)
II	Chapter 4(Section 4.1 to 4.5)
III	Chapter 5(Section 5.1 to 5.6, 5.9 to 5.11)
IV	Chapter 8(Section 8.1 to 8.5)
V	Chapter 8(Section 8.6 to 8.11)

Reference Books:

1) Simmons. G.F., Differential Equations, 1979, Tata McGraw Hill.
2) Sanchez. D.A. and Freeman, 1968, Ordinary Differential Equations and Stability Theory.
3) Grimzhiaw. R., Nonlinear Ordinary Differential Equations, 1993, CRC Press.

Course designers:

1) Dr. D. Pandiaraja
2) Dr. M. Senthilkumaran

THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Elective	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: IV	Max. Marks	: 100
Sub. Code	: 4PME1(A)	Hours / week	: 6
Title of the Paper	**: Numerical Analysis**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. learn various tools in solving numerical problems
2. prepare competitive examinations like CSIR-NET, SLET, etc.

Unit - I **(18 Hours)**

Solution of Algebraic and Transcendental equations: Introduction – Ramanujan's Method- Muller Method – Graffe's Root-Squaring Method – Lin-Bairstow's Method.

Unit - II **(18 Hours)**

Interpolation: Introduction – Errors in Polynomial Interpolation – Central Differences – Central Difference Interpolation Formulae : Gauss Central Difference Interpolation Formula – Striling's Formula – Bessel's Formula – Everett's Formula – Relationship between Bessel's and Everett's formulae– Interpolation with Unevenly Spaced Points :Hermite's Interpolation Formula.

Unit - III **(18 Hours)**

Approximation of Functions :Chebyshev Polynomials – Economization of Power Series. Fourier Approximation - Fourier transform – Fast Fourier transform – Cooley-Tukey Algorithm – Sande-Tukey Algorithm – Computation of the Inverse DFT.

Unit - IV **(18 Hours)**

Numerical Differentiation and Integration: Introduction – Numerical Differentiation – Errors in Numerical Differentiation – Cubic Splines Method – Maximum andMinimum Values of a Tabulated Function. Numerical Integration - Boole's and Weddle's rules – Use of Cubic Splines - Romberg integration – Newton-Cotes Integration Formulae. Numerical Calculation of Fourier Integrals – Numerical Double Integration.

Unit – V **(18 Hours)**

Numerical solution of Partial Differential Equations : Introduction –Laplace's equations- Finite difference Approximations to Derivatives —Solution of Laplace's equations - Iterative Methods for the Solution of Equations.

Text Book:

Sastry, S.S., 2012, Introductory Methods of Numerical Analysis, Fifth Edition, PHILearning Private Limited, New Delhi.

Unit	Chapter/Section
I	2(2.1, 2.6, 2.8 – 2.10)
II	3(3.1, 3.2 , 3.3.3,3.7, 3.9.3)
III	4(4.5, 4.6.1, 4.6.3 – 4.6.6)
IV	6(6.1, 6.2.1,6.2.2, 6.3, 6.4.4 - 6.4.7, 6.9, 6.10)
V	9(9.1 - 9.4, 9.6)

Reference books:

1. Jain, M.K., Iyengar, S.R.K., Jain, R.K., 2012, Numerical Methods for Scientific and Engineering Computation, New Age international (P) Limited, New Delhi.
2. Samuel D. Conte and Carl de Boor,2009, Elementary Numerical Analysis,Tata McGraw-Hill, Third edition
3. ShankaraRao, K.,2001, Numerical Methods for Scientists and Engineers, Prentice Hall of India, New Delhi.

Course Designers:

1. Mrs. S.SHANAVAS PARVIN

2. Dr. B. ARIVAZHAGAN

THIAGARAJAR COLLEGE, MADURAI- 9
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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(For those who join in 2017 and after)

Course	: Elective	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: IV	Max. Marks	: 100
Sub. Code	: 4PME1(B)	Hours / week	: 6
Title of the Paper	**: Algorithmic Graph Theory**	Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. learn the advance Algorithmic approach in Graph theoretical problems and their efficiency by means of computational complexity.
2. understand Hamiltonian cycles and Network flows.

Unit - I **(18 Hours)**

Graphs and their complements : Introduction – Degree sequence – Analysis – Paths and Walks: Introduction complexity – Walks – tTe shortest path problem – Weighted graphs and Dijkstra's algorithm – Data structures – Floyd's algorithm.

Unit - II **(18 Hours)**

Trees and Cycles: Spanning tree algorithms – Prim's algorithm – Data structure – Kruskal'salgorithm – Data structure and complexity – The Cheriton – Tarjan algorithm.

Unit - III **(18 Hours)**

Connectivity: Introduction – Blocks – Finding blocks of a graph – The DFS (Depth First Search) – Complexity.

Unit - IV **(18 Hours)**

Hamiltonian cycles: Introduction – The crossover algorithm – Complexity – The Hamiltonian closure **–** The extended multi graph algorithm – Data structures for the segments – Decision problems – NP completeness – The travelling salesman problem – The TSP-Christofides algorithm.

Unit - V **(18 Hours)**

Network Flows: Introduction – The Ford-Fulkerson algorithm – Matching and flows – Menger's theorems – Disjoint paths and separating sets.

Text Book: William Kocay and Donald L. Kresher, 2005, Graphs, Algorithms and OptimizationChapman & Hall/CRC.

Unit	Chapter/Section
I	1: 1.1 to 1.3, 2: 2.1 to 2.7
II	4 : 4.4
III	6 : 6.1 to 6.4
IV	9 : 9.1 to 9.8
V	8: 8. 1 to 8.5

Reference Books:

1) Thulasiraman. K. and Swamy. M.N.S., 1992, Graphs: Theory and Algorithms, John Wiley & Sons.

2) Martin Charles Golumbic, 2004, Algorithmic Graph Theory and Perfect Graphs, 2nd Edition, Academic Press.

Course designers: 1) Dr. D. Pandiaraja 2) Dr. G. Prabakaran

THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)

POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Elective	Int. Marks	: 25
Class	: II Year	Ext. Marks	: 75
Semester	: IV	Max. Marks	: 100
Sub. Code	: 4PME1(C)	Hours / week	: 6
Title of the Paper	**: Differential Equations and Dynamical Systems**		
		Credits	: 4

Course Outcome: On the successful completion of the course, students will be able to

1. Developing knowledge to analyze the dynamical behavior of systems using differential equations.
2. Understand the concept of nonlinear systems, global existence theorem, Periodic orbits and The Poincare map.

Unit - I **(18 Hours)**

Linear Systems: Uncoupled linear systems – Diagonalization – Exponential of Operators - The Fundamental theorem for linear systems – Linear System in R^2.

Unit - II **(18 Hours)**

Linear Systems: Complex Eigenvalues – Multiple Eigen values – Jordan forms – Stability theory – Nonhomogeneous Linear Systems.

Unit – III **(18 Hours)**

Nonlinear Systems : Local Theory : Some preliminary Concepts and Definitions – The fundamental Existense-Uniqueness theorem – Dependence on initial conditions and parameters – The maximal Interval of Existence.

Unit – IV **(18 Hours)**

Nonlinear Systems : Local theory: The flow defined by a Differential equation – Linearization – The stable manifold theorem – The Hartman-Grogman theorem – Saddles, Nodes, Foci and Centers.

Unit – V **(18 Hours)**

Nonlinear Systems: Global theory: Dynamical Systems and Global Existence Theorem – Limit sets And Attractors – Periodic Orbits, Limit Cycles and Separatrix Cycles – The Poincare map.

Text Book : Lawrence Perko, 2001, Differential Equations and Dynamical Systems, 3rd Edition, Springer

Unit	Chapter/Section
I	Chapter 1: 1.1 to 1.5
II	Chapter 1 : 1.6 to 1.10
III	Chapter 2 : 2.1 to 2.4
IV	Chapter 2 : 2.5 to 2.10
V	Chapter 3: 3.1 to 3.4

Reference Books :

1) Gerald Teschl, 2011, Ordinary Differential Equations and Dynamical Systems, AMS.
2) Morris W. Hirsch, Stephen Smale and Robert L Devaney, 2013, Differential Equations, Dynamical Systems and An Introduction to Chaos, 3rd Edition, Academic Press.
3) Stephen L. Caompbell and Richard Haberman, 2008, Introduction to Differential Equations with Dynamical Systems, Princeton University Press.

Course designers:

1) Dr. M. Senthilkumaran 2) Dr. D. Pandiaraja

M.Phil. Mathematics

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(For those who join in 2017 and after)

M.Phil. MATHEMATICS
COURSE STRUCTURE (w.e.f. 2017 – 2018 batch onwards)

Semester – I

Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks CA	Max Marks SE	Total
S1MM1	Research Methodology	6		90	100	100	200
S1MM2	Advanced Algebra and Analysis	6		90	100	100	200
S1MM3	Elective	6		90	100	100	200

Semester – II

Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks CA	Max Marks SE	Total
S2MMD	Dissertation				100	100	200

Elective papers: (One paper is to be chosen in Semester II)

1. Advanced Graph Theory

2. Delay Differential Equations

3. Computational Complexity

Question paper pattern:

5 Internal choice questions 5 x 20 = 100 Marks

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
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Course	: Core	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: I	Max. Marks	: 100
Sub. Code	: S1MM1	Hours / week	: 6
Title of the Paper	**: Research Methodology**		

Course Outcome: On the successful completion of the course, students will be able to
1) get motivation in research, objectives of research and motivation in research.
2) write a research paper using Latex software.
3) develop Matlab programs.

Unit – I **(18 Hours)**

Research Methodology : Introduction: Meaning of Research – Objectives of Research – Motivation in Research – Types of Research – Research Approaches – Significance of Research – Research Methods versus Methodology – Research and Scientific Method – Importance of Knowing How Research is done – Research Process – Criteria of Good Research – Problems Encountered by Researchers in India

Defining the Research Problem: What is a Research Problem? – Selecting the Problem – Necessity of Defining the Problem – Techniques Involved in Defining the Problem

Unit – II **(18 Hours)**

Latex: To produce a Simple Document – To Deal with Complication Features in a Document – Figures and Tables

Unit – III **(18 Hours)**

Latex: Cross References, Index and Bibliography – Mathematical Expressions and Equations

Unit – IV **(18 Hours)**

Matlab: Introduction – Tutorial Lessons - Interactive Computation

Unit – V **(18 Hours)**

Matlab: Programming in MATLAB: Scripts and Functions – Applications

Books:

1. C.R.Kothari , 2010 , Research Methodology – Methods & Techniques , Second Revised edition , New Age International Publishers ,
2. K.B.M.Nambudiripad , 2014 , Latex for Beginners ,Narosa Publishing House , New Delhi
3. Rudra Pratap , 2010 , Getting Started with MATLAB A Quick Introduction to Scientists and Engineers **,** OXFORD University Press, 2010

Unit	**Book**	**Chapters / Sections**
I	1	Chapters 1 & 2
II	2	Chapters 2,3,5
III	2	Chapters 6 & 11
IV	3	Chapters 1, 2, 3
V	3	Chapters 4 & 5

Reference Books :

1. R. Pannerselvam, 2007, Research Methodology, Prentice Hall of India , New Delhi
2. Helmut kopka and Patrick W. Daly, 2003, Guide to Latex, Addison Wesley Professional.
3. Swapna kumar. S and Lenina. S.V.B., 2016, Matlab:Easy way of learning, Prentice – Hall of India
4. Gilat, 2007, Matlab :An Introduction with Applications, Wiley.

Course Designers

1. Dr. B. Arivazhagan
2. Dr. M.Senthil kumaran

THIAGARAJAR COLLEGE, MADURAI- 9
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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
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Course	: Core	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: I	Max. Marks	: 100
Sub. Code	: S1MM2	Hours / week	: 6
Title of the Paper	: **Advanced Algebra and Analysis**		

Course Outcome: On the successful completion of the course, students will be able to

1) study certain topological-algebraic structures and the methods by which knowledge of these structures can be applied to analytic problems
2) study the basic properties of Fourier transform.
3) Remember basic abstract algebra concepts.
4) Understand theory of Modules and Modules of fractions.

Unit - I **(18 hours)**

Modules : Modules and module homomorphisms - Submodules and quotient modules - Operations and submodules – Direct sum and product – Finitely generated modules – Exact sequences – Tensor product of modules –Restriction and extension of scalars – Exactness properties of the tensor product – Algebras – Tensor product of algebras .

Unit - II **(18 hours)**

Rings and Modules of fractions: Local properties – Extended and contracted ideals in rings of fractions - Primary Decomposition.

Unit - III **(18 hours)**

Chain conditions - Noetherian rings – Primary Decomposition in Noetherian rings – Artin rings.

Unit - IV **(18 hours)**

Banach Algebras: Definition and examples – Regular and singular elements – Topological divisors of zero – The spectrum – The formula for the spectral radius – The radial and semi-simplicity.

Unit – V **(18 hours)**

The Gelfand mapping – Application of the formula $r(x) = \lim \|x^n\|^{1/n}$ - Involution in Banach algebras- The Gelfand Neumark theorem – Ideals in $C(X)$ and the Banach-Stone theorem.

Text Books:

1) Atiyah. M.F. and GeMacdonald. I.G., 1969, Introduction to Commutative Algebra, Addison – Wesley Publishing Company

2) Simmons. G.F., 2012, Introduction to Topology and Modern Analysis -Tata McGraw – Hill.

Unit	Book	Chapter/Section
I	1	Chapter 2
II	1	Chapters 3 and 4
III	1	Chapters 6,7 and 8
IV	2	12 (Full)
V	2	13 (Full), 14(section 74)

Reference Books:

1) Thomas W. Hungerford, 2008, Algebra, Springer International edition.

2) Serge Lang, 2010, Revised Third Edition, Algebra, Springer International edition.

3) Walter Rudin, II edition, 2006, Functional Analysis, Tata McGraw-Hill.

4) Yoshida, 2008, Functional Analysis, Springer Verlag.

Course Designers

1. Dr. B. Arivazhagan
2. Dr. G. Prabakaran

THIAGARAJAR COLLEGE, MADURAI- 9

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Elective	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: I	Max. Marks	: 100
Sub. Code	: S1MM3	Hours / week	: 6

Title of the Paper **: Advanced Graph Theory**

Course Outcome: On the successful completion of the course, students will be able to

1. Understand the recent developments in Graph theory.
2. Develop research skills in Domination, Factorization and Graceful Labeling.

Unit – I **(18 hours)**

Dominating sets in graphs – Bounds in terms of order - Bounds in terms of order, degree and packing - Bounds in terms of order and size - Bounds in terms of degree, diameter and girth.

Unit – II **(18 hours)**

Conditions on the dominating sets - Introduction – Independent dominating sets – Total dominating sets – Connected dominating sets.

Unit – III **(18 hours)**

Introduction to Digraphs **–** Strong Digraphs – Eulerian and Hamiltonian Digraphs – Tournaments – Kings in tournaments – Hamiltonian tournaments.

Unit – IV **(18 hours)**

Factorization – Decomposition – Cycle Decomposition – Graceful graphs.

Unit – V **(18 hours)**

Classical Ramsey numbers – More general Ramsey Numbers.

Text Books:

1. Haynes T.W., Hedetniemi. S.T. and Peter J. Slater, 1998. Fundamentals of domination in Graphs, Marcel Dekker Inc, New York.
2. Chartrand. G, Lesniak. L and Ping Zhang, 2015. Graphs Digraphs, Chapman & Hall/CRC.

Unit	Book	Chapter/Section
I	1	1(1.2) 2(2.1 – 2.4)
II	1	6(6.1 – 6.4)
III	2	7(7.1 – 7.6)
IV	2	13(13.1 – 13.4)
V	2	20(20.1, 20.2)

Reference Books :

1) Kulli. V.R., 2010. Theory of domination in graphs, Vishwa International Publications, Gulbarga.

2) Parthasarathy. K.R., 1994. Basic Graph Theory, Tata McGraw – Hill publishing Company.

3) http://diestel-graph-theory.com/basic.html

4) http://www.maths.lse.ac.uk/Personal/jozef/LTCC/Graph_Theory_Bondy_Murty.pdf

5) http://www.freetechbooks.com/graph-theory-f67.html

Course designers1. Dr. K. Kayathri 2. Dr. G. Prabakaran

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POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS
(For those who join in 2017 and after)

Course	: M.Phil.	Int.Marks	: 25
Class	: I Year	Ext.Marks	: 75
Semester	: I	Max.Marks	:100
Sub. Code	: S1MM3(B)	Hours / week	: 6
Title of the Paper	**: Delay Differential Equations**		

Course Outcome: On the successful completion of the course,students will be able to

1. Understand the basic concepts of delay differentiation and its applications
2. Apply the stability concept in various research problems

Unit - I **(12 Hours)**

Introduction: Examples of Delay Differential Equations - Some Terminology - Solving Delay Equations Using a Computer - Delayed Negative Feedback: A Warm-Up: Preliminaries - The Simplest Delay Equation - Oscillation of Solutions - Solutions Backward in Time.

Unit - II **(12 Hours)**

Existence of Solutions: The Method of Steps for Discrete Delay Equations Positivity of Solutions - A More General Existence Result - Continuation of Solutions - Remarks on Backward Continuation - Stability Definitions - Linear Systems and Linearization: Autonomous Linear Systems - Laplace Transform and Variation of Constants Formula - The Characteristic Equation - Small Delays Are Harmless - The Scalar Equation $x'(t) = Ax(t)+Bx(t-r)$ - Principle of Linearized Stability - Absolute Stability.

Unit - III **(12 Hours)**

Semi dynamical Systems and Delay Equations: The Dynamical Systems Viewpoint - Semiflows and Omega Limit Sets – Semi Dynamical Systems Induced by Delay Equations - Monotone Dynamics - Delayed Logistic Equation - Delayed Microbial Growth Model - Liapunov Functions - Logistic Equation with Instantaneous and Delayed Density Dependence.

Unit - IV **(12 Hours)**

Hopf Bifurcation: A Canonical Example - Hopf Bifurcation Theorem - Delayed Negative Feedback - Computation of the Hopf Bifurcation - Series Expansion of Hopf Solution - The Logistic Equation - A Second-Order Delayed Feedback System - Delayed Feedback Dominates Instantaneous Feedback - Instantaneous Feedback Dominates Delayed Feedback - Stabilizing the Straight-Up Steady State of the Pendulum - Gene Regulation by End-Product Repression - A Poincar´e-Bendixson Theorem for Delay Equations.

Unit - V **(12 Hours)**

Distributed Delay Equations and the Linear Chain Trick: Infinite Delays of Gamma Type - Characteristic Equation and Stability - The Linear Chain Trick - A Model of HIV Transmission - An ODE Approximation to a Delay Equation - Phage and Bacteria in a Chemostat: - Model - Positivity and Boundedness of Solutions - Basic Reproductive Number

for Phage - Persistence of Host and Phage Extinction - The Coexistence Equilibrium - Another Formulation of the Model.

Text Book:

Hal Smith, 2010. Delay Differential Equations with Applications to the Life Sciences, Springer.

Unit	**Chapter/section**
I	Chapters 1, 2
II	Chapters 3, 4
III	Chapters 5
IV	Chapters 6
V	Chapters 7, 8

Reference books:

1) Thomas Erneux., 2009, Applied Delay Differential Equations, Springer.
2) Yang Kuang, 1993, Delay Differential Equations with Applications in Population Dynamics, Academic press
3) Gobalsamy. K, 2013 Stability and Oscillation of Delay Differential equations of Population Dynamics, Springer..

Course designers

1. Dr. D.. Pandiaraja
2. Dr. M. Senthilkumaran

THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)

POST GRADUATE & RESEARCH DEPARTMENT OF MATHEMATICS

(For those who join in 2017 and after)

Course	: Elective	Int. Marks	: 25
Class	: I Year	Ext. Marks	: 75
Semester	: I	Max. Marks	: 100
Sub. Code	: S1MM3(C)	Hours / week	: 6
Title of the Paper	**: Computational Complexity**		

Course Outcome: On the successful completion of the course, students will be able to

1) understand space complexity and time complexity in computation
2) develop efficient algorithms for numerical problems

Unit - I **(18 hours)**

Turing Machines: The standard Turing Machine – Combining Turing Machines for Complicated Tasks - Turing's Thesis.

Unit - II **(18 hours)**

Other Models of Turing Machines: Monor Variations on the Turing Machine Theme – Turing Machines with More Complex Storage.

Unit - III **(18 hours)**

Hierarchy of Formal Languages and Automata: Recursive and Recursively Enumerable Languages – Unrestricted Grammars – Context-Sensitive Grammars and Languages – The Chomsky Hierarchy.

Unit - IV **(18 hours)**

Limits of Algorithmic Computation: Some Problems that cannot be solved by Turing Machines – Undecidable Problems for Recursively Enumerable Laguages – The Post Correspondance Problem – Undecidable Problems for Context-Free Languages – A question of efficiency.

Unit – V **(18 hours)**

An Overview of Computational Complexity: Efficiency of computation – Turing Machine Models and Complexity – Language Families and Complexity Classes – The Complexity Classes P and NP – Some NP Problems – Polynomial-Time Reduction – NP-Completeness and an Open Question

Text Book:

Peter Linz, 2006, An Introduction to Formal Languages and Automata, Jones and Bartlett Publishers.

Unit	Chapter/Section
I	9
II	10
III	11
IV	12
V	14

Reference books:

1) Ellis Horowitz, Sartaj Sahani and Sanguthevar Rajasekaran, 2007, Fundamentals of Computer Algorithms, Galgotia.

2) John E. Hopcroft and Jeffery D. Ullman, 2002, Introduction to Automata Theory, Languages, and Computation, Narosa.

Course designers

1. Dr. D.. Pandiaraja
2. Dr. B. Arivazhagan