BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI - 620 024.

B.Sc. Mathematics

Course Structure under CBCS

(Applicable to the candidates admitted from the academic year 2016 -2017 onwards)

Updated on 09.07.2018

Sem	Part	Course	Title	Ins. Hrs	Credit	Exam Hours	Marks		Total
							Int	Ext.	
I	I	Language Course – I (LC) – Tamil*/Other Languages +#		6	3	3	25	75	100
	II	English Language Course - I (ELC)		6	3	3	25	75	100
	III	Core Course – I (CC)	Differential Calculus and Trigonometry	5	5	3	25	75	100
		Core Course – II (CC)	Integral Calculus	4	4	3	25	75	100
		First Allied Course – I (AC)		4	4	3	25	75	100
		First Allied Course – II (AP)		3	---	---	---	---	---
	IV	Value Education	Value Education	2	2	3	25	75	100
	TOTAL			**30**	**21**				**600**
II	I	Language Course – II (LC) - Tamil*/Other Languages +#		6	3	3	25	75	100
	II	English Language Course – II (ELC)		6	3	3	25	75	100
	III	Core Course – III (CC)	Differential Equations and Laplace Transforms	5	5	3	25	75	100
		Core Course – IV (CC)	Analytical Geometry 3D	4	3	3	25	75	100
		First Allied Course – II (AP)		3	3	3	40	60	100
		First Allied Course – III (AC)		4	2	3	25	75	100
	IV	Environmental Studies	Environmental Studies	2	2	3	25	75	100
	TOTAL			**30**	**21**				**700**
III	I	Language Course – III (LC) Tamil*/Other Languages +#		6	3	3	25	75	100
	II	English Language Course - III (ELC)		6	3	3	25	75	100
	III	Core Course – V (CC)	Sequences and Series	5	4	3	25	75	100
		Core Course – VI (CC)	Classical Algebra and Theory of Numbers	4	4	3	25	75	100
		Second Allied Course – I (AC)		4	4	3	25	75	100
		Second Allied Course – II (AP)		3	---	---	---	---	---
	IV	Non Major Elective I – for those who studied Tamil under Part I a) Basic Tamil for other language students b) Special Tamil for those who studied Tamil upto 10th +2 but opt for other languages in degree programme	Quantitative Aptitude I	2	2	3	25	75	100
	TOTAL			**30**	**20**				**600**

IV	I	Language Course –IV (LC) Tamil*/Other Languages +#		6	3	3	25	75	100
	II	English Language Course – IV (ELC)		6	3	3	25	75	100
	III	Core Course – VII (CC)	Vector Calculus and Fourier Series	4	4	3	25	75	100
		Core Course – VIII (CC)	Linear Algebra	4	4	3	25	75	100
		Second Allied Course – II (AP)		3	3	3	40	60	100
		Second Allied Course – III		3	2	3	25	75	100
	IV	Non Major Elective II – for those who studied Tamil under Part I a) Basic Tamil for other language students b) Special Tamil for those who studied Tamil upto 10th +2 but opt for other languages in degree programme	Quantitative Aptitude II	2	2	3	25	75	100
		Skill Based Elective - I	Skill Based Elective - I	2	2	3	25	75	100
	TOTAL			**30**	**23**				**800**
V	III	Core Course – IX (CC)	**Numerical Methods with** MATLAB **Programming**	5	4	3	25	75	100
		Core Course – X (CC)	Real Analysis	6	6	3	25	75	100
		Core Course – XI (CC)	Statics	6	5	3	25	75	100
		Core Practical – I (CP)	Numerical Methods with MATLAB Programming (P)	2	2	3	40	60	100
		Major Based Elective – I	Operations Research / Stochastic Processes	5	5	3	25	75	100
	IV	Skill Based Elective – II	Skill Based Elective - II	2	2	3	25	75	100
		Skill Based Elective – III	Skill Based Elective - III	2	2	3	25	75	100
		Soft Skills Development	Soft Skills Development	2	2	3	25	75	100
	TOTAL			**30**	**28**				**800**
VI	III	Core Course – XII (CC)	Abstract Algebra	6	5	3	25	75	100
		Core Course – XIII (CC)	Complex Analysis	6	5	3	25	75	100
		Core Course - XIV (CC)	Dynamics	5	5	3	25	75	100
		Major Based Elective II	Graph Theory / Mathematical Modelling	6	5	3	25	75	100
		Major Based Elective III	Astronomy / Number Theory	6	5	3	25	75	100
	V	Extension Activities	Extension Activities	-	1	-	-	-	-
		Gender Studies	Gender Studies	1	1	3	25	75	100
	TOTAL			**30**	**27**				**600**
GRAND TOTAL				**180**	**140**	**-**	**-**	**-**	**4100**

List of Allied Courses

Group I (Any one)

1. Physics
2. Mathematical Statistics
3. Financial Accounting

Group II (Any one)

1. Chemistry
2. Computer Science
3. Management Accounting

Language Part – I	-	4	
English Part –II	-	4	
Core Paper	-	14	
Core Practical	-	1	
Allied Paper	-	4	
Allied Practical	-	2	
Non-Major Elective	-	2	
Skill Based Elective	-	3	
Major Based Elective	-	3	
Environmental Studies	-	1	
Value Education	-	1	
Soft Skill Development	-	1	
Gender Studies	-	1	
Extension Activities	-	1	(Credit only)

* for those who studied Tamil upto 10^{th} +2 (Regular Stream)

+ Syllabus for other Languages should be on par with Tamil at degree level

those who studied Tamil upto 10^{th} +2 but opt for other languages in degree level under Part I should study special Tamil in Part IV

** Extension Activities shall be out side instruction hours

Non Major Elective I & II – for those who studied Tamil under Part I

a) Basic Tamil I & II for other language students
b) Special Tamil I & II for those who studied Tamil upto 10^{th} or +2 but opt for other languages in degree programme

Note:

	Internal Marks	**External Marks**
1. Theory	25	75
2. Practical	40	60

3. Separate passing minimum is prescribed for Internal and External marks

FOR THEORY

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks]
The passing minimum for University Examinations shall be 40% out of 75 marks [i.e. 30 marks]

FOR PRACTICAL

The passing minimum for CIA shall be 40% out of 40 marks [i.e. 16 marks]
The passing minimum for University Examinations shall be 40% out of 60 marks [i.e. 24 marks]

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CORE COURSE I

DIFFERENTIAL CALCULUS AND TRIGONOMETRY

Objectives

1. To inculcate the basics of differentiation and their applications.
2. To introduce the notion of curvatures, Evolutes & Involutes and polar co-ordinates.
3. To understand the basic concepts of Trigonometry

UNIT I

Methods of Successive Differentiation – Leibnitz's Theorem and its applications- Increasing & Decreasing functions –Maxima and Minima of function of two variables.

UNIT II

Curvature – Radius of curvature in Cartesian and in Polar Coordinates – Centre of curvature–Evolutes & Involutes

UNIT III

Expansions of sin (nx), cos (nx), tan (nx) – Expansions of $\sin^n x$, $\cos^n x$ –Expansions of sin(x), cos(x), tan(x) in powers of x.

UNIT IV

Hyperbolic functions – Relation between hyperbolic & Circular functions- Inverse hyperbolic functions.

UNIT V

Logarithm of a complex number –Summation of Trigonometric series – Difference method- Angles in arithmetic progression method –Gregory's series

TEXT BOOKS:

1. S.Narayanan and T.K.Manicavachagom Pillai, **Calculus Volume I**, S.Viswanathan (Printers&Publishers) Pvt Limited , Chennai -2011.
2. S.Arumugam & others, **Trigonometry and Fourier series**, New Gamma Publications -1999

UNIT – I -	Chapter III	Sections 1.1 to 2.2 & Chapter IV Section 2.1, 2.2 and Chapter V 1.1 to 1.4 of [1]
UNIT – II -	Chapter X Sections 2.1 to 2.6 of [1]	
UNIT – III -	Chapter 1	Sections 1.2 to 1.4 of [2]
UNIT – IV -	Chapter 2	Sections 2.1& 2.2 of [2]
UNIT – V -	Chapter 3 & Chapter 4 Sections 4.1,4.2 & 4.4 of [2]	

REFERENCE(S)

1. S.Arumugam and Isaac, Calculus, Volume1, New Gamma Publishing House, 1991.
2. S. Narayanan, T.K. Manichavasagam Pillai, Trigonometry, S. Viswanathan Pvt Limited, and Vijay Nicole Imprints Pvt Ltd, 2004.

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CORE COURSE II

INTEGRAL CALCULUS

Objectives

1. To inculcate the basics of integration and their applications.
2. To study some applications of definite integrals.
3. To understand the concepts of Beta, Gamma functions

UNIT I

Revision of all integral models – simple problems -

UNIT II

Definite integrals - Integration by parts & reduction formula

UNIT III

Geometric Application of Integration-Area under plane curves: Cartesian co-ordinates -Area of a closed curve - Examples - Areas in polar co-ordinates.

UNIT IV

Double integrals – changing the order of Integration – Triple Integrals.

UNIT V

Beta & Gamma functions and the relation between them – Integration using Beta & Gamma functions

TEXT BOOK(S)

1. S.Narayanan and T.K.Manicavachagom Pillai, **Calculus Volume II**, S.Viswanathan (Printers & Publishers) Pvt Limited, Chennai -2011.

UNIT I : Chapter 1 section 1 to 10
UNIT II : Chapter 1 section 11, 12 & 13
UNIT III : Chapter 2 section 1.1, 1.2, 1.3 & 1.4
UNIT IV : Chapter 5 section 2.1, 2.2 & 4
UNIT V : Chapter 7 section 2.1 to 2.5

REFERNECE(S)

1. Shanti Narayan, Differential & Integral Calculus.

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CORE COURSE III

DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

OBJECTIVES:

1. To know the order and degree of the ODE's
2. To identify some specific methods and solve them
3. To make difference between ODE and PDE
4. To solve some standard methods
5. To know the concept of Laplace transforms and its inverse with applications

UNIT I

First order, higher degree differential equations solvable for x, solvable for y, solvable for dy/dx, Clairauts form – Conditions of integrability of M dx + N dy = 0 – simple problems.

UNIT II

Particular integrals of second order differential equations with constant coefficients - Linear equations with variable coefficients – Method of Variation of Parameters (Omit third & higher order equations).

UNIT III

Formation of Partial Differential Equation – General, Particular & Complete integrals – Solution of PDE of the standard forms - Lagrange's method - Solving of Charpit's method and a few standard forms.

UNIT IV

PDE of second order homogeneous equation with Constant coefficients – Particular integrals of the forms e^{ax+by}, Sin(ax+by), Cos(ax+by), $x^r y^s$ and $e^{ax+by}.f(x,y)$.

UNIT V

Laplace Transforms – Standard formulae – Basic theorems & simple applications – Inverse Laplace Transforms – Use of Laplace Transforms in solving ODE with constant coefficients.

TEXT BOOK

1. T.K.Manicavachagom Pillay & S.Narayanan, Differential Equations, S.Viswanathan Publishers Pvt. Ltd., 1996.
2. Arumugam & Isaac, Differential Equations, New Gamma Publishing House, Palayamkottai, 2003.

Unit : 1 Chapter IV – Sections 1,2 & 3, Chapter II – Section 6 [1]
Unit : 2 Chapter V – Sections 1,2,3,4 & 5, Chapter VIII – Section 4 [1]
Unit : 3 Chapter XII – Sections 1 – 6 [1]
Unit : 4 Chapter V [2]
Unit : 5 Chapter IX – Sections 1 – 8 [1]

Reference book:

1. M.D.Raisinghania , Ordinary and Partial Differential Equations, S.Chand & Co
2. M.K. Venkatraman, Engineering Mathematics, S.V. Publications, 1985 Revised Edition

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CORE COURSE IV

ANALYTICAL GEOMETRY 3D

OBJECTIVES :

1. To study 3 dimensional Cartesian Co-ordinates system
2. To enable the students to develop their skill in 3 dimensions

UNIT I

Coordinates in space-Direction consines of a line in space-angle between lines in space – equation of a plane in normal form. Angle between planes – Distance of a plane from a point.

UNIT II

Straight lines in space – line of intersection of planes – plane containing a line. Coplanar lines – skew lines and shortest distance between skew lines- length of the perpendicular from point to line.

UNIT III

General equation of a sphere-Section of sphere by plane-tangent planes –condition of tangency-system of spheres generated by two spheres - System of spheres generated by a sphere and plane.

UNIT IV

The equation of surface – cone – intersection of straight line and quadric cone – tangent plane and normal

UNIT V

Condition for plane to touch the quadric cone - angle between the lines in which the plane cuts the cone. Condition that the cone has three mutually perpendicular generators- Central quadrics – intersection of a line and quadric – tangents and tangent planes – condition for the plane to touch the conicoid

Books for Study

1. Shanthi Narayanan and Mittal P.K:Analytical Solid Geometry 16th Edition S.Chand & Co., New Delhi.
2. Narayanan and Manickavasagam Pillay, T.K. Treatment as Analytical Gementry S.Viswanathan (Printers & Publishers) Pvt. Ltd.,

Unit I : Chapter I, Sec 1.5 to 1.9, Chapter II Sec 2.1 to 2.3, Pages : 10-31, Chapter II Sec 2.4 to 2.8 pages : 32-47 of [1]
Unit II : chapter III section 3.1-3.7, pages 55-89 of [1]
Unit III : Chapter VI Sec. 6.1 to 6.6 pages : 121-143 of [1]
Unit IV : Chapter V Sec.43 to 47 pages : 103-113 of [2]
Unit V: Chapter V Sec.49 to 53, Pages:115-125 of [2]

Book for Reference

1. P.Duraipandian & others- Analytical Geometry 3 Dimensional – Edition.

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CORE COURSE V

SEQUENCES AND SERIES

OBJECTIVES :

1. To lay a good foundation for classical analysis
2. To study the behavior of sequences and series.

Unit I

Sequences – Bounded Sequences – Monotonic Sequences – Convergent Sequence – Divergent Sequences – Oscillating sequences

Unit II

Algebra of Limits – Behavior of Monotonic functions

Unit III

Some theorems on limits – subsequences – limit points : Cauchy sequences

Unit IV

Series – infinite series – Cauchy's general principal of convergence – Comparison – test theorem and test of convergence using comparison test (comparison test statement only, no proof)

Unit V

Test of convergence using D Alembert's ratio test – Cauchy's root test – Alternating Series – Absolute Convergence (Statement only for all tests)

Book for Study

Dr. S.Arumugam & Mr.A.Thangapandi Isaac Sequences and Series – New Gamma Publishing House – 2002 Edition.

Unit I : Chapter 3 : Sec. 3.0 – 3.5 Page No : 39-55
Unit II : Chapter 3 : Sec. 3.6, 3.7 Page No:56 – 82
Unit III : Chapter 3 : Sec. 3.8-3.11, Page No:82-102
Unit IV : Chapter 4 : Sec. (4.1 & 4.2) Page No : 112-128.
Unit V : Relevant part of Chapter 4 and Chapter 5: Sec. 5.1 & 5.2 Page No:157-167.

Book for Reference

1. Algebra – Prof. S.Surya Narayan Iyer
2. Algebra – Prof. M.I.Francis Raj

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CORE COURSE VI

CLASSICAL ALGEBRA AND THEORY OF NUMBERS

Objectives

1. To lay a good foundation for the study of Theory of Equations.
2. To train the students in operative algebra.

Unit I

Relation between roots & coefficients of Polynomial Equations – Symmetric functions – Sum of the r^{th} Powers of the Roots

Unit II

Newtion's theorem on the sum of the power of the roots-Transformations of Equations – Diminshing, Increasing & Multiplying the roots by a constant - Reciprocal equations - To increase or decrease the roots of the equation by a given quantity.

Unit III

Form of the quotient and remainder – Removal of terms – To form of an equation whose roots are any power – Transformation in general – Descart's rule of sign

Unit IV

Inequalities – elementary principles – Geometric & Arithmetic means – Weirstrass inequalities – Cauchy inequality – Applications to Maxima & Minima.

Unit V

Theory of Numbers – Prime & Composite numbers – divisors of a given number N – Euler's Function (N) and its value – The highest Power of a prime P contained in N! – Congruences – Fermat's, Wilson's & Lagrange's Theorems.

Text Book(s)

1. T.K.Manickavasagam Pillai & others Algebra Volume I.S.V. Publications – 1985 Revised Edition.
2. T.K. Manickavasagam Pillai & others Algebra Volume II, S.V.Publications – 1985 Revised Edition.

Unit I : Chapter 6 Section 11 to 13 of (1)
Unit II : Chapter 6 Section 14 to 17 of (1)
Unit III : Chapter 6 Section 18- 21 & 24 of (1)
Unit IV : Chapter 4 of (2)
Unit V : Chapter 5 of (2)

References :

1. H.S.Hall and S.R. Knight, Higher Algebra, Prentice Hall of India, New Delhi.
2. H.S. Hall and S.R.Knight, Higher Algebra, McMillan and Co., London, 1948.

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NON-MAJOR ELECTIVE I

QUANTITATIVE APTITUDE I

Objectives :

1. To lean the problems solving techniques for aptitude problems
2. To enable to students prepare themselves for various competitive examinations

Unit I

Numbers – HCF – LCM – Problems on numbers

Unit II

Decimal Fractions and Simplification

Unit III

Surds and Indices – Percentage – Profit and Loss

Unit IV

Ratio and Proportion – Partnership – Allegation or Mixture

Unit V

Average – Problems on Age

Text Book:

Scope and treatment as in "Quantitative Aptitude" by R.S.Aggarwal, S.Chand & Company Ltd., Ram Nagar, New Delhi (2007)

Unit 1: (Chapters 1, 2 & 7)
Unit 2: (Chapter 3 & 4)
Unit 3: (Chapters 9, 10 & 11)
Unit 4: (Chapters 12, 13 & 20)
Unit 5: (Chapters 6 &8)

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CORE COURSE VII

VECTOR CALCULUS AND FOURIER SERIES

Objectives:

To provide the basic knowledge of vector differentiation & vector integration.
To solve vector differentiation & integration problems.

UNIT I

Vector differentiation –velocity & acceleration-Vector & scalar fields –Gradient of a vector- Directional derivative – divergence & curl of a vector solinoidal & irrotational vectors –Laplacian double operator –simple problems

UNIT II

Vector integration –Tangential line integral –Conservative force field –scalar potential-Work done by a force - Normal surface integral- Volume integral – simple problems.

UNIT III

Gauss Divergence Theorem – Stoke's Theorem- Green's Theorem – Simple problems & Verification of the theorems for simple problems.

UNIT IV

Fourier series- definition - Fourier Series expansion of periodic functions with Period 2π and period 2a – Use of odd & even functions in Fourier Series.

UNIT V

Half-range Fourier Series – definition- Development in Cosine series & in Sine series Change of interval – Combination of series

TEXT BOOK(S)

1. M.L. Khanna, Vector Calculus, Jai Prakash Nath and Co., 8th Edition, 1986.
2. S. Narayanan, T.K. Manicavachagam Pillai, Calculus, Vol. III, S. Viswanathan Pvt Limited, and Vijay Nicole Imprints Pvt Ltd, 2004.

UNIT – I - Chapter 1 Section 1 & Chapter 2 Sections 2.3 to 2.6 , 3 , 4 , 5 , 7 of [1]
UNIT – II - Chapter 3 Sections 1 , 2 , 4 of [1]
UNIT – III - Chapter 3 Sections 5 & 6 of [2]
UNIT – IV - Chapter 6 Section 1, 2, 3 of [2]
UNIT – V - Chapter 6 Section 4, 5.1, 5.2, 6, 7 of [2]

Reference:

1. P.Duraipandiyan and Lakshmi Duraipandian, Vector Analysis, Emarald publishers (1986).
2. Dr. S.Arumugam and prof. A.Thangapandi Issac, Fourier series, New Gamma publishing house (Nov 12)

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CORE COURSE VIII

LINEAR ALGEBRA

Objectives

1. To facilitate a better understanding of vector space
2. To solve problems in linear algebra

Unit I Vector spaces:

Vector spaces – Definition and examples – Subspaces-linear transformation – Span of a set.

Unit II Basis and Dimension:

Linear Independence – Basis and Dimension –Rank and Nullity.

Unit III Matrix and Inner product space:

Matrix of a linear transformation -Inner product space – Definition and examples – Orthogonality – Gram Schmidt orthogonalisation process – Orthogonal Complement.

Unit IV Theory of Matrices:

Algebra of Matrices - Types of Matrices – The Inverse of a Matrix – Elementary Transformations – Rank of a matrix.

Unit V Characteristic equation and bilinear forms:

Characteristic equation and Cayley -Hamilton theorem – Eigen values and Eigen vectors

Textbook

1. Arumugam S and Thangapandi Isaac A, Modern Algebra, SciTech Publications (India) Ltd., Chennai, Edition 2012.

Unit1: Chapter 5, Sec 5.1 to 5.4
Unit2: Chapter 5, Sec 5.5 to 5.7
Unit3: Chapter 5,Sec 5.8, Chapter 6, Sec 6.1 to 6.3
Unit4: Chapter 7 Sec 7.1 to 7.5
Unit5: Chapter 7, Sec 7.7, 7.8

References

1. I. N. Herstein, Topics in Algebra, Second Edition, John Wiley & Sons (Asia), 1975.

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NON- MAJOR ELECTIVE II

QUANTITATIVE APTITUDE II

Objectives :

1. To learn the problems solving techniques for aptitude problems
2. To enable to students prepare themselves for various competitive examinations

Unit I

Chain Rule – Time and Work – Pipes and Cisterns

Unit II

Time and Distance –Problems on Trains – Boats and Streams

Unit III

Simple Interest – Compound Interest - Stocks and Shares.

Unit IV

Clocks – Area – Volume and Surface Area.

Unit V

Permutations and Combinations.

Text Book:

Scope and treatment as in "Quantitative Aptitude "by R.S.Aggarwal, S.Chand & company limited, Ram Nagar, New Delhi - 2015

Unit1: (Chapters 14, 15 & 16)
Unit 2: (Chapters 21, 22 & 29)
Unit 3: (Chapters 17, 18 & 19)
Unit 4: (Chapters 24, 25 & 28)
Unit 5: (Chapters 30 & 31)

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CORE COURSE IX

NUMERICAL METHODS WITH MATLAB PROGRAMMING

Objectives:

1. To introduce the exciting world of programming to the students through numerical methods.
2. To introduce the techniques of MATLAB programming.
3. To solve numerical problems using MATLAB programming.

UNIT I

MATLAB Environment : Getting Started – Solving Problems in MATLAB – Saving you works – Predefined MATLAB Functions – Using Predefined Functions – Manipulating Matrices – Computational Limitations-Special Values and Functions.

UNIT II

Plotting : Introduction Two Dimensional Plots – Three Dimensional Plotting – Editing Plots from the Menu Bar – Creating Plots from the Workshop Window – Programming in MATLAB : introduction – Problems with Two Variables – Input/Functions – Statement level Control Structures.

UNIT III

Numerical Techniques : Introduction – Curve Fitting: Linear and Polynomial Regression – Using the Interactive Fitting Tools – Numerical Integration – Numerical Differentiation.

UNIT IV

Curve Fitting – Linear and parabolic curves by the method of least squares principle-Solving algebraic and transcendental equations-Bisection method, false position method and Newton Raphson method – Solving simultaneous algebraic equation – Guass – seidal method – Guass elimination method.

UNIT V

Interpolation – Newton's forward and backward difference formulae – Lagrange's interpolation formulae – Numerical integration using Trapezoidal and Simpson's one – third rules – solution of ODE's = Euler method and Runge – Kutta fourth order method.

Books for Study

1. Delores M.Etter, David C.Kuncicky, Holly Moore. Introduction to MATLAB, Published by Dorling Kindersley (india) Pvt. Ltd., licenses of Pearson Education in South Asia.
2. M.K.Venkatraman, Numerical methods in Science and Engineering, National Publisher Company, Fifth Edition, 2001 (For Units IV and V).
   Unit 1 : Chapter 2 & 3
   Unit 2 : Chapter 4 & 5
   Unit 3 : Chapter 8.
   Unit 4 : Chapter 2 section 1.7-1.8, Chapter 3, section 2, 4 and 5, Chapter 4, section 2, 6 of (2).
   Unit 5 : Chapter 6, sec 3, 4. Chapter 8, sec 4, Chapter 9, sec 8, 10, Chapter 11, sec 10, 16.

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CORE COURSE X

REAL ANALYSIS

Objectives: To enable the students to

1. Understand the real number system and countable concepts in real number system
2. Provide a Comprehensive idea about the real number system.
3. Understand the concepts of Continuity, Differentiation and Riemann Integrals
4. Learn Rolle's Theorem and apply the Rolle's theorem concepts.

UNIT I

Real Number system – Field axioms –Order relation in R. Absolute value of a real number & its properties –Supremum & Infimum of a set – Order completeness property – Countable & uncountable sets.

UNIT II

Continuous functions –Limit of a Function – Algebra of Limits – Continuity of a function –Types of discontinuities – Elementary properties of continuous functions – Uniform continuity of a function.

UNIT III

Differentiability of a function –Derivability & Continuity –Algebra of derivatives – Inverse Function Theorem – Daurboux"s Theorem on derivatives.

UNIT IV

Rolle's Theorem –Mean Value Theorems on derivatives- Taylor's Theorem with remainder- Power series expansion .

UNIT V

Riemann integration –definition – Daurboux's theorem –conditions for integrability – Integrability of continuous & monotonic functions - Integral functions –Properties of Integrable functions - Continuity & derivability of integral functions – The Fundamental Theorem of Calculus and the First Mean Value Theorem.

TEXT BOOK(S)

1. M.K,Singhal & Asha Rani Singhal , A First Course in Real Analysis, R.Chand & Co., June 1997 Edition
2. Shanthi Narayan, A Course of Mathematical Analysis, S. Chand & Co., 1995

UNIT – I - Chapter 1 of [1]
UNIT – II - Chapter 5 of [1]
UNIT – III - Chapter 6 – Sec 1 to 5 of [1]
UNIT – IV - Chapter 8 – Sec 1 to 6 of [1]
UNIT – V - Chapter 6 – Sec 6.2, 6.3, 6.5, 6.7, 6.9 of [2]

REFERENCE(S)

1. Goldberge, Richard R, Methods of Real Analysis, Oxford & IBHP Publishing Co., New Delhi, 1970.

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CORE COURSE XI

STATICS

OBJECTIVE:

1. To provide the basic knowledge of equilibrium of a particle.
2. To develop a working knowledge to handle practical problems.

UNIT I

Introduction – Forces acting at a point: Triangle of forces – Resolution of force – Condition of equilibrium.

UNIT II

Parallel forces and Moments: Resultant of parallel forces – Theorems on Moments – Moment about an axis – couples.

UNIT III

Equilibrium of three forces acting on a rigid body: Conditions of equilibrium – Trigonometrical theorems and problems - Coplanar forces: Reduction of Coplanar forces – Equation of Line of action of the resultant **–** Conditions of equilibrium

UNIT IV

Friction: Introduction – Laws of Friction – Definitions – Equilibrium of a particle on a rough inclined plane.

UNIT V

Equilibrium of strings: Equation of the Common Catenary -Parabolic Catenary.

TEXT BOOK:

M.K.Venkataraman, Statics, Agasthiyar Publications, 17th edition, 2014.

UNIT I -Chapter1, Chapter2.
UNIT II -Chapter 3, Chapter 4.
UNIT III -Chapter 5 (Section 1-6), Chapter 6 (Section 1-12).
UNIT IV -Chapter 7 (Section 1-13) Pages: 206 – 238.
UNIT V -Chapter 9 (Section 1- 8)

REFERENCE(S)

1. A.V.Dharmapadham, Statics, S.Viswanathan Publishers Pvt.Ltd, 2006.
2. P. Duraipandian, Laxmi Duraipandian and Muthamizh Jayapragasam, Mechanics S.Chand & Company PVT, LTD, 2014
3. S.L.Lony, Elements of Statics and Dynamics, Part-I, A.I.T.B.S.Publishers, 2007.

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CORE PRACTICAL I

NUMERICAL METHODS WITH MATLAB PROGRAMMING (P)

Objectives:

1. 1. To introduce the exciting world of programming to the students through numerical methods.
2. To introduce the techniques of MATLAB programming.
3. To solve numerical problems using MATLAB programming.

LIST OF PRACTICALS

1. Linear Interpolation
2. Linear Regression
3. Curve Fitting
4. Trapezoidal rule of integration
5. Simpson's 1/3 rule of integration
6. Newton – Raphson method of solving equations
7. Gauss – elimination method of solving simultaneous equations
8. Gauss – Seidal method of solving simultaneous equations
9. R-K fourth order method of solving differential equations
10. Lagrange's method of interpolation.

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MAJOR BASED ELECTIVE I (A)

OPERATIONS RESEARCH

Objectives:

1. To introduce the various techniques of Operations Research.
2. To make the students solve real life problems in Business and Management

UNIT I

Linear programming problem - Mathematical formulation – Illustrations on Mathematical formulation on Linear Programming Problems – Graphical solution method - some exceptional cases - Canonical and standard forms of Linear Programming Problem - Simplex method.

UNIT II

Use of Artificial Variables (Big M method - Two phase method) – Duality in Linear Programming - General primal-dual pair - Formulating a Dual problem - Primal-dual pair in matrix form -Dual simplex method.

UNIT III

Transportation problem - LP formulation of the TP - Solution of a TP - Finding an initial basic feasible solution (NWCM - LCM -VAM) – Degeneracy in TP - Transportation Algorithm (MODI Method) - Assignment problem - Solution methods of assignment problem – special cases in assignment problem.

UNIT IV

Queuing theory - Queuing system - Classification of Queuing models - Poisson Queuing systems Model I (M/M/1)(∞/FIFO) only - Games and Strategies – Two person zero sum - Some basic terms - the maximin-minimax principle -Games without saddle points-Mixed strategies - graphic solution 2xn and mx2 games.

UNIT V

PERT and CPM – Basic components – logical sequencing - Rules of network construction- Critical path analysis - Probability considerations in PERT.

Book for Study:

Kanti Swarup, P.K. Gupta and ManMohan, Operations Research, 13th edition, Sultan Chand and Sons, 2007.

Unit 1: Chapter 2 Sec 2.1 to 2.4, Chapter 3 Sec 3.1 to 3.5, Chapter 4 Sec 4.1 , 4.3
Unit 2: Chapter 4 Sec 4.4, Chapter 5 Sec 5.1 to 5.4, 5.9
Unit 3: Chapter 10 Sec 10.1, 10.2, 10.8, 10.9, 10.12, 10.13, Chapter 11 Sec 11.1 to 11.4
Unit 4: Chapter 21 Sec 21.1, 21.2, 21.7 to 21.9, Chapter 17 Sec 17.1 to 17.6
Unit 5: Chapter 25 Sec 25.1 to 25.4, 25.6, 25.7

Book for Reference:

1. Sundaresan.V, Ganapathy Subramanian. K.S. and Ganesan.K, Resource Management Techniques, A.R. Publications, 2002.
2. Taha H.A., Operations Research: An introduction, 7th edition, Pearson Prentice Hall, 2002.

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MAJOR BASED ELECTIVE I (B)

STOCHASTIC PROCESSES

OBJECTIVES

1. To know probability and distribution function
2. To understand the concept Stochastic Process
3. To identify Markov chains ,Poisson Process and Birth and death Process
4. To know the concept of queuing theory with some examples

UNIT I

Generating function - Laplace transforms – Laplace transforms of a probability distribution function - Difference equations – Differential difference equations – Matrix analysis.

UNIT II

Stochastic Process - Notion – Specification – Stationary Process - Markov Chains – Definition and examples – Higher transition probabilities.

UNIT III

Classification of states and chains – Determination of higher transition probabilities – Stability of Markov system – Limiting behaviour.

UNIT IV

Poisson Process and related distributions – Generalization of Poisson Process – Birth and death process.

UNIT V

Stochastic Process in queuing and reliability – queuing systems – M/M/1 models – Birth and death process in queuing theory – Multi channel models – Bulk Queues.

TEXT BOOK

J.Medhi, Stochastic Processes, Chapters 1,2,3 (Omitting 3.6,3.7,3.8), Chapter 4 (Omitting 4.5 and 4.6) and Chapter 10 (Omitting 10.6,10.7).
Unit 1: Chapter 1 – Sec 1.1, 1.2, 1.3, Appendix A 1, 2, 3, 4.
Unit 2: Chapter 2 – Sec 2.1, 2.2, 2.3 & Chapter 3 – Sec 3.1, 3.2.
Unit 3: Chapter 3 – Sec 3.4, 3.5, 3.6.
Unit 4: Chapter 4 – Sec 4.1, 4.2, 4.3, 4.4
Unit 5: Chapter 10 – Sec 10.1, 10.2, 10.3, 10.4, 10.5

REFERENCES

[1] First Course in Stochastic Processes by Samuel Karlin.
[2] Stochastic Processes by Srinivasan and Metha (TATA McGraw Hill).
[3] Elements of Applied Stochastic Processes by V.Narayan.

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CORE COURSE XII

ABSTRACT ALGEBRA

Objectives

1. To introduce the concept of Algebra from the basic set theory and Functions, etc.
2. To introduce the concept of Group theory and Rings.

UNIT I

Groups : Definition and Examples – Elementary Properties of a Group – Equivalent Definitions of a Group.-Permutation Groups

UNIT II

Subgroups - Cyclic Groups-Order of an Element – Cosets and Lagrange's Theorem .

UNIT III

Normal Subgroups and Quotient Groups - Isomorphism –Homomorphism

UNIT IV

Rings: Definitions and Examples - Elementary properties of rings –Isomorphism - Types of rings.-Characteristic of a ring – subrings – Ideals - Quotient rings

UNIT V

Maxi mal and Prime Ideals.-Homomorphism of rings – Field of quotient of an integral domain – unique factorization domain-Euclidean domain

Textbook

1. S Arumugam and A Thangapandi Isaac, Modern Algebra, SciTech Publications, Chennai, 2003.

Unit 1: Chapter 3 Sections 3.1-3.4
Unit 2: Chapter 3 Sections3.5-3.8
Unit 3: Chapter 3 Sections 3.9-3.11
Unit 4: Chapter 4 Sections 4.1-4.8
Unit 5: Chapter 4 Sections 4.9- 4.11, 4.13-14

References

1. N. Herstein, Topics in Algebra, John Wiley & Sons, Student 2nd edition, 1975.
2. Vijay, K. Khanna and S.K. Bhambri, A Course in Abstract Algebra, Vikas Publishing House Pvt. Ltd.

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CORE COURSE XIII

COMPLEX ANALYSIS

Objectives: To enable the students to

1. Understand the functions of complex variables, continuity and differentiation of complex variable functions, C – R equations of analytic functions.
2. Learn about elementary transformation concepts in complex variable.
3. Know about complex Integral functions with Cauchy's Theorem, power series expansions of Taylor's and Laurant's series.
4. Understand the singularity concepts and residues, solving definite integrals using the residue concepts.

UNIT I

Functions of a Complex variable –Limits-Theorems on Limits –Continuous functions – Differentiability – Cauchy-Riemann equations – Analytic functions –Harmonic functions.

UNIT II

Elementary transformations - Bilinear transformations – Cross ratio – fixed points of Bilinear Transformation – Some special bilinear transformations.

UNIT III

Complex integration - definite integral – Cauchy's Theorem –Cauchy's integral formula –Higher derivatives - .

UNIT IV

Series expansions – Taylor's series – Laurant's Series – Zeroes of analytic functions – Singularities.

UNIT V

Residues – Cauchy's Residue Theorem –Evaluation of definite integrals.

TEXT BOOK(S)

1. S.Arumugam, A.Thangapandi Isaac, & A.Somasundaram, Complex Analysis, New Scitech Publications (India) Pvt Ltd, 2002.

UNIT – I -Chapter 2 section 2.1 to 2.8 of Text Book
UNIT – II -Chapter 3 Sections 3.1 to 3.5 of Text Book
UNIT – III -Chapter 6 sections 6.1 to6.4 of Text Book
UNIT –IV -Chapter 7 Sections 7.1 to 7.4 of Text Book
UNIT – V -Chapter 8 Sections 8.1 to 8.3 of Text Book

REFERENCE(S)

1. J.N. Sharma, Functions of a Complex variable, Krishna Prakasan Media(P) Ltd, 13th Edition, 1996-97.
2. T.K.Manickavachaagam Pillai, Complex Analysis, S.Viswanathan Publishers Pvt Ltc, 1994.

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CORE COURSE XIV

DYNAMICS

OBJECTIVE:

1. To provide a basic knowledge of the behavior of objects in motion.
2. To develop a working knowledge to handle practical problems.

UNIT I

Introduction-Kinematics: Velocity-Relative Velocity-Angular Velocity-Acceleration-Relative Acceleration-Motion in a straight line under uniform acceleration.

UNIT II

Projectile: Projectile-Path of a projectile-Characteristics-Horizontal projection-Projectile up/down an inclined plane-Enveloping parabola.

UNIT III

Collision of Elastic Bodies: Introduction-Definitions-Fundamental Laws of impact-Impact of a smooth sphere on a fixed smooth plane-Direct impact of two smooth spheres-Oblique impact of two smooth spheres-Dissipation of energy due to impact-Compression and Restitution-Impact of a particle on a rough plane.

UNIT IV

Simple Harmonic Motion: Introduction-S.H.M. in straight line-Compositions of simple harmonic motions of the same period.

UNIT V

Motion Under The action Of Central Forces: Velocity and acceleration in polar coordinates-Equiangular spiral-Differential Equation of central orbits-Pedal Equation of the central orbit-Two-fold problems in central orbits.

TEXT BOOK:

1. Dr.M.K.VENKATARAMAN, Dynamics, Agasthiyar Publications, Thirteenth Edition, July 2009.

UNIT I	-Chapter2, Chapter 3, Section 3.1-3.22
UNIT II	-Chapter6, Sections 6.1-6.17
UNIT III	-Chapter8, Sections 8.1-8.11
UNIT IV	-Chapter 10, Sections 10.1-10.13
UNIT V	-Chapter 11, Sections 11.1-11.13

REFERENCE(S)

1. P. Duraipandian, Laxmi Duraipandian and Muthamizh Jayapragasam, Mechanics S.Chand &Company PVT, LTD, 2014
2. A.V.Dharmapadham, Dynamics, S, Viswanathan Publishers Pvt.Ltd. 2006.

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MAJOR BASED ELECTIVE II (A)

GRAPH THEORY

Objectives

1. To introduce the notion of graph theory and its applications.
2. To learn the techniques of combinatorics in Graph Theory.

UNIT I

Introduction - The Konigsberg Bridge Problem - Graphs and subgraphs: Definition and Examples - Degrees - Subgraphs - Isomorphism. –independent sets and coverings.

UNIT II

Matrices - Operations on Graphs - Walks, Trails and Paths – Connectedness and Components - Eulerian Graphs.

UNIT III

Hamiltonian Graphs (Omit Chavatal Theorem) - Characterization of Trees - Centre of a Tree.

UNIT IV

Planarity: Introduction - Definition and Properties - Characterization of Planar Graphs.

UNIT V

Directed Graphs: Introduction - Definitions and Basic Properties – Some Applications: Connector Problem - Kruskal's algorithm - Shortest Path Problem – Dijkstra's algorithm.

Textbook

1. S. Arumugam and S. Ramachandran, Invitation to Graph Theory, SciTech Publications (India) Pvt. Ltd., Chennai, 2006.

UNIT-I Chapter-1 Sec 1.0, 1.1 and Chapter -2 Sec 2.0, 2.1, 2.2, 2.3, 2.4.2.6
UNIT-II Chapter-2 Sec 2.8,2.9 ,Chapter-4 Sec 4.1,4.2 and Chapter-5 Sec 5.0,5.1
UNI-III Chapter-5 Sec 5.2, Chapter-6 Sec 6.0, 6.1, 6.2.
UNIT-IV Chapter-8 Sec 8.0, 8.1, 8.2.
UNIT-V Chapter-10 Sec 10.0, 10.1 Chapter-11 Sec 11.0, 11.1, 11.2

References

1. Narsingh Deo, Graph Theory with applications to Engineering and Computer Science, Prentice Hall of India, 2004.
2. Gary Chartrand and Ping Zhang, Introduction to Graph Theory, Tata McGraw-Hill Edition, 2004.

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MAJOR BASED ELECTIVE II (B)

MATHEMATICAL MODELLING

OBJECTIVES

1. To study the mathematical models through ode and difference equations
2. To train the students to develop mathematical models in real life problems

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

TEXT BOOK(S)

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

Unit 1: Chap 2, Sec 2.1 – 2.6
Unit 2: Chap 3, Sec 3.1 – 3.6
Unit 3: Chap 4, Sec 4.1 – 4.4
Unit 4: Chap 5, Sec 5.1 – 5.5
Unit 5: Chap 7, Sec 7.1 – 7.5

REFERENCE(S)

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

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MAJOR BASED ELECTIVE III (A)

ASTRONOMY

Objectives:

1. To introduce the exciting world of astronomy to the students.
2. To help the students to study spherical trigonometry in the field of astronomy.
3. To understand the movements of the celestial objects.

UNIT I

Relevant properties of sphere and formulae in spherical trigonometry (no proof, no problems) - Celestial sphere and diurnal motion -Celestial coordinates-sidereal time.

UNIT II

Morning and evening stars -circumpolar stars- diagram of the celestial sphere -zones of earth -perpetual day-dip of horizon-twilight.

UNIT III

Refraction - laws of refraction -tangent formula-Cassini's formula - horizontal refraction- geocentric parallax -horizontal parallax.

UNIT IV

Kepler's laws - verification of 1^{st} and 2^{nd} laws in the case of earth - Anomalies -Kepler's equation - Seasons -causes -kinds of years.

UNIT V

Moon-sidereal and synodic months - elongation - phase of moon - eclipses-umbra and penumbra - lunar and solar eclipses - ecliptic limits - maximum and minimum number of eclipses near a node and in a year - Saros.

Book for Study:

1. Kumaravel, S. and Susheela Kumaravel, *Astronomy*, 8th Edition, SKV Publications, 2004.

Unit 1: Sec: 39-79
Unit 2: Sec: 80-90,106-116
Unit3: Sec: 117-144
Unit 4: Sec: 146-162,173-178
Unit 5: Sec: 229-241,256-275

Book for Reference:

1. G V Ramachandran, Text Book of Astronomy, Mission Press, Palayamkottai, 1965.

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MAJOR BASED ELECTIVE III (B)

NUMBER THEORY

OBJECTIVES :

1. To highlight the niceties and nuances in the world of numbers.
2. To prepare the students for coding through congruences.

Unit I

Euclid's Division Lemma – Divisibility – The Linear Diophantine Equation – The Fundamental Theorem of Arithematic

Unit II

Permutations and Combinations – Fermat's Little Theorem – Wilson's Theorem – Generating Functions

Unit III

Basic Properties of Congruences Residue Systems. Linear Congruences – The Theorems of Fermat and Wilson Revisited.

Unit IV

The Chinese Remainder Theorem – Polynomial Congruences – Combinational Study of F(n).

Unit V

Formulae for d(n) and s(n) – Multiplicative Arithmetic Function – The Mobius Inversion Formula.

Books for Study

1. Number Theory by George E.Andrews, Hindustan Publishing Corporation – 1984, Edition.

Unit I : Chapter - 2 Sec. 2.1 – 2.4 pages 12-29
Unit II : Chapter – 3 Sec. 3.1, 3.4 pages 30-44
Unit III : Chapter – 4Sec. 4.1 – 4.2 Pages 49 – 55, Sec. 5.1- 5.2 Pages 58-65
Unit IV : Chapter – 4 Sec. 5.3 – 5.4 pages 66-74, Sec. 6.1 Pages 75-81
Unit V : Chapter – 5 Sec. 6.2 – 6.3 Pages 82-92

Books for Reference

1. Basic Number Theory by S.B.Malik, Vikas Publishing House Pvt. Ltd.,
2. A First Course Theory of Numbers by K.C.Chowdhury. Asian Books Pvt. Ltd., I Edition (2004)

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