

MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

UG COURSES – AFFILIATED COLLEGES

B.Sc. Mathematics

(Choice Based Credit System)

(with effect from the academic year 2017-2018 onwards)

Sem	Part	Sub. No	Subject Status	Subject title	Hrs / Week	Credits	Marks				
							Maximum			Passing minimum	
							Int.	Ext.	Tot.	Ext.	Tot.
I	I	1	Language	Tamil/Other Languages	6	4	25	75	100	30	40
	II	2	Language	English	6	4	25	75	100	30	40
	III	3	Core -1	Calculus	5	4	25	75	100	30	40
		4	Core-2	Classical Algebra	5	4	25	75	100	30	40
		5	Allied-I	Statistics-I OR Physics/ Chemistry/ Computer Science With Practicals	6	3	25	75	100	30	40
					6	4	25	75	100	30	40
IV	6	Common	Environmental Studies	2	2	25	75	100	30	40	
II	I	7	Language	Tamil/Other Languages	6	4	25	75	100	30	40
	II	8	Language	English	6	4	25	75	100	30	40
	III	9	Core-3	Analytical Geometry of Three Dimensions	5	4	25	75	100	30	40
		10	Core-4	Differential Equations	5	4	25	75	100	30	40
		11	Allied-I	Statistics -II OR Physics/ Chemistry/ Computer Science With Practicals	6	3	25	75	100	30	40
					6	4	25	75	100	30	40
IV	12	Common	Value Based Education/	2	2	25	75	100	30	40	

				Social Harmony							
III	I	13	Language	Tamil/Other Languages	6	4	25	75	100	30	40
	II	14	Language	English	6	4	25	75	100	30	40
	III	15	Core-5	Real Analysis-I	6	4	25	75	100	30	40
		16	Allied-II	Statistics-I	6	3	25	75	100	30	40
				OR Physics /Chemistry With Practicals	6	4	25	75	100	30	40
17	Skilled Based core	Vector Calculus	4	4	25	75	100	30	40		
	IV	18	Non-major Elective	Any one of the following 1.1) Mathematics for Competitive Examinations I 1.2) Fundamentals of Statistics I	2	2	25	75	100	30	40
IV	I	19	Language	Tamil/Other Languages	6	4	25	75	100	30	40
	II	20	Language	English	6	4	25	75	100	30	40
	III	21	Core-6	Abstract Algebra I	5	4	25	75	100	30	40
		22	Allied-II	Statistics II	6	3	25	75	100	30	40
	OR Physics/ Chemistry with Practicals			6	4	25	75	100	30	40	
	IV	23	Non-major Elective	Any one of the following 2.1) Mathematics for Competitive Examinations II 2.2) Fundamentals of Statistics II	2	2	25	75	100	30	40
				24	Common	Personality Development and Yoga	4	4	25	75	100
V		Extension Activities	NCC/NSS/YRC/YWF	-	1	-	-	-	-	-	

V	III	25	Core-7	Abstract Algebra II	5	4	25	75	100	30	40
		26	Core-8	Real Analysis II	6	4	25	75	100	30	40
		27	Core-9	Mechanics	5	4	25	75	100	30	40
		28	Major Elective -I	Any one of the following 1.1. Astronomy -I 1.2.Discrete Mathematics 1.3.Programming in C	4	4	25	75	100	30	40
		29	Major Elective-II	Any one of the following 2.1.Operations Research - I 2.2.Combinatorial Mathematics 2.3.Numerical Methods	4	4	25	75	100	30	40
	III	30	Skilled Based Major	Trigonometry , Fourier series and Laplace transforms	4	4	25	75	100	30	40
	IV	31	Skilled Based Common	Computers for Digital Era	2	2	25	75	100	30	40
VI	III	32	Core-11	Complex Analysis	5	4	25	75	100	30	40
		33	Core-12	Number Theory	4	4	25	75	100	30	40
		34	Core-13	Graph Theory	5	4	25	75	100	30	40
		35	Major Elective-III	Any one of the following 3.1 Astronomy II 3.2Fuzzy Mathematics 3.3 Mathematical Modeling	4	4	25	75	100	30	40
		36	Major Elective-IV	Any one of the following 4.1 Operations Research II 4.2 Coding Theory 4.3 LaTeX	4	4	25	75	100	30	40
		37	Major Project	Group Project	8	8	25	75	100	30	40

CALCULUS

(75 Hours)

- Unit I :** Curvature, Radius of Curvature and Centre of curvature in Cartesian and polar Co-ordinates
- Unit II** Pedal Equation-Involute and evolute-Asymptotes
- Unit III** Singular Points(Node, cusp, conjugate points)-Tracing of curves (cartesian only)
- Unit IV** Double and Triple Integrals - Changing the order of integration - Jacobians and change of variables
- Unit V** Beta and Gamma functions – Application of Beta and Gamma Functions in evaluation of Double and Triple Integrals, Improper Integrals.

Text Book:

Narayanan S and T.K. Manickavasagam Pillai - Calculus Volume I (2004), Volume II (2004), S. Viswanathan Printer Pvt.Ltd.

Books for Reference :

- Kandasamy P and K. Thilagavathi - Mathematics for B.Sc., Volume II – 2004, S. Chand & Co., New Delhi.
- Apostol T.M. - Calculus, Vol. I (4th edition) John Wiley and Sons, Inc., New York 1991.
- Apostol T.M. - Calculus, Vol. II (2nd edition) John Wiley and Sons, Inc., New York 1969)
- Stewart, J - Single Variable Calculus (4th edition) Brooks / Cole, Cengage Learning 2010.

CLASSICAL ALGEBRA (75 Hours)

- Unit I** Theory of Equations – Formation of equations – Relation between roots and coefficients – symmetric function of the roots.
- Unit II** Sum of the powers of the roots of an equation – Newton’s theorem, Reciprocal Equations.
- Unit III** Transformation of equations, Descarte’s rule of signs – Rolle’s theorem
- Unit IV** Multiple roots, Sturm’s Theorem, solving appropriate solution of equations using Newton’s and Horner’s method.
- Unit V** Biquadratic equations – solution by Ferrari’s method – cubic equations – solutions by Cardon’s method.

Text Book:

Manickavasagam Pillai .T.K and S. Narayanan - Algebra – Viswanathan Publishers and Printers Pvt. Ltd., - 2004.

Books for Reference :

- Kandasamy P and K. Thilagavathi - Mathematics for B.Sc., - 2004, Volume I and Volume IV, S. Chand & Co., New Delhi.
- Arumugam .S, Thangapandi Issac – Classical Algebra, New Gamma Publishing House, Palayamkottai.
- Burnside, W.S. and A.W. Panton - The Theory of Equations, Dublin University Press, 1954.
- MacDuffee, C.C. - Theory of Equations, John Wiley & Sons Inc., 1954.

SEMESTER – I/III

Statistics

(For Mathematics Students)

Paper – I (90 Hours)

- Unit I** Moments, Skewness and Kurtosis - Curve fitting - method of least squares – Fitting lines – Parabolic, Exponential and Logarithmic curves.
- Unit II** Correlation and Regression – Scatter Diagram – Karl Pearson’s coefficient of correlation – Properties – Lines of Regression – Coefficient of Regression and properties – Rank Correlation.
- Unit III** Association of Attributes – Consistency of data – criteria for independence – Yule’s coefficient of Association.
- Unit IV** Random variable – Distribution function – properties of Distribution function – Mathematical Expectation – Addition theorem of Expectation – Multiplication theorem of Expectation – Moment generating function – cumulants – characteristic function – Properties of characteristic function.
- Unit V** Discrete and continuous Probability Distributions - Binomial and Poisson Distribution and their moments, Generating function, characteristic function, properties and simple applications. Normal Distribution – Standard normal distribution and their properties – simple problems.

Text Book:

Gupta .S.C and V.K. Kapoor – Fundamentals of Mathematical Statistics – (2002)
Sultan Chand & Sons, New Delhi.

Books for Reference :

- Vittal, V.R. – Mathematical Statistics (2004) Maragatham Publications
- D.C. Sancheti & Kapoor – Statistics
- M.L. Khanna – Statistics
- S. Arumugam & others – Statistics

SEMESTER – I/III

**Allied Mathematics
(For Science Students)**

Paper – I

Algebra and Differential Equations (90 Hours)

- Unit I** Theory of Equations – Formation of Equations – Relation between roots and coefficients – Reciprocal equations.
- Unit II** Transformation of Equations – Approximate solutions to equations – Newton’s method and Horner’s method.
- Unit III** Matrices – Characteristic equation of a matrix – Eigen values and Eigen vectors – Cayley Hamilton theorem and simple problems.
- Unit IV** Differential equation of first order but of higher degree – Equations solvable for p , x , y – Partial differential equations – formations – solutions – Standard form $P_p + Q_q = R$.
- Unit V** Laplace transformation – Inverse Laplace transform.

Text book:

- Dr. S. Arumugam & others – Allied Mathematics – I

ANALYTICAL GEOMETRY OF THREE DIMENSIONS: (75 Hours)

- Unit I** Analytical Geometry of 3D Co-ordinate system, direction cosines, direction ratios
- Unit II** Equation of plane in different forms - angle between planes-Length of perpendicular-angle bisection.
- Unit III -** Equation of a line in different forms - image of a point – image of a line-The plane and the straight line-angle between plane and line-Coplanar lines-Shortest distance between two lines
- Unit IV** Sphere – Tangent plane – circle of intersections – Tangency of Spheres – coaxial system of spheres - Radical Planes – Orthogonal Spheres.
- Unit V** Equation of a cone-cone with vertex at the origin –Tangent plane and normal-Quadratic cone with the vertex at origin – Right circular cone – Cylinder – Right circular cylinder-enveloping cylinder

Text Book:

T.K.Manicavachagom Pillay and T.Natarajan-A text book of Analytical Geometry - Part-II Three Dimensions-S.Viswanathan(Printers&Publishers)Pvt Ltd(2012)

Books for Reference :

- Duraipandian .P. Laxmi Duraipandian and D.Muhilan - Analytical Geometry of Three Dimension - Emerald Publishers.
- Kandasamy .P. and K. Thilagavathi – Mathematics for B.Sc., Vol. IV – 2004 S.Chand and Co. New Delhi.
- Loney .S.L. - The Elements of Coordinate Geometry - Mcmillan and Company London.
- B. Stephen John - Analytical Geometry of 3D and vector differentiation : IDEAL publication.

DIFFERENTIAL EQUATIONS : (75 Hours)

- Unit I** First order higher degree equations – solvable for x, y, p and Clairaut's form – Simultaneous differential equations of the form $f_1(D)x + g_1(D)y = h_1(t)$, $f_2(D)x + g_2(D)y = h_2(t)$
- Unit II (Ordinary differential equation)** Second order linear differential equations with constant coefficients – Find the P.I for functions of the form $e^{ax} f(x)$ and $x^n f(x)$
- Unit III** Linear equations of second order with variable coefficients – Homogeneous equations – Equation reducible to homogeneous equation.
- Unit IV (Partial differential equations)** Formation of equations by elimination of arbitrary constants and functions – Definition of general, particular and complete solutions – solving standard forms $f(p, q) = 0$, $f(x, p, q) = 0$, $f(y, p, q) = 0$, $f(z, p, q) = 0$, $f(x, p) = f(y, q)$, $z = px + qy + f(p, q)$ – Lagrange's differential equations $P_p + Q_q = R$
- Unit V** Application of differential equations – Growth and Decay – chemical reaction - Newton's law of cooling – Brochistocrone problem – simple electric circuits.

Text Book:

Narayanan .S and T.K. Manickavachagam Pillai – Differential equations and its applications, 2003 - S. Viswanathan Printers.

Books for Reference :

- Kandasamy .P and K. Thilagavathi - Mathematics for B.Sc., Vol. III – 2004 – S.Chand and Co., New Delhi.
- Braun .M. - Differential Equations and their applications (III edition) Springer – Verlag, New York 1983)
- Boyce .W.E and R.C. Diprima – Elementary differential equations and Boundary value Problems (VII editions) - John Wiley and Sons, Inc, New York 2001.
- Sankaranarayan and Manguldoss – Differential Equations.

SEMESTER – II / IV

Statistics

(For Mathematics Students)

Paper – II (90 Hours)

- Unit I** Characteristics of index numbers – Laspeyer’s and Paasche’s – Fisher’s and Bowley’s Marshall and Edgeworth’s index numbers – Tests – Unit test, Commodity Reversal test, Time Reversal test, circular test.
- Unit II** Testing of Hypothesis – Null hypothesis and Alternate hypothesis – Type I and Type II errors - Critical Region, Level of significance – Test of significance for large samples – Testing a single proportion – Difference of proportions. Testing a single mean and Difference of means.
- Unit III** Tests based on t-distribution – single mean and Difference of means – Tests based on F-distribution – Variance Ratio test – Tests based on Chi-square Distribution – Independence – Goodness of fit.
- Unit IV** Analysis of variance – one way and two way classified data – Basis of experimental design – Randomized Block Design – Latin square – simple problems.
- Unit V** Statistical Quality control – Definition – Advantages, Process control – Control chart, Mean chart, Range chart, P-chart, Product Control – Sampling Inspection Plans.

Text Book:

- Gupta .S.C & V.K. Kapoor – Fundamentals of Mathematical Statistics – (2002) Sultan Chand & Sons, New Delhi.

Books for Reference :

- Vittal .P.R – Mathematical Statistic (2004) – Maragatham Publications
- DC Sancheti & Kapoor – Statistics
- M.L. Khanna – Statistics
- S. Arumugam & others – Statistics

SEMESTER – II/IV

**Allied Mathematics
(For Science Students)
Paper – II**

Vector Calculus & Fourier Series (90 Hours)

- Unit I** Vector differentiation – Gradient – Divergence and curl
- Unit II** Evaluation of double and triple integrals
- Unit III** Vector integration – Line, surface and volume integrals
- Unit IV** Green’s, Stokes and Divergence theorems (without proof) – simple problems.
- Unit V** Fourier series – Even and odd functions – Half range Fourier series.

Text Books:

- Dr. S. Arumugam & others – Vector Calculus
- T.K. Manicavachagom Pillai – Calculus (Vol II)

**MANONMANIAM SUNDARANAR UNIVERSITY,
TIRUNELVELI
UG COURSES – AFFILIATED COLLEGES
B.Sc. MATHEMATICS**

(Choice Based Credit System)

(with effect from the academic year 2017-2018 onwards)

Sem	Part	Sub. No	Subject Status	Subject title	Hrs / Week	Cre-dits	Mark				
							Maximum			Passing minimum	
							Int.	Ext.	Tot.	Ext.	Tot.
III	I	13	Language	Tamil/Other Languages	6	4	25	75	100	30	40
	II	14	Language	English	6	4	25	75	100	30	40
	III	15	Core-5	Real Analysis-I	6	4	25	75	100	30	40
		16	Allied-II	Statistics-I	6	3	25	75	100	30	40
				OR Physics/ Chemistry/Computer With Practicals	6	4	25	75	100	30	40
17	Skill Based core	Vector Calculus	4	4	25	75	100	30	40		
	IV	18	Non-major Elective	Any one of the following 1.1) Mathematics for Competitive Examinations- I 1.2) Fundamentals of Statistics-I	2	2	25	75	100	30	40
		19	Common	Yoga*	2	2	25	75	100	30	40

IV	I	20	Language	Tamil/Other Languages	6	4	25	75	100	30	40
	II	21	Language	English	6	4	25	75	100	30	40
	III	22	Core-6	Abstract Algebra- I	6	4	25	75	100	30	40
		23	Allied-II	Statistics II	6	3	25	75	100	30	40
				OR Physics/ Chemistry/ Computer with Practicals	6	4	25	75	100	30	40
	24	Skill Based Core	Trigonometry, Fourier Series and Laplace Transforms	4	4	25	75	100	30	40	
	IV	25	Non-major Elective	Any one of the following 2.1) Mathematics for Competitive Examinations- II 2.2) Fundamentals of Statistics II	2	2	25	75	100	30	40
26				Common	Computers for Digital Era*	2	2	25	75	100	30
	V		Extension Activities	NCC/NSS/YRC/YWF/PE	-	1	-	-	-	-	-

V	III	27	Core-7	Abstract Algebra II	5	4	25	75	100	30	40
		28	Core-8	Real Analysis II	5	4	25	75	100	30	40
		29	Core-9	Statics	5	4	25	75	100	30	40
		30	Core-10	Transforms and their Applications	5	4	25	75	100	30	40
		31	Major Elective -I	Any one of the following 1.1. Astronomy -I 1.2. Discrete Mathematics 1.3. Combinatorial Mathematics	4	4	25	75	100	30	40
		32	Major Elective-II	Any one of the following 2.1. Operations Research - I 2.2. Stochastic Process 2.3. MS Office	4	4	25	75	100	30	40
	IV	33	Skill Based Common	Personality Development /Effective Communication / Youth Leadership	2	2	25	75	100	30	40

VI	III	34	Core-11	Complex Analysis	5	4	25	75	100	30	40
		35	Core-12	Number Theory	4	4	25	75	100	30	40
		36	Core-13	Graph Theory	5	4	25	75	100	30	40
		37	Core-14	Dynamics	4	4	25	75	100	30	40
		38	Core-15	Numerical Methods	4	4	25	75	100	30	40
		39	Major Elective-III	Any one of the following 3.1 Astronomy II 3.2 Fuzzy Mathematics 3.3 Mathematical Modeling	4	4	25	75	100	30	40
		40	Major Elective-IV	Any one of the following 4.1 Operations Research II 4.2 Coding Theory 4.3 Programming in	4	4	25	75	100	30	40

SEMESTER – III

CORE PAPER –V

REAL ANALYSIS - I (90 Hours) (SMMA31)

L	T	P	C
2	4	0	4

Objectives:

- To lay a good foundation of classical analysis
- To study the behaviour of sequences and series

Unit I **Real number system :**

The field of axioms, the order axioms, the rational numbers, the irrational numbers, upper bounds, maximum element, least upper bound (supremum). The completeness axiom, absolute values, the triangle inequality. Cauchy – schwartz's inequality. **11L**

Unit II Sequences : Bounded sequences – monotonic sequences – convergent sequences – divergent and oscillating sequences – The algebra of limits. **17L**

Unit III Behaviour of monotonic sequences – Cauchy's first limit theorem – Cauchy's second limit theorem – Cesaro's theorem – subsequences - Cauchy sequence – Cauchy's general principle of convergence. **19L**

Unit IV Series : Infinite series – n^{th} term test – Comparison test – Kummer's test – D'Alembert's ratio test – Raabe's test - Gauss test – Root test **23L**

Unit V Alternating series – Leibnitz's test - Tests for convergence of series of arbitrary terms – Multiplication of series- Abel's Theorem-Mertens theorem-Power Series- Radius of convergence **20L**

Text Books:

- Arumugam .S and Thengapandi Issac – “sequences and series”, New Gamma publishing House, Palayamkottai – 627 002.
- Tom M. Apostol – Mathematical Analysis, II Edition, Narosa Publishing House, New Delhi (unit I)

Book for Reference :

- Goldberg .R – Methods of Real Analysis, Oxford and IBH Publishing Co., New Delhi.

Statistics
(For Mathematics Students)
Paper – I (90 Hours)

Objectives:

- To study the concept of measures of dispersion and measures of central tendencies
- To develop the concept Probability distributions

- Unit I** Moments, Skewness and Kurtosis - Curve fitting - method of least squares – Fitting lines – Parabolic, Exponential and Logarithmic curves. **16L**
- Unit II** Correlation and Regression – Scatter Diagram – Karl Pearson’s coefficient of correlation – Properties – Lines of Regression – Coefficient of Regression and properties – Rank Correlation. **16L**
- Unit III** Association of Attributes – Consistency of data – criteria for independence – Yule’s coefficient of Association. **14L**
- Unit IV** Random variable – Distribution function – properties of Distribution function – Mathematical Expectation – Addition theorem of Expectation – Multiplication theorem of Expectation – Moment generating function – cumulants – characteristic function – Properties of characteristic function. **22L**
- Unit V** Discrete and continuous Probability Distributions - Binomial and Poisson Distribution and their moments, Generating function, characteristic function, properties and simple applications. Normal Distribution – Standard normal distribution and their properties – simple problems. **22L**

Text Book:

Gupta .S.C and V.K. Kapoor – Fundamentals of Mathematical Statistics – (2002)
Sultan Chand & Sons, New Delhi.

Books for Reference :

- Vittal, V.R. – Mathematical Statistics (2004) Maragatham Publications
- D.C. Sancheti & Kapoor – Statistics
- M.L. Khanna – Statistics
- S. Arumugam & others – Statistics

MSU/ 2017-18 / UG-Colleges /Part-III (B.Sc. Mathematics) / Semester – I / Allied – I

SEMESTER – I/III

**Allied Mathematics
(For Science Students)**

Paper – I

Algebra and Differential Equations (90 Hours)

Objectives:

- To know the order and degree of the ODE
- To understand the basic Theory of equations
- To study the concept of Laplace transforms
- To know the theory of matrices

Unit I	Theory of Equations – Formation of Equations – Relation between roots and coefficients – Reciprocal equations.	20L
Unit II	Transformation of Equations – Approximate solutions to equations – Newton’s method and Horner’s method.18L	
Unit III	Matrices – Characteristic equation of a matrix – Eigen values and Eigen vectors – Cayley Hamilton theorem and simple problems	15L.
Unit IV	Differential equation of first order but of higher degree – Equations solvable for p, x, y – Partial differential equations – formations – solutions – Standard form $P_p + Q_q = R$.	20L
Unit V	Laplace transformation – Inverse Laplace transform.	17L

Text book:

- Dr. S. Arumugam & others – Allied Mathematics – I

SEMESTER III

Skill Based Core

Paper – I

VECTOR CALCULUS (60 Hours) (SSMA3A)

L	T	P	C
4	0	0	4

Objectives:

- To provide basic knowledge of vector differentiation and vector integration
- To solve problems related to that

Unit I	Vector point functions – Scalar point functions – Derivative of a Vector & Derivative of sum of vectors – Derivative of product of a Scalar and Vector point function – The vector operator ‘del’ – Gradient	13L
Unit II	Divergence – Curl, solenoidal, irrotational vectors – Laplacian operator.	12L
Unit III	Integration of point function – Line integral – Surface integral,	13L
Unit IV	Volume integral – Gauss divergence theorem (statement only) – Problems.	12L
Unit V	Greens theorem and Stoke’s theorem (statements only) – problems.	10L

Text Book:

- Durai Pandian.P and Laxmi Durai Pandian – Vector Analysis (Revised Edition – Reprint 2005) Emerald Publishers.

Books for Reference :

- Dr. S. Arumugam and others – Vector Calculus, New Gamma Publishing House.
- Susan .J.C - Vector Calculus, (4th Edn.) Pearson Education, Boston 2012.
- Anil Kumar Sharma, - Text book of Vector Calculus, Discovery Publishing House, 1993.

SEMESTER – III

L T P C

Non – Major Elective Paper – I

2 0 0 2

Mathematics for Competitive Examinations -I (30 Hours) (SNMA3A)

Objectives:

- To learn the problems solving techniques for aptitude problems
- To enable the students prepare themselves for various competitive examinations

Unit I	Simplifications, averages	7L
Unit II	Ratio and proportion	5L
Unit III	Partnership – Percentage	5L
Unit IV	Profit and Loss	6L
Unit V	Problems on numbers	7L

Text Book:

Objective Arithmetic – R.S. Aggarwal – S.Chand & Co

Books for Reference :

- Quantitative Aptitude for Competitive examinations – Abhijit Guha – TMH
- Mathematics for life – M. Immaculate – Nanjil offset Printers

SEMESTER – III

Non – Major Elective Paper – I

Fundamentals of Statistics - I (30 Hours) (SNMA3B)

Objectives:

- To introduce measures of central tendency to other major students
- To study correlation and regression and solving simple problems

Unit I	Classification of datas – Bar diagram – Pie chart	7L
Unit II	Measures of Central tendency : Mean, median, mode (with frequency)	5L
Unit III	Measures of dispersion : Range – standard deviation, variance – Quartile deviation 7L.	
Unit IV	Correlation – rank correlation (Problems only)	6L
Unit V	Regression equations (Problem only)	5L

Text Book:

- Dr. S. Arumugam – Statistics

Books for Reference :

- S.P. Gupta – Statistics
- M.L. Khanna – Statistics
- T.Veerarajan-Fundamentals of Mathematical Statistics

SEMESTER – IV

L	T	P	C
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2	4	0	4
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CORE PAPER – VI ABSTRACT ALGEBRA-I (90 Hours) (SSMA41)

Objectives:

- To introduce the concept of Groups ,Ring and Field
- To study the concept of homomorphism

Unit I Groups – definition and Examples – Subgroup – order of an element – centre of a group – Normalizer and centralizer. Product of two subgroups – order of HK – Intersection and union of subgroups. **18L**

Unit II Cyclic groups – generators of a cyclic group – Number of generators of a cyclic groups – Cosets – Partitioning of a group by Cosets – Lagrange’s theorem – Euler’s theorem – Fermat’s theorem **16L**

Unit III **Normal subgroups** : Quotient groups – Group Homomorphis – Canonical homomorphism – kernel of a homomorphism – Isomorphism – Automorphism – Inner automorphism – Permutation groups – Cayley’s theorem. **20L**

Unit IV **Rings:** Definition and examples – Types of rings – Elementary properties of a ring – Integral domain – Field – Sub rings – Subfields – Ideals – Principal ideal – quotient ring – Maximal and prime ideals - characteristic of a ring – PID – UFD. **18L**

Unit V Homomorphism of rings – Isomorphism – kernel of a homomorphism – Fundamental theorem – Field of quotients of an integral domain – polynomial rings – Division algorithm **18L**

Text Book:

- Arumugam .S and Tangapandi Issac .A – “Modern Algebra”scitech publications Pvt. Ltd.

Books for Reference :

- Anton .H and C. Rorres - Elementary Linear Algebra (9th Edn) John Wiley and Sons, Inc., New York 2005.
- Manicavasagam Pillai .T.K and others – Modern Algebra, S. Viswanathan Publishers, Chennai 1993.
- Herstein .I.N – Topics in Algebra, Vikas Publishing Pvt. Ltd. 1975, New Delhi.

SEMESTER – II / IV

L	T	P	C
0	6	0	3

Statistics

(For Mathematics Students)

Paper – II (90 Hours)

Objectives:

- To know the concept of index numbers
- To study the distribution functions
- To understand the Analysis of variance

Unit I Characteristics of index numbers – Laspeyer’s and Paasche’s – Fisher’s and Bowley’s Marshall and Edgeworth’s index numbers – Tests – Unit test, Commodity Reversal test, Time Reversal test, circular test. **12L**

Unit II Testing of Hypothesis – Null hypothesis and Alternate hypothesis – Type I and Type II errors - Critical Region, Level of significance – Test of significance for large samples – Testing a single proportion – Difference of proportions. Testing a single mean and Difference of means. **18L**

Unit III Tests based on t-distribution – single mean and Difference of means – Tests based on F-distribution – Variance Ratio test – Tests based on Chi-square Distribution – Independence – Goodness of fit. **16L**

Unit IV Analysis of variance – one way and two way classified data – Basis of experimental design – Randomized Block Design – Latin square – simple problems. **22L**

Unit V Statistical Quality control – Definition – Advantages, Process control – Control chart, Mean chart, Range chart, P-chart, Product Control – Sampling Inspection Plans . **22L**

Text Book:

- Gupta .S.C & V.K. Kapoor – Fundamentals of Mathematical Statistics – (2002) Sultan Chand & Sons, New Delhi.

Books for Reference :

- Vittal .P.R – Mathematical Statistic (2004) – Maragatham Publications
- DC Sancheti & Kapoor – Statistics
- M.L. Khanna – Statistics
- S. Arumugam & others – Statistics

MSU/ 2017-18 / UG-Colleges /Part-III (B.Sc. Mathematics) / Semester – II / Allied – II

Allied Mathematics

(For Science Students) Paper – II

Vector Calculus & Fourier Series (90 Hours)

Objectives:

- To provide basic knowledge of vector differentiation and integration
- To solve integration problems

Unit I Vector differentiation – Gradient – Divergence and curl **20L**

Unit II Evaluation of double and triple integrals **18L**

Unit III Vector integration – Line, surface and volume integrals **18L**

Unit IV Green's, Stokes and Divergence theorems (without proof) – simple problems
17L

Unit V Fourier series – Even and odd functions – Half range Fourier series.
17L

Text Books:

- Dr. S. Arumugam & Issac – Vector Calculus
- T.K. Manicavachagom Pillai – Calculus (Vol II)

SEMESTER – IV

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Skill Based Core

Paper – II

TRIGONOMETRY, LAPLACE TRANSFORMS AND FOURIER SERIES

(60 Hours) (SSMA4A)

Objectives:

- To understand the concept of Trigonometry
- To know the concept of Laplace transform
- To study the concept of Fourier series

Unit I Trigonometry : Expansions of $\sin nx$, $\cos nx$, $\tan nx$ and expansions of $\sin^n x$ & $\cos^n x$. **10L**

Unit II Hyperbolic functions – Relations between hyperbolic functions and circular functions – Inverse hyperbolic functions – Logarithm of complex numbers – Summation of series by $C + iS$ method. **13L**

Unit III Laplace Transforms – Inverse Laplace Transforms. **13L**

Unit IV Solving linear differential equations with constant coefficients and simultaneous equations using Laplace Transforms. **12L**

Unit V Fourier Series – Definition - Finding Fourier coefficients for a given periodic function with period 2π and $2l$ – Odd and even functions – Half range series. **12L**

Text Books:

Arumugam .S and Tangapandi Issac .A -Trigonometry and Fourier Series

Manichavasagam Pillai, T.K., and S. Narayanan-Differential Equations and its Applications

Books for Reference :

- Manichavasagam Pillai, T.K., and S. Narayanan, - Trigonometry, Viswanathan Publishers and Printers Pvt. Ltd.
- Loney - Trigonometry.
- Robert T. Seeley - Fourier Series and Integrals, Dover Publications, New York, 2006.
- Ray Hanna J., - Fourier Series, Transforms and Boundary Value Problems, Dover Publications, New York, 2008.

SEMESTER – IV

Non – Major Elective Paper – II

Mathematics for Competitive Examinations -II (30 Hours) (SNMA4A)

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2	0	0	2

Objectives:

- To learn the problems solving techniques for aptitude problems
- To enable the students prepare themselves for various competitive examinations

Unit I	Simple Interest – Compound interest	6L
Unit II	Time and work	7L
Unit III	Time and distance	7L
Unit IV	Chain Rule	5L
Unit V	Pipes and Cistern	5L

Text Book:

- Objective Arithmetic – R.S. Aggarwal

Books for Reference :

- Descriptive Mathematics - R.S. Aggarwal, Deepak Aggarwal
- Mathematics for life – M. Immaculate – Nanjil offset Printers

SEMESTER – IV

Non – Major Elective Paper – II

Fundamentals of Statistics - II (30 Hours) (SNMA4B)

Objectives:

- To introduce measures of central tendency to other major students
- To study index numbers and simple problems
- To know the concepts of attributes

Unit I	Theory of attributes for two attributes (simple problems)	7L
Unit II	Characteristics of index numbers – Laspeyer’s and Paasche’s	6L
Unit III	Bowley’s – Marshall index numbers	6L
Unit IV	Fisher’s index number – Time Reversal test (Problems only)	5L
Unit V	Fitting a straight line	6L

Text Book:

S.Arumugam & Issac -Statistics

Books for Reference :

- S.P. Gupta – Statistics
- M.L. Khanna – Statistics
- T.Veerarajan-Fundamentals of Mathematical Statistics

SEMESTER – V

L	T	P	C
3	2	0	4

CORE PAPER – VII ABSTRACT ALGEBRA II (75 Hours) (SMMA51)

Objectives:

- To facilitate a better understanding of vector space
- To solve problems in matrices

Unit I **Vector Spaces** : Definition and examples – elementary properties – subspaces – linear transformation – fundamental theorem of homomorphism **16L.**

Unit II Span of a set – linear dependence and independence – basis and dimension – theorems **14L**

Unit III Rank and nullity Theorem – matrix of a linear transformation
Inner product space : Definition and examples – orthogonality – orthogonal complement – Gram Schmidt orthogonalisation process. **15L**

Unit IV **Matrices** : Elementary transformation – inverse – rank -Cayley Hamilton Theorem-Applications of Cayley Hamilton Theorem **15L**

Unit V Eigen values and Eigen vectors – Properties and problems-Bilinear Forms-Quadratic Forms-Reduction of quadratic form to diagonal form **15L**

Text Book:

Arumugam & Issac – Modern Algebra

Books for Reference :

- Shama .J.N and Vashistha .A.R, “Linear Algebra”, Krishna Prakash Nandir, 1981.
- John B. Fraleigh, “A First Course in Abstract Algebra”, 7th edition, Pearson, 2002.
- Strang G., “Introduction to Linear Algebra”, 4th edition, Wellesly Cambridge Press, Wellesly, 2009.
- Artin M., “Abstract Algebra”, 2nd edition, Pearson, 2011

SEMESTER – V

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CORE PAPER – VIII

3	2	0	4
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REAL ANALYSIS - II (75 Hours) (SMMA52)

Objectives:

- To understand the real number system and metric spaces
- To know the concepts of continuity and Riemann integrals
- To study the concept of connectedness and compactness

Unit I Metric spaces – Examples – bounded sets – open ball – open sets – subspaces – Interior of a set. **13L**

Unit II Closed sets – closure – Limit points – Dense sets – complete metric space – Cantor’s intersection theorem – Baire’s Category Theorem. **16L**

Unit III Continuous functions on metric spaces : Functions - continuous at a point on the real line – Functions - Continuous – uniform continuous in a metric space – Discontinuous function of \mathbb{R} . **15L**

Unit IV Connectedness and compactness : Connectedness – connected subset of \mathbb{R} – connectedness and continuity – compact metric spaces – compact subset of \mathbb{R} – Heine Borel theorem. **16L**

Unit V **Riemann Integral :**
Sets of measure zero – Existence of the Riemann integral – Derivatives – Rolle’s theorem – Fundamental theorem of Calculus – Mean value theorem – Cauchy’s mean value theorem – Taylor’s theorem. **15L**

Text Books:

Arumugam & Issac – Modern Analysis

- Malic .S.C - Mathematical Analysis, Wiley Eastern Limited, New Delhi.

Books for Reference :

- Tom .M. Apostol – Mathematical Analysis, II Edition, Narosa Publishing House, New Delhi (Unit I) (1997)
- Goldberg .R – Methods of Real Analysis Oxford and IBH Publishing Co. New Delhi (200)
- Viswanath Naik .K – Real Analysis, Emerald Publishers, Chennai.
- Berberian .S.K – First course in Real Analysis, Springer Verlag, New York.

SEMESTER – V

CORE PAPER – IX STATICS (75 Hours) (SMMA53)

Objectives:

- To provide the basic knowledge of equilibrium of a particle
- To develop a working knowledge to handle practical problems

Unit I : Forces acting at a point – parallelogram Law of forces – Triangle of forces – Lami's Theorem – Problems. **16L**

Unit II: Parallel forces and moments – resultant of two parallel forces – resultant of two unlike unequal parallel forces – Varignon's Theorem – Problems. **14L**

Unit III : Equilibrium of three forces acting on a rigid body – three coplanar forces theorem – problems. **16L**

Unit IV : Friction – Laws of friction – angle of friction – equilibrium of a particle (i) on a rough inclined plane (ii) under a force parallel to the plane (iii) under any force – problems **15L**

Unit V : Equilibrium of strings – equation of the common catenary – tension at any point – Geometrical properties of common catenary – problems. **14L**

Text Book:

Venkatraman, M.K. - Statics, Agasthiar Publications, Trichy.

Books for Reference:

- .S – Statics, Emerald Publishers.
3. Duraipandian, P, Laxmi Duraipandian and Muthamizh Jayapragasam- Mechanics, S.Chand & Company.
1. Narayanan, S-Statics, S.Chand & Company, New Delhi.
 2. Viswanatha Naik, K and Kasi, M

SEMESTER-V

CORE PAPER-X

TRANSFORMS AND THEIR APPLIATIONS (75 HOURS) (SMMA54)

Objectives:

- To develop the knowledge of Transformations
- To solve the problems connected

Unit I	Fourier transforms-Properties of Fourier transforms	13L
Unit II	Infinite Fourier Cosines and Sine transforms-Properties	12L
Unit III	Finite Fourier transforms	13L
Unit IV	Z tranforms-Properties	12L
Unit V	Inverse Z transforms	10L

Text Book:

A.Singaravelu-Engineering Mathematics (Volume III)-Meenakshi Agency,Chennai

Reference Book:

A.Gangatharan-Engineering Mathematics (Volume II)-PHI (2007)

SEMESTER – V

**Paper – XI
MAJOR ELECTIVE - I**

1.1 ASTRONOMY - I (60 Hours) (SMMA5A)

Objectives:

- To introduce the exciting world of Astronomy to students
- To understand the movements of the celestial sphere
- To study the Kepler's laws of motion

Unit I Spherical Trigonometry

Spherical triangle – The fundamental formula of Spherical trigonometry, the sine, cosine, four parts and Napier formula (without proof) and simple problems.
13L

Unit II The celestial sphere

Celestial co-ordinates – Diurnal motion – Rising and setting of a star – sidereal time – circumpolar stars – Morning and evening stars - Twilight.
12L

Unit III Earth – length of a day – Refraction – Tangent formula – Cassini's formula – Effects of refraction **12L**

Unit IV Geocentric parallax – Effects – Heliocentric parallax – Effects **11L**

Unit V Kepler's laws – verification of Kepler's laws – True anomaly, mean anomaly, Eccentric anomaly – Relation between them.
12L

Text Book:

- Kumaravelu .S and Susheela Kumaravelu – Astronomy for degree classes, Rainbow Printers, Nagercoil (2005)

Book for Reference :

- Ramachandran .G.V – Astronomy

SEMESTER – V

Paper – XI

MAJOR ELECTIVE - I

1.2 DISCRETE MATHEMATICS (60 Hours) (SMMA5B)

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Objectives:

- To study the concept of Mathematical logic
- To understand the basics of Lattices and Boolean Algebra
- To know the number system and codes

Unit I (Mathematical logic) Statement and notation – Connectives – Negation – Conjunction – Disjunctions – Statement formula and truth table – conditional and Biconditional – Well defined formulae – Tautologies

12L

Unit II Normal forms- The theory of inference for the statement calculus- The Predicate- The theory of inference for the Predicate calculus

13L

Unit III (Algebraic Structures)

Groups and Monoids – Simple properties–group codes.

11L

Unit IV (Lattices and Boolean algebra)

Lattices and Posets – Properties of lattices – special lattices – Boolean algebra – Gating networks – Minimal sums of products.

12L

Unit V (Number system and codes)

Decimal, Binary, octal, Hexadecimal – Conversion from one to another – Binary addition, subtraction multiplication and division – BCD – weighted excess time – Gray code

12L

Text Book:

- Tremblay and Manohar – Discrete Mathematical Structures with application to Computer Science, (Tata McGraw Hill, New Delhi) 1997.

Books for Reference :

- Ralph P. Grimaldi Pearson Edelen – Discrete and Combinatorial Mathematics – an applied Introduction (IV edition)
- Maluino .A and Leech – Digital Principles and Application McgraHill.
- Venkataraman .M.K. and others – Discrete mathematics 2000 The National Publishing Company.
- Balaji .G – Discrete Mathematics – Balaji Publishers, Chennai (2013)
- Veerarajan .T – Discrete mathematics – Tata McGraw Hill – (2009)

SEMESTER – V

Paper – XI

MAJOR ELECTIVE - I

1.3 Combinatorial Mathematics (60 Hours) (SMMA5C)

Objectives:

- To know the basic concepts of Pairings
- To understand relations
- To study the concepts of designs

Unit I	Selections and Binomial coefficients – Permutations – Ordered Selections – Unordered Selections – Miscellaneous Problems.	13L
Unit II	Pairings Problems - Pairings within a set – Pairings between sets	12L
Unit III	Recurrence – Fibonacci – type relations. Using generating functions – Miscellaneous methods.	12L
Unit IV	The inclusion – Exclusion Principles	11L
Unit V	Block designs – Square Block designs	11L

Text Book:

- Ian Andersen – A first course in combinatorial Mathematics – Clarendon Press, Oxford.

2.1 Operations Research-I (60 Hours) (SMMA5D)

Objectives:

- To introduce the various techniques of operations research
- To make the students solve real life problems in Business Management
- To understand different types of LPP

Unit I	Linear Programming Problem : Mathematical formulation of LPP –Graphical Method- Simplex Method – Artificial variable technique	13L
Unit II	Concept of Duality – Primal and Dual Problems – Duality – Dual Simplex Method.	12L
Unit III	Transportation Problem : North-West Corner Rule – Matrix Minima method – Vogel’s Approximation Method – MODI Method – Degeneracy and Unbalanced Transportationproblem.	12L
Unit IV	Assignment Problem : Hungarian Method – Unbalance Assignment Problem	11L
Unit V	Sequencing Problem: n jobs and 2 machines- n jobs and 3 machines- 2 jobs and m machines	12L

Text Book :

- KantiSwarup, P.K. Gupta and Manmohan – Operations Research – Sultan Chand & Sons – 2006, 12th edition.

Books for Reference :

- Gupta .P.K and D.S. Hira – Operations Research – S. Chand and Company.
- B.J. Ranganath and A.S.Srikantappa -Operations Research, Yesdee Publishing House,Chennai(2017)
- Hillier, F.S. and G.J. Lieberman - Introduction to Operations Research, 9th Ed., Tata McGrawHill, Singapore, 2009.
- Hamdy A. Taha, - Operations Research, An Introduction, 8th Ed., Prentice – Hall India, 2006.
- Hadley .G. - Linear Programming, Narosa Publishing House, New Delhi, 2002.

SEMESTER -V

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Paper -XII

MAJOR ELECTIVE -II

2.2 STOCHASTIC PROCESS (60 Hours) (SMMA5E)

Objectives:

- To know probability and distribution functions
- To understand the concepts of stochastic process
- To identify Markov chains

Unit I Generating functions-Laplace transform of probability distribution-classification of distribution-Stochastic process-introduction-specification of Stochastic process.

12L

Unit II Markov chains-Definition and examples-Higher transition probabilities-Generalisation of Independent Bernoulli Trials-classification of states and chains-Determination of Higher transition probabilities-Stability of Markov systems-Graph theoretic approach.

12L

Unit III Markov chain with Denumerable number states-Reducible chains-Statistical inference for Markov chains-Markov chain with continuous state space-Nonhomogenous chains

11L

Unit IV Markov process with discrete state space-Poisson process-Poisson process and related distributions-Generalisation of Poisson process-Birth and Death process

13L

Unit V Markov process with Discrete state space-Derived Markov chains-Erlang process

12L

Text Book :

Stochastic Proces-J.Medhi-New Age International Publishers (p) Ltd Third Edition

Reference Books:

Applied Stochastic Process-Suddhendu Biswas –New Central Book Agency (P) Ltd Kolkatta

Introduction to Stochastic Process-Hoel Port and Stone-Universal Book Stall, New Delhi

SEMESTER -V

Paper -XII MAJOR ELECTIVE -II

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2.3 M.S.OFFICE (60 Hours) (SMMA5F)

Objectives:

-To know the basic knowledge of computer

-To study word,excel andpowerpoint

Unit I: MS Word

Creating a document-saving, printing, editing and closing the document -copying, pasting, finding and replacing a text -adding headers and footers.
11L

Unit II:

Formatting a document-Turning Bold on/off, Underline on/off, highlight on/off-changing font size ,page setup-changing margins-bullets and numbering, working with tables-changing the column width and row height-inserting or deleting a row/column-mailmerge.
12L

Unit III: MS Excel

Creating a worksheet-entering, editing, deleting data in cells-saving and previewing the worksheet- entering formulas , working with basic functions SUM,AVERAGE,MAX and MIN -sorting
10L.

Unit IV :

Formatting a worksheet-inserting ,deleting a row/column changing font size -Graphs and charts-Simple calculations using mathematical, statistical, logical functions.
12L

Unit V: MS Power point

Creating a simple presentation -adding transition effects to a presentation-adding sound effects to a presentation-creating hyperlinks between slides-changing the background-inserting images on slides.
15L

Text Book :

Dr.P.Rizwan Ahmed, “Office Automation 2010”, Margham Publications 2016.

Reference Books :

1. Stephen . L . Nelson, “Office 2010, Computer Reference”, Tata McGraw Hill Publishing company Ltd.
2. Sumner Mary- “Enterprise Resource Planning”, Pearson Education, inc. I Edition 2012.

SEMESTER – VI

CORE -XI Major Paper – XIII

L T P C
3 2 0 4

COMPLEX ANALYSIS (75 Hours) (SMMA61)

Objectives:

- To understand the functions of complex variables
- To learn about elementary transformations concepts in complex variables
- To understand the singularity concepts and residues

Unit I (Analytic functions)

Functions of a complex variable – Derivatives – Cauchy – Riemann equations – sufficient conditions – Polar form – Analytic functions – Harmonic functions.

13L

Unit II (Integrals)

Definite integrals – Contours – Cauchy – Goursat theorem – antiderivatives and independence of path – Cauchy Integral formula – Morera's theorem.

17L

Unit III (Series)

Taylor's series – Examples – Laurent's series – Zeros of analytic functions – Residues – Residue theorem – Principal part of functions – Residues at poles.

16L

Unit IV (Evaluation of Integrals)

Evaluation of improper real integrals – improper integrals involving sines and cosines – Definite integrals involving sines and cosines.

14L

Unit V (Transformations)

Conformal mappings–basic properties–Bilinear maps – fixed points – Applications 15L

Text Book:

- Arumugam.S and T. Issac – “Complex Analysis” – Scitech Publishing House – Chennai.

Books for Reference :

- Churchill .R.V. and J.W. Brown – “Complex variables and Applications” – IV edition – McGraw Hill International Editions.
- Ponnuswamy .S – “Foundations of Complex Analysis”, Narosa Publication House, New Delhi, II edition 2005.
- Duraipandian .P and Lakshmi Duraipandian – “Complex Analysis” – Emerald Publications, Chennai (2001)

SEMESTER – VI

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CORE -XII
Major Paper – XIV

NUMBER THEORY (60 Hours) (SMMA62)

Objectives:

- To highlight the beauties in the world of numbers
- To prepare the students for coding through congruences

Unit I Peano's Axioms – Mathematical Induction – The Binomial Theorem – Early Number Theory. **11L**

Unit II Division Algorithm – GCD – Euclidean Algorithm – The Diophantine Equation $ax+by=c$. **12L**

Unit III The fundamental Theorem of Arithmetic – The Sieve of Eratosthenes – The Goldbach conjecture. **13L**

Unit IV Basis properties of congruences – Linear congruence and the Chinese Remainder Theorem. **11L**

Unit V Fermat's Theorem – Wilson's Theorem – The Fermat – Kraitchik Factorization Method. **13L**

Text Book:

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

Books for Reference :

- Ivan Niven and H, Zuckerman - An Introduction to Theory of Numbers.
- Kumaravelu .S, and Susheela Kumaravelu - Elements Theory - Nagercoil, 2002.

SEMESTER – VI

L	T	P	C
3	2	0	4

CORE -XIII
Major Paper – XV

GRAPH THEORY (75 Hours) (SMMA63)

Objectives:

- To introduce the notion of graph theory and its applications
- To learn the techniques of combinatorics in graph theory

Unit I: Definition and examples of graphs – degrees – subgraphs – isomorphism – independent sets and coverings – matrices – operation on graphs.

18L

Unit II: Degree sequences – graphic sequences – walks – trails and paths – connectedness and components – connectivity. **18L**

Unit III: Eulerian graphs – Hamiltonian graphs – characterisation of trees – centre of a tree. **13L**

Unit IV: Definition and properties of planar graphs – chromatic number and chromatic index **13L.**

Unit V: Chromatic polynomials – definition and basic properties of digraphs – paths and connectedness in digraphs.

13L

Text book:

Arumugam,S and S. Ramachandran – Invitation to graph Theory, Scitech publications, Chennai.

Books for reference:

- Kumaravelu. S and Susheela Kumaravelu – Graph theory.
- Narasingh Deo – Graph theory with application to engineering and computer science, Prentice – Hall of india pvt. Ltd., New Delhi.

SEMESTER -VI

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CORE -XIV

MAJOR PAPER -XVI

DYNAMICS(60 Hours) (SMMA64)

Objectives:

-To provide a basic knowledge of the behaviour of objects in motion

-To develop a working knowledge to handle practical problems

Unit I : Projectiles- Equation of path – range – maximum height- time of flight- range on an inclined plane-problems. **14L**

Unit II : Collision of elastic bodies- Laws of impact- direct and oblique impact-Problems. **11L**

Unit III : Simple Harmonic Motion (SHM) in a straight line- Geometrical representation – composition of SHM's of the same period in the same line and along two perpendicular directions – problems. **13L**

Unit IV : Motion under the action of central forces – velocity and acceleration in polar coordinates – problems. **10L**

Unit V : Differential Equation of central orbit - pedal equation of central orbit – problems to find the law of force towards the pole when the orbit is given. **12L**

Text Book:

Venkatraman, M.K. - A Text Book on Dynamics, Agasthiar Publication, Trichy.

Books for Reference:

1. Narayanan, S- Dynamics, S.Chand & company, 16th Edition,1986, New Delhi.
2. Duraipandiyar, P, Laxmi Duraipandian and Muthamiz Jayaprgasam- Mechanics 2003, S.Chand & Company.

SEMESTER -VI
CORE -XV
MAJOR PAPER -XVII

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NUMERICAL METHODS (60 Hours) (SMMA65)

Objectives:

- To introduce the finite differences
- To solve numerical problems by different methods

Unit I Solution of Numerical algebraic and Transcendental Equations : bisection method – Newton’s method. Criterion of order of convergence of Newton’s method. Regula False method – Gauss elimination – Gauss Jacobi – Gauss Seidal method
13L

Unit II **Finite Difference** : First and higher order differences – Forward and backward differences – Properties of Operator – Differences of a polynomial –Factorial Polynomial
11L

Unit III Interpolation : Newton’s Forward – backward, Gauss forward – backward interpolation formula – Bessel’s formula. Divided differences – Newton’s divided difference formula – Legrange’s interpolation formulè
11L

Unit IV Numerical Differentation and Integration : Newtons forward and backward differences for differentiation – Derivatives using Bessel’s formula – Trapezoidal rule, simpson’s 1/3 rule & 3/8 rule
13L

Unit V **Difference Equations** : Definition – order and degree of difference equation – Linear difference equation – Finding complementary function – particular Integral –simpleapplications.
12L

Text Book:

- Venkatraman .M.L - Numerical methods in Science and Engineering National Publishing Company V Edition 1998

Books for Reference :

- Kandasamy .P.K. Thilagavathy and K. Gunavathy ‘Numerical Methods’ S. Chand & Company Ltd. Edn. 2006.
- B. Stephen John – Numerical Analysis
- Autar Kaw and Egwwn Enc Kalu - Numerical methods with Application Abidet. Autokaw.com 2nd 2011.

SEMESTER – VI

Paper – XVIII

MAJOR ELECTIVE - III

3.1 Astronomy - II (60 Hours) (SMMA6A)

Objectives:

- To understand the exiting world of Astronomy to the students
- To study the concepts of eclipses
- To facilitate the movements of celestial objects

Unit I	Equation of time – Seasons – Conversion of time.	10L
Unit II	Moon – sidereal month, Lunation and relation between them – Phases of moon – Lunar Liberation - surface of moon – metonic cycle – Tides.	14L
Unit III	Eclipses – shadow cone – Minimum and maximum number of eclipses.	12L
Unit IV	Planetary Phenomena – Bode’s law – Elongation – Sidereal period, synodic period and the relation between them	14L
Unit V	Phases – Stationary points – solar system..	10L

Text Book:

- S. Kumaravelu and Susheela Kumaravelu – Astronomy Rainbow Printers, Nagercoil (2005)

Book for Reference :

- George - O - Abell – Exploration of the Universe (Second Edition)

SEMESTER – VI

Paper – XIX

MAJOR ELECTIVE - III

3.2 FUZZY MATHEMATICS (60 Hours) (SMMA6B)

Objectives:

- To introduce fuzzy concepts to students
- To facilitate the students to study fuzzy operations and fuzzy numbers

- Unit I** **Crisp Sets – Fuzzy Sets** – Basic Types – Basic Concepts – Characteristics and Significance of the Paradigm shift.
11L
- Unit II** Additional properties of α -cuts – representations of fuzzy sets – Extension principle for fuzzy sets.
13L
- Unit III** **Fuzzy set operations** – Fuzzy complements – Fuzzy intersections : t-norms – Fuzzy Unions : t-conorms – Combinations of operations – Aggregation operations. **11L**
- Unit IV** **Fuzzy Numbers** – Linguistic variables – Arithmetic operations on intervals – Arithmetic operations of fuzzy numbers – Lattice of fuzzy numbers – Fuzzy Equations. **13L**
- Unit V** Fuzzy Decision Making – Individual Decision Making – Multi-person decision making – Fuzzy linear Programming.
12L

Text Book:

- George J. Klir and Bo Bo Yuan – Fuzzy sets and Fuzzy Logic Theory Applications, Prentice Hall of India, 2002, New Delhi.

Book for Reference:

- George J. Klir and Tina .A Folger – Fuzzy sets, uncertainty and Informations – Prentice Hall of India, 2003, New Delhi.

SEMESTER – VI

Paper – XX

MAJOR ELECTIVE - III

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3.3 Mathematical Modelling (60 Hours) (SMMA6C)

Objectives:

- To study the mathematical models through ODE and difference equations
- To train the students to develop mathematical models in real life problems

Unit I (Mathematical modelling through O.D.E (First order))

Linear growth and Decay models – Non-linear growth and Decay models – Compartment Models – Dynamics Problems – Geometrical Problems.
11L

Unit II Population dynamics – Epidemics – Compartment Models – Economics, Medicine, Arms race, Battles and International Trade.
13L

Unit III (Mathematical Modelling through O.D.E. (Second order))

Planetary motion – circular motion – Motion of satellites – Modelling through linear difference equations of second order.
11L

Unit IV (Mathematical Modelling through difference equations)

Basic theory of difference equation with constant coefficients – Economics and Finance – Population dynamics and genetics – Probability theory.
13L

Unit V (Modelling through graphs)

Solutions that can be modelled through graphs - models in terms of directed graphs, signed graphs – weighted digraphs and unoriented graphs.
11L

Text Book:

- Kapur .J.N – Treatment as in “Mathematical Modelling” – New Age International Publishes, 2004.

Books for Reference :

- Kapur .J.N – Mathematical Modelling in Biology and Medicine – East West Press – 1985.
- Singh – Mathematical Modelling, International Book house – 2003.
- Frank R. Giordano, Maurice D.Weir and William P. Fox, - A first course in mathematical modelling, Thomson Learning, London and New York, 2003.

SEMESTER-VI

**PAPER-XXI
MAJOR ELECTIVE-IV**

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4.1 OPERATIONS RESEARCH-II (60 Hours) (SMMA6D)

Objectives:

- To introduce Games and strategies**
- To understand networking problems**
- To make the students solve real life problems in business and management**

- Unit I Games and Strategies :** Two Person Zero sum Games – The Maximin – Minimax Principle – Games without Saddle Points – Mixed Strategies – Graphical Solution of $2 \times n$ and $m \times 2$ games – Dominance Property **12L**
- Unit II Replacement** of items that deteriorate with time – replacement age of a machine taking money value into consideration – replacement of items that completely fail suddenly and Staffing Problems **13L**
- Unit III Queuing models :** General concept and definitions – characteristics – properties of Poisson process Models (M/M/1: /FCFS), (M/M/1 : N/FCFS), (M/M/S : /FCFS) **11L**
- Unit IV Network scheduling by PERT / CPM :** Network and basic components – Rules of Network Construction – Time Calculation in network – Critical Path Method – PERT Calculation. **13L**
- Unit V Inventory Control :** Introductions – Types of Inventories – Inventory decisions – Deterministic inventory Problem – EOQ problems with shortages. **13L**

Text Book:

- Kanti Swarup, P.K. Gupta and Manmohan – Operations Research – Sultan Chand & Sons – 2006, 12th edition.

Books for Reference :

- Gupta .P.K and D.S. Hira – Operations Research – S. Chand and Company.
- B.J. Ranganath and A.S. Srikantappa -Operations Research, Yesdee Publishing House, Chennai (2017)
- Hillier, F.S. and G.J. Lieberman - Introduction to Operations Research, 9th Ed., Tata McGrawHill, Singapore, 2009.
- Hamdy A. Taha, - Operations Research, An Introduction, 8th Ed., Prentice – Hall India, 2006.
- . Hadley .G. - Linear Programming, Narosa Publishing House, New Delhi, 2002

SEMESTER – VI

PAPER-XXII

MAJOR ELECTIVE - IV

4.2 Coding Theory (60 Hours) (SMMA6E)

Objectives:

- To introduce coding and decoding concepts
- To develop the students in the field of coding theory

- Unit I** Basic assumptions – Correcting and detecting error patterns – information rate – effects of error correction and detection – finding the most likely code word transmitted. **12L**
- Unit II** Linear codes – two important – subspaces independence – basic, dimension – matrices – Bases for C and C^+ generating matrices on coding. **12L**
- Unit III** Parity check matrices – equivalent codes – distance of a linear code – Linear codes – cosets – MLD for linear codes – Reliability of IMLD for linear codes. **11L**
- Unit IV** Some bounds for codes – perfect codes – hamming codes – extended codes – The extended Golay code – decoding the extended Golay code – Golay code **13L**
- Unit V** Polynomials and words – introduction to cyclic codes – introduction to cyclic codes – Polynomial encoding and decoding – finding cyclic codes – Dual cyclic codes. **12L**

Text Book:

- Coding theory, the essentials – Marcel Dekker, Inc. Madtrison Avenue, Newyork.

Paper- XXIII
MAJOR ELECTIVE-IV

4.3 Programming in C (60 Hours) (SMMA6F)

Objective:

- To introduce the exiting world of programming to the students
- To train the students to run simple C programmes

Unit I

C Declarations:- Introduction – Character Set – C tokens – Keywords and Identifiers – Identifiers – Constants – Variables – Data types – Declaration of Variables – Declaration of Storage Class – Assigning Values to Variables – Defining Symbolic Constants – Declaring VariablesConstant.
11L

Unit II

Operators and Expressions:- Introduction – Arithmetic Operators – Relational Operators – Logical Operators – Assignment Operators – Increment and Decrement Operators – Conditional Operator – Bitwise Operators – Special Operators – Arithmetic Expressions – Evaluation of Expressions–PrecedenceofArithmeticExpressions.
13L

Unit III

Managing Input and Output Operations:-getchar() – putchar() – scanf() – printf().
Decision Making and Branching:- Introduction – Decision Making with IF Statement – Simple IF statement – The IF...Else Statement – Nesting of IF...Else Statements – The ELSE IF ladder – The Switch Statement – The ?: Operator – The GOTO statement. **Decision Making and Looping:-** Introduction – The WHILE Statement – The DO Statement – The FOR statement – Jumps in Loops.
13L

Unit IV

Arrays :- Introduction – One-dimensional arrays – Declaration of One-dimensional arrays – Initialization of One-dimensional arrays - Two-dimensional arrays – Initialization of Two-dimensional arrays – Multi-dimensional arrays. **Character Arrays and Strings:-** Introduction – Declaring and Initializing String Variables – Reading Strings from Terminal – Writing Strings to Screen–StringHandlingFunctions
12L

Unit V

User-Defined functions:- Introduction – Need for User-defined functions – Definition of functions – Return Values and their Types – Function Calls – Function Declaration – Category of functions – No Arguments and No return values – Arguments but No return Values – Arguments with return values – No arguments but a return a value – Recursion –The Scope, Visibility and lifetime of a variables.
11L

Text Book:

Programming in ANSI C – 6th Edition by E Balagurusamy – Tata McGraw Hill Publishing Company Limited.

Reference Books:

- Programming with C, Third Edition, Byron S Gottfried, Tata McGraw Hill Education Private Limited.
- . Programming in C ReemaThareja, Oxford University press.

1. VISION AND MISSION OF THE UNIVERSITY.

**MANONMANIAM SUNDARANARUNIVERSITY, TIRUNELVELI-627012.
UG COURSES- AFFILIATED COLLEGES**

VISION AND MISSION

Vision:

- ❖ “To provide quality education to reach the un-reached”

Mission:

- ❖ To conduct research, teaching and outreach programs to improve conditions of human living.
- ❖ To create an academic environment that honours women and men of all races, caste, creed, cultures and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity.
- ❖ To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- ❖ To develop partnerships with industries and government so as to improve the quality of workplace and to serve as catalyst for economic and cultural development.
- ❖ To provide quality/inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled.

2.VISION AND MISSION OF THE MATHEMATICS DEPARTMENT

MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI-627012.

UGC COURSES– AFFILIATED COLLEGES

Department of Mathematics

Vision and Mission

Vision

- The longterm vision is to be an internationally leading Mathematics Department that will offer innovative educational programs in Mathematical Sciences and their applications in science and technology

Mission

- ❖ To create an environment that will identify, nurture and encourage mathematical intelligence.
- ❖ To enhance use of mathematical knowledge readily for problem solving, exploring all subjects by proper understanding of the mathematical content with various possible representation.
- ❖ To improve the skills of students in Practical Applications and Life Skills by means of a close and continuous monitoring of their progress throughout the course.

3.PREAMBLE

The LOCF (Learning outcomes based curriculum framework) committee constituted University Grants Commission (UGC) is pleased to submit the report concerning the syllabi of B.Sc with Mathematics as a subject. The committee discussed the framework of syllabi in its meetings and suggests the implementation these syllabi in the Colleges based on following facts.

1. The learning outcomes of each paper are designed so that these may help learners understand the main objectives of studying the course
2. This will enable learners to select elective papers depending on the individual inclinations and contemporary requirements
3. The objectives of the LOCF are to mentally prepare the students to learn mathematics leading graduate degree with mathematics as a subject.
4. These syllabi in mathematics under CBCS are recommended keeping in view of the wide applications of mathematics in science, engineering, social science, business and a host of other areas.
5. The study of the syllabi will enable the students to equip with the state of the art of the subject and will empower them to get jobs in technological and engineering fields as well as business, education and healthcare sectors.
6. The LOCF committee in Mathematics had prepared this draft paying suitable attention objectives and learning outcomes of the papers. These syllabi may be implemented with minimum modifications with appropriate justifications keeping in view regional, national and international contents and needs.
7. The outcomes of each paper may be modified as per the local requirements.
8. The text books mentioned in references are denotative/demonstrative. The divisions of each paper in units are specified to the context mentioned in course. These units will help the learners to complete the study of concerned paper in certain periods and prepare them for examination.
9. The mathematics is a vast subject with immense diversity. Hence it is difficult for every student to learn each branch of mathematics, even though each paper has its unique importance. Under these circumstances, LOCF in Mathematics suggests a number of elective papers also with compulsory papers. A student can select elective papers as per his needs and interests.
10. The committee expects that the papers may be taught using various Computer Algebraic systems (CAS) softwares such as Mathematica, MATLAB, Maxima and R to strengthen the conceptual understanding and to wide up the horizon of student's self experience.
11. The committee of the LOCF in Mathematics expects that the concerned colleges will encourage their faculty members to include necessary topics in addition to courses suggested by LOCF committee. It is hoped that the needs of all around development in the careers of learners will be fulfilled by the recommendations of LOCF in mathematics.

4.PROGRAMME STRUCTURE

MANONMANIAMSUNDARANARUNIVERSITY, TIRUNELVELI-627012.

UGCOURSES- AFFILIATEDCOLLEGES

B.Sc. Mathematics

(ChoiceBased Credit System)

(Witheffectfromtheacademicyear2021- 2022 onwards)

	Part	Sub. No.	Subject Status	Subject Title	Hrs/ Week	Credits	Marks				
							Maximum			Passing Minimum	
							Int.	Ext	Tot.	Ext.	Tot.
I	I	1	Language	Tamil/OtherLanguages	6	4	25	75	100	30	40
	II	2	Language	CommunicativeEnglish-I	6	4	25	75	100	30	40
	III	3	Core-IPaper-I	Calculus and ClassicalAlgebra	6	4	25	75	100	30	40
		4	Addonmajor(Mandatory) Paper-II	ProfessionalEnglishforP hysicalSciences-I	4	4	25	75	100	30	40
		5	Allied-I(ForMaths students)	Statistics-I OR Physicswith Practical /Chemistry withPractical/ ComputerScience**	6	3	25	75	100	30	40
				Allied-I (ForScience students)	AlgebraandDifferentialE quations	6	4	25	75	100	30
	IV	6	Common	EnvironmentalStudies	2	2	25	75	100	30	40
Total					30	21/23					
II	I	7	Language	Tamil/OtherLanguages	6	4	25	75	100	30	40
	II	8	Language	Communicative English-II	6	4	25	75	100	30	40
	III	9	Core-IIPaper-III	Differential Equationsand Analytical GeometryofThree Dimensions	6	4	25	75	100	30	40
		10	Addon major(Mandatory)Paper-IV	ProfessionalEnglishforP hysicalsciences-II	4	4	25	75	100	30	40
		11	Allied-II(ForMath sStudents)	Statistics-II OR Physics with Practical /Chemistry with Practical /ComputerScience**	6	3	25	75	100	30	40
				Allied-II(For ScienceSt udents)	Vector Calculus &FourierSeries	6	4	25	75	100	30
	IV	12	Common	Valuebasededucation	2	2	25	75	100	30	40
Total					30	21/23					

**** The Allied Computer Science shall be taken by the Department of Mathematics**

Sem	Part	Sub. No.	Subject Status	Subject Title	Hrs/week	credits	Mark				
							Maximum			Passing minimum	
							Int.	Ext.	Tot.	Ext.	Tot.
III	I	13	Language	Tamil/Other Languages	6	4	25	75	100	30	40
	II	14	Language	English	6	4	25	75	100	30	40
	III	15	CoreIII Paper-V	SequencesandSeries	6	4	25	75	100	30	40
		16	Allied-II	Statistics-I OR Physics with Practical / Chemistrywith Practical / Computer Science	6	3	25	75	100	30	40
		17	Skill Based Core	Vector Calculus	4	4	25	75	100	30	40
	IV	18	Non-Major Elective	Anyoneofthefollowing 1.1) Mathematics forCompetitiveExaminations-I 1.2) Fundamentals of Statistics-I	2	2	25	75	100	30	40
		19	Common	Yoga*	2	2	25	75	100	30	40
				Total	30	25/27					
IV	I	20	Language	Tamil/Other Languages	6	4	25	75	100	30	40
	II	21	Language	English	6	4	25	75	100	30	40
	III	22	Core-IV Paper-VI	Abstract Algebra	6	4	25	75	100	30	40
		23	Allied-II	Statistics-II OR Physics with Practical / Chemistry with Practical/ Computer Science	6	3	25	75	100	30	40
		24	Skill Based Core	Trigonometry, Laplace Transforms and Fourier Series	4	4	25	75	100	30	40
	IV	25	Non-Major Elective	Anyone of the Following: 2.1) Mathematics for Competitive Examinations-II 2.2) Fundamentals of Statistics-II	2	2	25	75	100	30	40
		26	Common	Computers for Digital Era*	2	2	25	75	100	30	40
V			Extension activities	NCC/NSS/YRC/YWF/PE	-	1	-	-	-	-	-
				Total	30	26/28					
V	III	27	Core-V Paper-VII	LinearAlgebra	5	4	25	75	100	30	40
		28	Core-VI	RealAnalysis	5	4	25	75	100	30	40

			Paper-VIII								
		29	Core-VII Paper-IX	Statics	5	4	25	75	100	30	40
		30	Core-VIII Paper-X	Integral Transforms and Z Transforms	5	4	25	75	100	30	40
		31	Major Elective-I Paper-XI	Anyone of the Following: 1.1) Programming in C 1.2) Discrete Mathematics 1.3) Combinatorial Mathematics	4	4	25	75	100	30	40
		32	Major Elective -II Paper-XII	Anyone of the Following: 2.1) Operations Research-I 2.2) Stochastic Process 2.3) Math Typing using LaTeX	4	4	25	75	100	30	40
	IV	33	Skill Based Common	Personality Development	2	2	25	75	100	30	40
			Total		30	26					
VI	III	34	Core-IX Paper-XIII	Complex Analysis	5	4	25	75	100	30	40
		35	Core-X Paper-XIV	Graph Theory	5	4	25	75	100	30	40
		36	Core-XI Paper-XV	Number Theory	4	4	25	75	100	30	40
		37	Core-XII Paper-XVI	Dynamics	4	4	25	75	100	30	40
		38	Core-XIII Paper-XVII	Numerical Methods	4	4	25	75	100	30	40
		39	Major Elective-III Paper-XVIII	Any one of the following 3.1) Astronomy 3.2) Fuzzy Mathematics 3.3) Mathematical Modeling	4	4	25	75	100	30	40
		40	Major Elective-IV Paper-XIX	Any one of the following 4.1) Operations Research-II 4.2) Coding Theory 4.3) Programming in C++	4	4	25	75	100	30	40
			Total		30	28					

5.EVALUATION SCHEME (INTERNAL,EXTERNAL,PASSING MINIMUM)

Evaluation Scheme

Internal Marks	25 Marks
External Marks	75 Marks
Maximum Marks	100 Marks
Passing Minimum	40 Marks

6. MODEL QUESTION PAPER

MODEL QUESTION PAPER- CBCS-PATTERN (UG MATHEMATICS)

MAXIMUM MARKS: 75

TIME: 3 HOURS

Part –A (10×1 = 10 Marks)

Answer all the questions, Choose the correct answer

Question No. 1,2	Unit –I	Question No. 7,8	Unit –IV
Question No. 3,4	Unit -II	Question No. 9,10	Unit –V
Question No. 5,6	Unit –III		

Part –B(5×5 = 25 Marks)

Answer all the questions, Choosing either (a) or (b).

Question No. 11(a) or11 (b)	Unit –I	Question No. 14(a) or14 (b)	Unit –IV
Question No. 12(a) or12 (b)	Unit -II	Question No. 15(a) or15 (b)	Unit –V
Question No. 13(a) or13 (b)	Unit –III		

Part –A (8×5 = 40 Marks)

Answer all the questions, Choosing either (a) or (b).

Question No. 16(a) or16 (b)	Unit –I	Question No. 19(a) or19 (b)	Unit –IV
Question No. 17(a) or17 (b)	Unit –II	Question No. 20(a) or20 (b)	Unit –V
Question No. 18(a) or18 (b)	Unit –III		

MODEL QUESTION PAPER
CALCULUS AND CLASSICAL ALGEBRA
(For those who joined in July 2021 onwards)

Time: Three hours

Maximum: 75 marks.

Part-A (10× 1 = 10 marks)

Answer All questions

Sl.No	Choose the correct Answer.	Course outcome	Knowledge Level
1.	The curvature of the curve $ax+by+c=0$ is..... a) b b) a c) 0 d) none of the above	CO 1	K1, K5
2.	The radius of the curvature of $y = e^x$ at (0,1) is..... a)1 b) 2 c) $2\sqrt{2}$ d) none of the above	CO 1	K1, K5
3.	The value of $\int_1^b \int_1^a \frac{dx dy}{xy} = \dots\dots\dots$ a) $\log\left(\frac{a}{b}\right)$ b) $\log\left(\frac{ab}{1}\right)$ c) $\log\log b$ d) none of the above	CO 2	K2, K3
4.	The Jacobian of $u = x + y$ and $v = x - y$ is..... a) 2 b) 1 c) -2 d) none of the above	CO 2	K2, K3
5.	$\int_0^1 x^2(1-x)dx = \dots\dots\dots$ a)2 b) $\frac{1}{12}$ c) $\frac{1}{3}$ d) none of the above	CO 3	K2, K4
6.	$\int_0^\pi \int_0^{\pi/2} \int_0^1 r^2 \sin\theta dr d\theta d\phi = \dots\dots\dots$ a) $\frac{\pi}{2}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{4}$ d) none of the above.	CO 3	K4
7.	The least degree of the equation with rational coefficients one of whose roots $\sqrt{2} + \sqrt{3}$ is..... a) 3 b)2 c) 4 d) none of the above	CO 4	K4, K5
8.	If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$ then $\sum \frac{1}{\alpha}$ a) $-\frac{q}{r}$ b) $\frac{q}{r}$ c) $\frac{p}{r}$ d) none of the above	CO 4	K6
9.	The roots of the equation $x^n + 1=0$ (n is even) are a) All imaginary b) (n-1) imaginary c)(n-2) imaginary d) none of the above	CO 5	K3
10.	One of the roots of the equation $2x^3 + 3x^2 - 3x - 2 = 0$ is -2, the other roots are..... a) -2, -1 b) $-\frac{1}{2}, 1$ c) $-\frac{1}{2}, -1$ d) none of the above	CO 5	K6

PART B – (5× 5 = 25 marks)

Sl.No	Answer ALL questions, choosing either (a) or (b)	Course outcome	Knowledge Level
11.	a) Find the p-r equation (pedal equation) of the curve $r^2 = a^2 \sin 2\theta$	CO 1	K1
	Or b) Find the co-ordinates of the center of curvature of the curve $x^3 + y^3 = 3axy$ at $\left(\frac{a}{2}, \frac{a}{2}\right)$.	CO 1	K1
12.	a) Find the area of the region common to $y^2 = 4ax$ and $x^2 = 4ay$.	CO 2	K2, K3
	Or b) If $u = 2xy, u = x^2 - y^2, x = r \cos\theta, y = r \sin\theta$, evaluate $\frac{\partial(u,v)}{\partial(r,\theta)}$ without actual substitution.	CO 2	K2, K3
13.	a) Prove that $\left[\frac{n+1}{2}\right] = \frac{(2n)! \sqrt{\pi}}{4^n n!}$ Where $n=0,1,2,\dots$ Or	CO 3	K5

	b) Prove that $\int_0^{\pi/4} \sin^p \theta \cos^q \theta d\theta = \frac{1}{2} \beta\left(\frac{p+1}{2}, \frac{q+1}{2}\right)$	CO 3	K5
14.	a) Show that the sum of the 6 th powers of the roots of $x^7 - x^4 + 1 = 0$ is 3 Or b) If α, β, γ are the roots of the equation $x^3 + ax^2 + bx + c = 0$, form the equation whose roots are $\alpha\beta, \alpha\gamma$ and $\beta\gamma$	CO 4 CO 4	K2, K4 K2, K5
15.	a) Transform the equation $x^4 - 4x^3 - 18x^2 - 3x + 2 = 0$ into an equation with the third term absent. Or b) Remove the fractional coefficient from the equation $x^3 + \frac{1}{4}x^2 - \frac{1}{16}x + \frac{1}{72} = 0$	CO 5 CO 5	K6 K6

PART C – (5× 8 = 40marks)

Sl.No	Answer ALL questions,choosing either (a) or (b)	Course outcome	Knowledge Level
16.	a) Find the coordinates of the center of curvature of $y = x \log x$ at the point where $\frac{dy}{dx} = 0$. Or b) Find the evolute of the asteroid $x^{2/3} + y^{2/3} = a^{2/3}$	CO 1 CO 1	K1, K6 K1, K6
17.	a) By changing the order of integration, evaluate the integral $\int_0^1 \int_y^{2-y} xy \, dx dy$ Or b) By changing into polar coordinates, show that $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dx dy = \frac{\pi}{4}$. Hence evaluate $\int_0^\infty e^{-t^2} dt$.	CO 2 CO 2	K2, K4 K2, K4
18.	a) Evaluate $\int_0^1 x^m (1-x^n)^p dx$ in terms of gamma functions and hence find $\int_0^1 \frac{dx}{\sqrt{1-x^n}}$. Or b) Using gamma functions evaluate $\iint xy(1-x-y)^{1/2} dx dy$ over the area enclosed by the lines $x = 0, y = 0$ and $x + y = 1$ in the positive quadrant.	CO 3 CO 3	K3, K5 K3, K5
19.	a) Solve $6x^3 - 11x^2 + 6x - 1 = 0$ where roots are in harmonic progression Or b) If $a + b + c + d = 0$, show that $\frac{a^5+b^5+c^5+d^5}{5} = \frac{a^2+b^2+c^2+d^2}{2} \cdot \frac{a^3+b^3+c^3+d^3}{3}$	CO 4 CO 4	K3 K3
20.	a) Show that the equation $x^4 - 3x^3 - 4x^2 - 2x + 1 = 0$ can be transformed into a reciprocal equation by diminishing the roots by unity. Hence solve the given equation. Or b) Solve the equation $6x^6 - 35x^5 + 56x^4 - 56x^2 + 35x - 6 = 0$.	CO 5 CO 5	K1 K1

➤ K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

7. PROGRAMME OUTCOMES FOR B.Sc MATHEMATICS

PROGRAMME OUTCOMES

1. Bachelor's degree in mathematics is the culmination of in-depth knowledge of algebra, calculus, geometry, differential equations and several other branches of mathematics. This also leads to study of related areas like computer science and statistics. Thus, this programme helps the learners in building a solid foundation for higher studies in mathematics.
2. The skills and knowledge gained has intrinsic beauty, which leads to proficiency in analytical reasoning. This can be utilized in modelling and solving real life problems
3. Students undergoing this programme learn to logically question assertions, to recognise patterns and to distinguish between essential and irrelevant aspects of problems. They also share ideas and insights while seeking and benefitting from knowledge and insight of others. This helps them to learn to behave responsibly in a rapidly changing independent society
4. Students completing this programme will be able to present mathematics clearly and precisely, make vague ideas precise by formulating them in the language of mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of mathematics to non-mathematicians.
5. Completion of this programme will also enable the learners to join teaching profession in primary and secondary schools.
6. This programme will also help students to enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

8. PROGRAM SPECIFIC OUTCOMES

PROGRAM SPECIFIC OUTCOMES

After the completion of B.Sc. program in mathematics, the students are able to have

PSO 1: A Solid Foundation in Knowledge: B.Sc. degree is the culmination of depth knowledge of my core branches of mathematics such as Calculus, Classical Algebra, Analytical Geometry, Differential Equations, Sequence and Series, Abstract Algebra, Real and Complex Analysis, Number Theory, Mechanics, Operation Research, Statistics, Graph Theory, Discrete Mathematics, Trigonometry, Transforms and their application and C++/Python. Thus, this programme helps students in creating a solid foundation for further higher studies and research in mathematics

PSO 2: A Competency in Skills: The skills and knowledge gained have intrinsic logic which leads to proficiency in analytical reasoning critical understanding, analysis and synthetic in order to solve theoretical and practical problems. This can orient students towards applications of mathematics in other disciplines and moreover, it can also be applied in modelling and solving the real-life problems.

PSO 3: A Problem-Solving Techniques: Students undergoing this programme learn to logically understand the question assertions to classify the patterns and to evaluate the difference between the necessities and unnecessities of the problems which helps to analyze the problem clearly and to take correct decision for solving the problems.

PSO 4: Interdisciplinary and Research Skills: Students completing this programme will be able to create and present mathematical concepts clearly and precisely, to describe mathematical ideas from multiple perspectives and to explain fundamental concepts of mathematics to non-mathematics people in a better manner.

PSO 5: A Proficiency in Employments: The programme will help students build up with employability for government jobs, jobs in banking, insurance and investments sectors, data analysis jobs and jobs in various other public and private enterprises.

9.COURSE OUTCOMES

**Semester-I
Core-I
Calculus and Classical Algebra**

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Core-I		Calculus and Classical Algebra	90	----	-	4

Contact hours per semester:90

Contact hours per week:6

Year	Semester	Internal Marks	External Marks	Total marks
I	I	25	75	100

Objective: To explain the curvature and radius of curvature in polar coordinates and Cartesian coordinates. Also to find the roots of the equations by various methods.

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

CO No.	Course Outcome	Knowledge Level
CO1	Apply the mathematical knowledge to analyze the properties of a curve such as curvature, radius of curvature, Involute and Evolute.	K3, K4
CO2	Classify double and triple integrals	K4
CO3	Identify Beta and gamma function and to apply the rules of beta and gamma function in evaluating double and triple integrals.	K3
CO4	Construct different types of equations and to find the roots of the equations by Newton's Theorem	K1,K6
CO5	Solve the different types of reciprocal equations and to find the number of real roots using Descartes rule of signs.	K6

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
COs					
CO1	3	3	3	3	2
CO2	2	3	3	3	1
CO3	3	3	3	1	1
CO4	3	1	3	2	2
CO5	3	1	2	1	2
Total contribution of COs to PSOs	14	11	14	10	8
Weighted Percentage of COs contribution to PSOs	93.33	73.33	93.33	66.66	53.33

Course Content

UNIT-1:

Curvature, Radius of Curvature and Centre of curvature in Cartesian and polar Co-ordinates-
Pedal equation – Involute and Evolute.

UNIT-2:

Double and Triple Integrals - Changing the order of integration – Jacobians and change of variables.

UNIT-3:

Beta and Gamma functions – Applications of Beta and Gamma Functions in evaluation of
Double and Triple Integrals.

UNIT-4:

Theory of Equations – Formation of equations – Relation between roots and coefficients
– symmetric function of the roots. Sum of the powers of the roots of an equation –
Newton's theorem.

UNIT-5:

Reciprocal equation - Transformation of equations - Descartes' rule of signs.

Text Books:

1. Narayanan.S and T.K.Manickavachagam Pillai-Differential Equations and its applications,
S.Viswanathan Printers Pvt.Ltd,2006.
2. Manickavachagam Pillai.T.K,and S,Narayanan -Algebra -Viswanathan Publishers and Printers
Pvt.Ltd,2004.

Books for Reference:

1. Kandasamy Pand K. Thilagavathi- Mathematics for B.Sc., Volume II – 2004, S.Chand & Co., New Delhi.
2. Kandasamy Pand K. Thilagavathi- Mathematics for B.Sc., -2004, Volume I and Volume IV,
S.Chand & Co., New Delhi.
3. Apostol T.M. - Calculus, Vol. I (4th edition) John Wiley and Sons, Inc., New York 1991.
4. Apostol T.M. Calculus, Vol. II (2nd edition) John Wiley and Sons, Inc., New York 1969.

Semester-I/III
Allied Paper-I
Statistics- I (For Mathematics Students)

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Allied		Statistics-I	90	-	-	3

Contact hours per semester:90

Contact hours per week:6

Year	Semester	Internal Marks	External Marks	Total marks
I/II	I/III	25	75	100

Objective: To study the concepts of measures of dispersion and measures of central tendencies and also to develop the concept of probability distributions.

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

CO No.	Course Outcomes	Knowledge Level
CO 1	Find and relate the concepts of moments, skewness and kurtosis and to demonstrate the method of least squares and to classify parabolic, exponential and logarithmic curves.	K1, K2, K3
CO 2	Interpret correlation and regression and to illustrate Karl's Pearson's coefficient of correlation and also the lines of regression and coefficient of regression	K2
CO 3	Develop the statistical techniques used in the theory of attributes and to analyze consistency of data and criteria independence and to interpret Yule's coefficient of association.	K3, K4
CO 4	Explain distribution function and its properties, able to find mathematical expectation and to find the cumulants using generating function.	K2
CO 5	Distinguish discrete and continuous probability distributions and to construct binomial, Poisson distribution	K4, K6

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	2	1
CO2	3	2	3	3	2
CO3	2	2	3	2	1
CO4	2	1	2	1	1
CO5	3	2	3	2	2
Total contribution of COs to PSOs	13	9	14	10	7
Weighted Percentage of COs contribution to PSOs	86.66	60	93.33	66.67	46.66

Course Content**UNIT-1:**

Moments,SkewnessandKurtosis-Curvefitting-methodofleastquares-Fittinglines-Parabolic, ExponentialandLogarithmiccurves.

UNIT-2:

Correlation and Regression – Scatter Diagram – Karl Pearson’scoefficient of correlation – Properties – Lines ofRegression–CoefficientofRegressionandproperties–RankCorrelation.

UNIT-3:

AssociationofAttributes –Consistencyofdata–Criteria independence – Yule’sCoefficientofAssociation.

UNIT-4:

Random variable – Distribution function – Properties of Distribution function – Mathematical Expectation –Multiplication theorem of Expectation – Moment generating function – Cumulants – Characteristic function –PropertiesofCharacteristicfunction.

UNIT-5:

Discrete and continuous Probability Distributions - Binomial and Poisson Distribution and their moments,Generatingfunction,characteristicfunction,properties andsimpleapplications.NormalDistribution –Standardnormaldistributionandtheirproperties–simpleproblems.

TextBooks:

1. Arumugam&ThangapandiIsaac,Statistics,New Gamma Publishing House,July 2016 for Unit I,II,III
2. Gupta.S.C and V.K.Kapoor-Fundamentals of Mathematical Statistics,Sultan Chand &sons,New Delhi.(2002) for (Unit IV &V)

BooksforReference:

1. Vittal,V.R., Mathematical Statistics, Maragatham Publications,2004
2. D.C.Sacheti&KapoorStatistics,Sultan Chand & Sons, New Delhi,2017.

Semester I/III
Allied paper-I
Algebra and Differential equations
(For Science Students)

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-IV	Allied		Algebra and Differential equations	90	-	-	3

Contact hours per semester:90

Contact hours per week:6

Year	Semester	Internal Marks	External Marks	Total marks
I/II	I/III	25	75	100

Objective: To explain the simple concepts of the theory of equations and to find the roots of the equations by using techniques in various methods.

Course Outcomes (COs)

On successful completion of the course, the learners should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Construct different types of equations and to compare and to find the relationships between roots and coefficients.	K6, K1
CO2	Identify the transformation of equations and to find approximate solutions to equations by making use of Newton's Method and Korner's Method.	K3
CO3	Identify types of matrices and to find the characteristic equation of matrix. Eigen values and eigen vectors can be determined by applying Cayley Hamilton Theorem.	K3, K5
CO4	Distinguish the differential equations of first order and higher degrees and to identify the equations which are all solvable for p, x, y and the equations in the standard form $Pp+Qq=R$.	K3, K4
CO 5:	Identify and distinguish Laplace transformation and inverse Laplace transformation	K3,K4

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
COs					
CO1	3	2	3	1	2
CO2	3	3	3	2	1
CO3	2	3	3	1	2
CO4	3	3	2	3	2

CO5	2	2	3	2	2
Total contribution of COs to PSOs	13	13	14	9	9
Weighted Percentage of COs contribution to PSOs	86.6	86.6	93.3	60	60

Course Content

UNIT-1:

Theory of Equations – Formation of Equations – Relation between roots and coefficients – Reciprocal equations.

UNIT-2:

Transformation of Equations – Approximate solutions to equations – Newton's method and Horner's method.

UNIT-3:

Matrices – Characteristic equation of a matrix – Eigen values and Eigen vectors – Cayley Hamilton theorem and simple Problems.

UNIT-4:

Differential equation of first order but of higher degree – Equations solvable for p, x, y – Partial differential equations – Formations – Solutions – Standard form $Pp + Qq = R$.

UNIT-5:

Laplace transformation – Inverse Laplace transform.

Text Books:

1. Dr. S. Arumugam & Isaac – Allied Mathematics Paper- I, New Gamma Publishing House (2012), Palayamkottai

Books for Reference:

4. Narayanan. S and T. K. Manikavachagam Pillai - Differential Equations and its applications, S. Viswanathan Printers Pvt. Ltd., 2006.
5. T. Veerarajan - Algebra and Trigonometry - Yes Dee Publishing Pvt. Ltd., (2009)

Semester -II

Core II

Differential Equations and Analytical Geometry of Three dimension

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-IV	Core-II		Differential Equations and Analytical Geometry of Three dimension	90	-	-	4

Contact hours per semester:90

Contact hours per week:6

Year	Semester	Internal Marks	External Marks	Total marks
I	II	25	75	100

Objective: To explain ordinary differential equations with constant and variable coefficients and to describe sphere, intersection of two spheres and tangency of spheres

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

CO No.	Course Outcomes	Knowledge Level
CO1	Solve the differential equations which are all solvable for x, y, p and Clairaut's form. Also, to illustrate the method of solving the differential equations of the form $f_1(D)x + g_1(D)y = h_1(t)$, $f_2(D)x + g_2(D)y = h_2(t)$.	K2, K6
CO2	Identify and solve the second order linear differential equation with constant coefficients and to interpret the linear equations of second order with variable coefficients.	K2, K3, K6
CO3	Analyze the 3D-co-ordinate systems and how to find the direction cosines and direction ratios. Also to find the angle between planes, the length of the perpendicular and angle of bisection.	K1, K4
CO4	Find and classify the equation of lines in different forms and calculate the image of the point, image of a line and to distinguish lines and planes. The angle between the line and plane can be determined. coplanar lines can be shown and the shortest distance between	K1, K2, K5
CO5	The equations of spheres and circles of intersection can be interpreted and	K2, K4

	to illustrate and analyze the tangency of sphere.	
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K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs \ COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	1	2
CO2	3	2	3	2	1
CO3	3	3	2	3	2
CO4	2	3	3	2	1
CO5	3	1	2	1	1
Total contribution of Cos to PSOs	14	11	13	9	7
Weighted Percentage of COs contribution to PSOs	93.33	73.33	86.66	60	46.66

Course Content

Unit I:

First order higher degree equations -Solvable for x,y,p and Clairaut's Form-Simultaneous Differential equations of the form $f_1(D)x + g_1(D)y = h_1(t)$, $f_2(D)x + g_2(D)y = h_2(t)$

Unit II:

Ordinary Differential Equations-Second Order linear Differential Equations with constant Coefficients-Find the P.I for the function of the form $e^{ax}f(x)$ and $x^n f(x)$ -Linear Equation of second order with Variable coefficients.

Unit III:

Analytical Geometry of 3D -Co-Ordinate system, Direction Cosines, Direction Ratios-Equation of planes in different forms-angle between planes-Length of perpendicular-angle of bisection.

Unit IV:

Equation of a line in different forms-image of a point-image of a line-The plane and the straight line-angle between plane and the line-Coplanar lines-Shortest distance between two lines.

Unit V:

Sphere-Tangent plane-Circle of intersection-Tangency of spheres-Orthogonal spheres.

Text Books:

1. Narayanan.S and T.K.Manikavachagam Pillai-Differential Equations and its applications, S.Viswanathan Printers Pvt.Ltd,2006
2. Manickavachagam Pillai.T.K.,and T.Natarajan-A Text book of Analytical Geometry-Part II-Three dimensions-S.Viswanathan (Printers & Publishers) Pvt.Ltd(2012)

Book For Reference

1. Kandasamy.P and K.Thilagavathi-Mathematics for B.Sc., Vol. III and VI-S.Chand and Co.,New Delhi (2004)
2. Braun .M-Differential equations and their applications (III Edition)Springer-Verlag,Newyork (1983)
3. Boyce. W.E and R.C.Diprima-Elementary Differential Equations and Boundary value problems (VII Editions)-John Wiley and Sons,Inc,Newyork (2001)

Semester -II/IV

Allied Paper -II
Statistics-II (For Mathematics Students)

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-IV	Allied		Statistics-II	90	-	-	4

Contact hours per semester:90

Contact hours per week:6

Year	Semester	Internal Marks	External Marks	Total marks
I/II	II/IV	25	75	100

Objective: To know the importance of Correlation and regression and also to explain the basic concepts of various types of distribution.

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

CO No.	Course Outcomes	Knowledge Level
CO 1	To list out the characteristics of index numbers and to find Laspeyer's and Paache's, Fisher and Bowley's Edgeworth's index numbers. The method to classify and analyse the unit test, commodity reversal test, time reversal test and circular tests can be shown.	K1, K2
CO2	Construct testing of hypothesis and to distinguish null hypothesis and alternative hypothesis. Type I and Type II errors can be classified. The level of significance and test of significance for large samples can be explained.	K2, K4, K6,
CO3	Identify the distributions such as t-distributions and F-distribution. By making use of t-test the single mean and difference of means can be found out. Variance ratio test based on Chi-Square distribution by making use of this the goodness of fit can be decided.	K1, K3, K5
CO4	To find analysis of variance. One way and two way classified data can be explained and to randomize block design. Latin squares can be analysed and constructed.	K1, K4, K5
CO5	To explain statistical quality control and its advantages. Process control can be illustrated by making use of this control chart, range chart, P-chart can be designed	K2, K3

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs \ COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	1	1
CO2	3	3	3	3	2
CO3	3	2	2	3	2
CO4	2	3	2	3	3
CO5	3	2	3	2	1
Total contribution of COs to PSOs	14	12	13	12	9
Weighted Percentage of COs contribution to PSOs	93.33	80	86.66	80	60

Course Content

UNIT-1:

Characteristics of index numbers – Laspeyres' and Paasche's – Fisher's and Bowley and Edgeworth's index numbers Tests – Unit Test, Commodity Reversal Test, Time Reversal Test, Circular Test.

UNIT-2:

Testing of Hypothesis – Null hypothesis and Alternate hypothesis – Type I and Type II errors - Critical Region, Level of significance – Test of significance for large samples – Testing a single proportion – Difference of proportions Testing a single mean and Difference of means..

UNIT-3:

Tests based on t-distribution - Single mean and Difference of means – Tests based on F-Distribution – Variance Ratio Test based on Chi-Square Distribution – Independence – Goodness of fit.

UNIT-4:

Analysis of Variance – one way and two way classified data – Basic of experimental design – Randomized Block Design – Latin Square – Simple Problems.

UNIT-5:

Statistical Quality control – Definition – Advantages, Process Control – Control Chart, Mean Chart, Range Chart, P-Chart, Product Control – Sampling Inspection Plans.

Text Books:

1. Statistics – Arumugan & Thangapandi Issac, New Gamma Publications, 2016 (Unit-I, II & III).
2. Gupta. S.C & V.K. Kapoor – Fundamentals of Mathematical Statistics – (2002) Sultan Chand & Sons, New Delhi, for (Unit-IV & V).

Books for Reference:

1. Vittal. P.R – Mathematical Statistics, Maragatham Publications, 2004.
2. DCSacheti & Kapoor – Statistics, Sultan Chands New Delhi, Reprint-2017
3. R.S.N Pillai & Bagavathi, Statistics Theory and Practice, S Chand and Company Ltd, Reprint 2018.

Semester II/IV
Vector Calculus and Fourier Series
Allied Paper II (For Science students)

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-IV	Allied		Vector Calculus and Fourier Series	90	-	-	4

Contact hours per semester:90

Contact hours per week:6

Year	Semester	Internal Marks	External Marks	Total marks
I/II	II/IV	25	75	100

Objective: To know the concepts of vector differentiation and vector integration.

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

CO No.	Course outcomes	Knowledge level
CO1	Analyze what is meant by vector differentiation and how to apply vector differentiation and its properties..	K4, K3
CO2	Evaluate the double and triple integrals.	K5
CO3	Analyze and apply vector integration. By making use of Vector integration line, surface and volume integrals can be interpreted.	K2, K3, K4
CO4	Analyze and apply Green's, Stokes and divergence theorems	K3
CO5	Determine the functions whether the functions are odd or even. By making use of these concepts half range series can be found out.	K3, K5

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
COs					
CO1	3	3	3	2	2
CO2	3	3	3	3	2
CO3	3	3	2	2	1
CO4	2	2	3	1	1
CO5	3	2	2	2	1
Total contribution of	14	13	13	10	7

COs to PSOs					
Weighted Percentage of COs contribution to PSOs	93.33	86.66	86.66	66.67	46.67

Course Content:

UNIT-1:

Vector differentiation–Gradient–Divergence and curl.

UNIT-2:

Evaluation of double and triple integrals

UNIT-3:

Vector integration–Line, surface and volume integrals.

UNIT-4:

Green's, Stoke's and Divergence theorems (without proof)–simple problems.

UNIT-5:

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

Text Books:

1. Dr. S. Arumugam & others- Allied Mathematics Paper-II, New Gamma Publishing House, Palayamkottai, 2012.

2. T.K. Manicavachagom Pillai–Calculus (Vol II), S. Vishvanathan Printer and Publisher PVT. LTD (2012)

Books for Reference:

1. Dr. S. Arumugam and others–Analytical Geometry 3D & Vector Calculus, New Gamma Publishing House, Palayamkottai. (2017).
2. Susan. J. C–Vector Calculus (4th Edition), Pearson Education, Boston (2012).
3. Murray Spiegel–Vector analysis –Schaum Publishing company, New York (2009).

Semester-III
Core-III
SEQUENCES AND SERIES

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Core-III		Sequences And Series	90	-	-	4

Contact hours per semester:90

Contact hours per week:6

Year	Semester	Internal Marks	External Marks	Total marks
II	III	25	75	100

Objective: To acquire basic ideas of classical analysis and to study the behavior of sequences and series.

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

CO No.	Course Outcome	Knowledge Level
CO1	Analyse the real number system and also to classify rational and irrational numbers. To find the upper bounds, least upper bounds and maximum element and to elaborate triangle inequality and Cauchy-Schwartz Inequality.	K1, K2, K4
CO2	Categorize the sequences as bounded sequences, monotonic sequences, convergent sequences and divergent sequences. Also to find the algebra of limits	K1, K4
CO3	Demonstrate the behavior of monotonic sequences and to apply Cauchy's first limit theorem, Make use of Cauchy's Second limit theorem and Cesaro's Theorem. Construct subsequence and to explain Cauchy's general principle of convergence.	K2, K3, K6
CO4	Interpret the series and to apply n^{th} term test, Comparison test, Kummer's test, D'Alembert's ratio test, Raabe's test, Gauss test and root test to compile the nature of the series.	K2, K3, K6
CO5	Analyse the alternating series. Apply the test for convergence for series of arbitrary terms. Also to identify the power series and to determine the radius of convergence.	K1, K3, K4, K5

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
COs					
CO1	3	3	3	3	3
CO2	2	2	3	3	1
CO3	3	3	2	3	2
CO4	3	1	3	2	2
CO5	3	1	2	1	2
Total contribution of COs to PSOs	14	10	13	12	10
Weighted Percentage of COs contribution to PSOs	93.33	66.67	86.67	0.8	66.67

Course Content**UNIT-1:**

Inequalities, Triangle inequalities, Cauchy-Schwartz inequality, Sequences, Bounded Sequences, Monotonic Sequences. (Sec 2.1-2.3, 2.5, 3.1-3.4).

UNIT-2:

Convergent Sequences, Divergent and Oscillating Sequences, The algebra of limits, Behaviour of monotonic Sequences. (Sec 3.5-3.8)

UNIT-3:

Some theorems on limits, Subsequences, Cauchy Sequences, Series of positive terms- Infinite series, Comparison test (Sec 3.9, 3.10, 3.12, 4.1 & 4.2).

UNIT-4:

Kummer's test, Root test and condensation test (Section 4.3, 4.4)

UNIT-5:

Series of arbitrary terms, Alternating Series, Tests for convergence of series of arbitrary terms.

TextBooks:

- ❖ S. Arumugam, A. Thangapandi Issac and A. Somasundaram- "Sequences and series"- Yesdee Publications, Chennai. (First reprint 2021).

Book for Reference:

- Shanti Narayan & Dr. M. D. Raishinghamia, Elements of Real Analysis S. Chand & Co., Revised Edition 16th (2014)
- Ellina Grigorieva- Methods of Solving Sequence and series Problem- Springer Link.
- Richard R. Goldberg "Methods of real analysis" Oxford and IBH Publications Co. Pvt limited, New Delhi, Indian Edition 1975.
- Tom. M. Apostol- Mathematical Analysis, Narosa Publishing house, New Delhi. (Reprint 1985).

Semester -III
Skill Based Core- Paper I
VECTOR CALCULUS

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Skill Based Core-I		Vector Calculus	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
II	III	25	75	100

Objective: To lay a good foundation of vector differentiation and vector integration. Also to solve problems related to this.

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

CO No.	Course Outcome	Knowledge Level
CO1	Classify the vector point function and scalar point function. Determine the derivative of a vector and derivative of product of scalar and vector function.	K2,K5
CO2	Find divergence, curl. Make use of the Laplacian operator.	K1,K3
CO3	Interpret the integration of point function and to illustrate line integral. To solve surface integral.	K5,K6
CO4	Analyze and solve the volume integral. Also to illustrate and make use of Gauss Divergence Theorem to solve problems.	K2, K3,K6
CO5	To solve problems based on Green's theorem and Stoke's Theorem	K6

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	1	3
CO2	2	2	3	2	1
CO3	3	3	3	3	2
CO4	3	1	2	2	1
CO5	1	1	2	3	3
Total contribution of COs to PSOs	12	10	13	12	10
Weighted Percentage of COs contribution to PSOs	80	66.67	86.67	80	66.67

Course Content

UNIT-1:

Vector point functions, Scalar point functions – Derivative of a vector and derivative of sum of vectors – Derivative of product of a scalar and vector point function – The vector operator ∇ - Gradient

UNIT-2:

Divergence–Curl, solenoidal, irrotational vectors–Laplacian operator.

UNIT-3:

Integration of point function–Line integral–Surface integral.

UNIT-4:

Volume Integral–Gauss divergence theorem (Statement without Proof)–Problems.

UNIT-5:

Green's theorem and Stoke's theorem (Statement without Proof)–Problems.

Text Book:

- ❖ Duraipandian and Laxmi Duraipandian, Vector Analysis-Emerald Publishers (Revised Edition, Reprint 2005).

Books for References:

- Dr. S. Arumugam and others–Vector Calculus, New Gamma Publishing House. (2006).
- Susan J. C–Vector Calculus (4th Edition), Pearson Education, Boston (2012).
- Murray Spiegel-Vector analysis – Schaum Publishing company, New York (2009).
- Dr. M. K. Venkataraman and Mrs. Manorama Sridhar, Vector Calculus and Fourier Series, The National Publishing Company, Chennai-1, (2002)
- R. Gupta, Vector Calculus, FIREWAL Media (An imprint of Lakshmi Publications Pvt. Ltd)-New Edition, Copyright © 2010.

SEMESTER-III
Non -Major Elective Paper I

Mathematics for competitive Examinations -I

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Non major-I		Mathematics for competitive Examinations -I	30	-	-	2

Contact hours per semester:30

Contact hours per week:2

Year	Semester	Internal Marks	External Marks	Total marks
II	III	25	75	100

Objective: To learn the techniques for solving aptitude problems and to enable the students prepare themselves for various competitive examinations.

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

CO No.	Course Outcome	Knowledge Level
CO1	Interpret simplification and find averages	K1, K2
CO2	Determine ratio and proportion	K5
CO3	Assess partnership and solve percentage problems	K4,K5
CO4	Distinguish profit and loss	K4
CO5	Solve problems on numbers	K6

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	3	2	3	3	1
CO3	2	3	2	3	2
CO4	3	1	3	2	2
CO5	1	1	1	3	2
Total contribution of COs to PSOs	12	10	12	14	10
Weighted Percentage of COs contribution to PSOs	80	66.67	80	93.33	66.67

Course Content

Unit -1:

Simplification,averages.

Unit -2:

Ratioand proportion.

Unit-3 :

Partnership-percentages.

Unit-4 :

Profit and Loss

Unit-5:

Problems on numbers.

Text Book:

- ❖ R.S.Agarwal -Objective arithmetic,Published by S.Chand& Co Ltd.Edition 2018

Book for References:

- ❖ R.S.Agarwal - Arithmetic subjective and Objective ,Published by S.Chand& Co Ltd. Revised Edition 1st April 2017
- ❖ Rajesh Verma, Fast track Objective arithmetic, Arihant Publications India Limited Fourth Edition, 1st January 2018.

SEMESTER-III
Non -Major Elective Paper I
FUNDAMENTALS OF STATISTICS-I

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Non major-I		Fundamentals of Statistics-I	30	-	-	2

Contact hours per semester:30

Contact hours per week:2

Year	Semester	Internal Marks	External Marks	Total marks
II	III	25	75	100

Objective: To introduce the new concept of Measure of Central Tendency to other major students .Also to study about correlation, regression and to solve simple problems.

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

CO No.	Course Outcome	Knowledge Level
CO1	Analyse the classification of datas.Also to construct bar diagram and Pie chart.	K3, K6
CO2	Illustrate measure of central tendency and to find mean,median and mode.	K1,K2
CO3	Explain the measure of dispersion .Also to find standard deviation,variance,quartile deviation and to obtain the relationship between them.	K4,K5
CO4	Interpret correlation and to solve rank correlation problems.	K2,K6
CO5	To find solution for regression equations	K1, K6

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	3	2	3	3	1
CO3	3	3	3	3	3
CO4	3	2	3	3	2
CO5	1	2	2	1	2
Total contribution of COs to PSOs	13	12	14	13	11
Weighted Percentage of COs contribution to PSOs	86.67	80	93.33	86.67	73.33

Course Content

UNIT-1:

Classification of datas–BarDiagram–Pie chart.

UNIT-2:

Measures of central tendency: Mean, median, mode (with frequency).

UNIT-3:

Measures of dispersion: Range–standard deviation, Variance–Quartile deviation.

UNIT-4:

Correlation–Rank correlation (Problem only)

UNIT-5:

Regression equations (Problem only)

Text Book:

- Dr. S. Arumugam, A. Thangapandi Issac - Statistics, New Gamma Publishing House, Palayamkottai. (2016)

Books for Reference:

- S.P. Gupta - Elementary Statistical Methods, Sultan Chand & Sons, (2017).
- T. Veerarajan, Fundamentals of mathematical Statistics, Yes Dee Publishing Pvt, Ltd.. (2017)
- C.B. Gupta and Vijay Gupta, An Introduction to Statistical Methods, Vikas Publishing House Pvt. Ltd. New Delhi – (1973)

Semester -IV
CORE -IV
ABSTRACT ALGEBRA

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Core		Abstract Algebra	90	-	-	4

Contact hours per semester:90

Contact hours per week:6

Year	Semester	Internal Marks	External Marks	Total marks
II	IV	25	75	100

Objective: To acquire knowledge about the concept of groups,rings and fields and to study about the concept of homomorphism.

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

CO No.	Course Outcome	Knowledge Level
CO1	Explain the definitions of groups and its examples.Also to determine the order of an element.Illustrate about Subgroups.	K2,K4
CO2	Interpret cyclic groups and to find the generators of cyclic subgroups. Illustrate and apply Lagrange's Theorem,Euler's Theorem and Fermat's Theorem.	K1,K3,K6
CO3	Elaborate about Normal Subgroups and group homomorphism.Illustrate Isomorphism ,Automorphism .Also to apply Cayley's theorem wherever required.	K4,K5
CO4	Compare and classify Rings and its types.Illustrate about Integral domain and Fields .To summarize about maximal and minimal ideals.	K1,K6
CO5	Utilize the concept of homomorphism and isomorphism on rings .Also to find kernel of homomorphism and to make use of fundamental theorem.	K3,K5

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	2	2	3	3	3
CO3	3	3	2	2	2
CO4	2	1	3	1	2
CO5	2	2	2	1	2
Total contribution of COs to PSOs	12	11	13	10	12
Weighted Percentage of COs contribution to PSOs	80	73.33	86.67	66.67	80

Course Content

UNIT-1: Groups – definition and examples-Elementary properties of groups – subgroup – order of an element– centre of a group –Normaliser and Centralizer – Product of two Subgroups – order of HK – Intersection and union of subgroups

UNIT-2 Cyclic groups–generators of a cyclic group–Cosets and Lagrange’s theorem– Euler’s theorem– Fermat’s theorem.

UNIT-3: Normal Subgroups-Quotient groups – Group Homomorphism – Canonical homomorphism – Kernel of a homomorphism–Isomorphism–Automorphism–Inner automorphism–Permutation groups– Cayley’s theorem.

UNIT-4: Rings: Definition and examples – Types of rings – Elementary properties of a ring – Integral domain – Field – Subrings – Subfields – Ideals – Principal ideal – Quotient ring – Maximal and prime ideals.

UNIT-5: Homomorphism of rings – Isomorphism – Kernel of a homomorphism – Fundamental theorem.

TextBook:

- ❖ S.Arumugam and A.Thangapandi Issac “ Modern Algebra ” - Scitech Publications, Privatelimited.(2008)

Books for Reference:

- M. L.Santiago, Modern Algebra–McGraw-Hill Education India Pvt. Limited,(2002).
- T K. Manicka Vachagampillai and others - Modern Algebra – Visvanathan Publishers(2011).
- Visvanathan Nayak, Modern Algebra-Emerald Publishers, Reprint 1992.

SEMESTER -IV
Skill Based Core-Paper- II
TRIGONOMETRY,LAPLACE TRANSFORMS AND FOURIER SERIES

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Skill Based Core		Trigonometry, Laplace Transforms and Fourier Series	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
II	IV	25	75	100

Objective: To understand the concept of Trigonometry and to acquire knowledge about Laplace Transform and its inverse. Also to study the concept of Fourier series and to solve problems by making use of it.

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

CO No.	Course Outcome	Knowledge Level
CO1	Summarize about Trigonometry and to illustrate about the expansion of $\sin^n x$, $\cos^n x$, $\sin^n x$, $\cos^n x$	K2,K3
CO2	Obtain the relationship between hyperbolic functions and circular function. Explain about inverse hyperbolic functions.To find summation of the series using C+iS method.	K1,K4
CO3	Illustrate laplace transform	K5
CO4	Solve differential equations with constant coefficients by making use of Laplace Transforms.	K6
CO5	Solve problems based on Fourier series . Identify the odd and even functions and to deduce half range series.	K3,K6

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	2	2	3	3	3
CO3	3	3	2	2	2
CO4	3	2	3	1	2
CO5	3	3	1	1	1
Total contribution of COs to PSOs	14	13	12	10	11
Weighted Percentage of COs contribution to PSOs	93.33	86.67	80	66.67	73.33

Course Content:

UNIT-1:

Trigonometry: Expansion of $\sin nx, \cos nx, \tan nx$ and expansions of $\sin^n x$ and $\cos^n x$.

UNIT-2:

Hyperbolic functions – Relation between hyperbolic functions and circular functions – Inverse hyperbolic functions – Logarithm of a complex number – Summation of series using $C+iS$ method

UNIT-3:

Laplace transforms.

UNIT-4:

Inverse transforms, Solving linear differential equations with constant coefficients using Laplace Transforms.

UNIT-5:

Fourier Series – Definition, Finding Fourier coefficients for a given periodic function with period 2π and $2l$, odd and even functions, Half range series.

TextBook:

- ❖ Arumugam. SandThangapandi Issac. A – Trigonometry and Fourier Series.
- ❖ T.K. Manickavachagam Pillai and S. Narayanan – Differential equations and its applications, S. Viswanathan Publishers 2011.

Books for reference:

- T. Veerarajan – Algebra and Trigonometry – YES DEE Publishing pvt. Ltd., Chennai. (2020).
- Ray Hanna. J – Fourier Series, Transforms and Boundary value Problems, Dover Publications New York, 2008.
- Dr. M.K. Venkataraman and Mrs. Manorama Sridhar, Vector Calculus and Fourier Series, The National Publishers Company, Chennai (2002).

SEMESTER -IV
Non-Major Elective -II
MATHEMATICS FOR COMPETITIVE EXAMINATION-II

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-IV	Non Major		Mathematics for competitive examinations-II	30	-	-	4

Contact hours per semester:30

Contact hours per week:2

Year	Semester	Internal Marks	External Marks	Total marks
II	IV	25	75	100

Objective: To learn the techniques for solving aptitude problems. Also to motivate the students for attending various competitive examinations.

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

CO No.	Course Outcome	Knowledge Level
CO1	Analyse and solve the problems based on simple interest and compound interest.	K2,K6
CO2	Apply short tricks on solving time and work problems	K3
CO3	Making use of the concept of time and distance while solving problems	K5
CO4	Utilize Chain rule	K4
CO5	Find solutions for pipes and Cistern problem	K1

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	2	2	3	3	3
CO3	3	3	2	2	2
CO4	3	2	3	2	3
CO5	3	3	1	3	3
Total contribution of COs to PSOs	14	13	12	13	14
Weighted Percentage of COs contribution to PSOs	93.33	86.67	80	86.67	93.33

Course Content:

UNIT-1:

Simple interest and Compound interest.

UNIT-2:

Time and work.

UNIT-3:

Time and Distance.

UNIT-4:

Chain Rule.

UNIT-5:

Pipes and Cistern

TextBook:

- ❖ R.S. Agarwal- Objective Arithmetic, Published by S. Chand & Co Ltd., Edition (2018).

Books for Reference:

- Rajesh Verma- Fasttrack Objective arithmetic, Arihant Publications (India) Limited., Fourth Edition 1st January 2018.
- R.S. Aggarwal, Arithmetic Subjective and objective, Published by S. Chand and Co. Ltd. Revised Edition on 1st April 2017.

SEMESTER -IV
Non-Major Elective -II
FUNDAMENTALS OF STATISTICS-II

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-IV	Non Major		Fundamentals of Statistics-II	30	-	-	4

Contact hours per semester:30

Contact hours per week:2

Year	Semester	Internal Marks	External Marks	Total marks
II	IV	25	75	100

Objective: To know the concept of attributes and to study the index numbers and simple problems.

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

CO No.	Course Outcome	Knowledge Level
CO1	Explain the theory of Attributes	K3
CO2	Illustrate about index numbers and to determine the weighted index numbers.	K1,K5
CO3	Analyse and predict consumer price index numbers	K6
CO4	Evaluate Time series	K4
CO5	Apply curve fitting for straight line ,parabola and exponential curve	K2

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	2	3	3	3	3
CO2	2	2	3	3	3
CO3	3	3	2	2	2
CO4	3	2	1	2	3
CO5	2	3	1	3	3
Total contribution of COs to PSOs	12	13	11	13	14
Weighted Percentage of COs contribution to PSOs	80	86.67	73.33	86.67	93.33

Course Content:

UNIT-I

Theory of attributes–two attributes.

UNIT –II

Index number –weighted index number.

UNIT – III

Consumer Price index number –conversion of index number.

UNIT –IV

Time series –measurement of trends.

UNIT–V

Curve fitting–Straight line –Parabola –Exponential curve.

TextBook:

- ❖ Dr. S. Arumugam, A.ThangapandiIssac- Statistics, New Gamma Publishing House,Palayamkottai (2016).

Books for Reference:

- S.P.Gupta-Elementary Statistical Methods,Sultan Chand & Sons,2017).
- T. Veerarajan Fundamentals of mathematical Statistics, YesDee Publishing Pvt.Ltd.Edition .(2017)

Semester-V

Core-V

LINEAR ALGEBRA

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-V		Linear Algebra	75	-	-	4

Contact hours per semester:75

Contact hours per week:5

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective:To acquire knowledge about vectors spaces,Inner product space and linear transformations.Also to solve problems in Matrices

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

CO No.	Course Outcome	Knowledge Level
CO1	Explain the definitions and general properties of vector spaces. Also to explain subspace. They know where to apply fundamental theorem of homomorphism.	K1, K2
CO2	Determine the span of a set and to check whether the given set is Linearly dependent or not.Also to find basis and dimensions.	K4
CO3	Illustrate and apply Rank Nullity theorem.Explain the definitions and examples of inner product space.Apply Gram Schmidt Orthogonalization process.	K3,K6
CO4	Construct matrices and also to summarize the elementary transformations.Determine the Inverse of matrix and rank of a matrix. To make use ofCayley Hamilton Theorem.	K2, K6
CO5	Determine Eigen Values and Eigen Vectors. Identify bilinear forms and quadratic forms.Also To deduce Diagonal form from Quadratic form.	K4,K5

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	2	2	3	3	1
CO3	3	3	2	3	2
CO4	2	1	3	2	2
CO5	2	2	2	1	3

Total contribution of COs to PSOs	12	11	13	12	11
Weighted Percentage of COs contribution to PSOs	80	73.33	86.67	0.8	73.33

Course Content

UNIT-1:

Vectorspaces:Definitionandexamples–Elementaryproperties–subspaces–lineartransformations–Fundamentaltheoremofhomomorphism.

UNIT-2:

Spanofaset–linear dependenceandindependence–basisanddimension.

UNIT-3:

Rank - Nullity theorem – Matrix of a linear transformation – Inner product space – Definitionandexamples–orthogonality –orthogonalcomplement–Gram Schmidorthogonalizationprocess.

UNIT-4:

Matrices –Elementarytransformation–Inverse and power of a matrix using CayleyHamilton’stheorem–Inverse and rank of a matrix using elementary transformations.

UNIT-5:

Eigen values and Eigen vectors – Properties and problems – Bilinear forms – Quadratic forms –Reductionofquadraticformtodiagonalform.

TextBook:

- ❖ S.Arumugan&ThangapandiIssac ,Modern Algebra-Scitech Publication,Reprint(2008).

BooksforReference:

- SharmaJ.NandVashisthaA. R.LinearAlgebra-KrishnaPrakashNandir1981.
- JohnB. Fraleigh–AfirstCourseinAbstractAlgebra 7thedition, Pearson, 2002.
- N. Ramabhadran&R.Balakrishnan,Textbookofalgebra – VikasPublishingCo.RevisedEdition1985.
- Ward Cheney and David Kincaid,Linear Algebra-Theory and Applications.Jones and Barlett India PVT Ltd, New Delhi -First Edition(2010)

Semester-V
Core-VI
REAL ANALYSIS

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-VI		Real Analysis	75	-	-	4

Contact hours per semester:75

Contact hours per week:5

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective: To acquire knowledge about the real number system and metric spaces. Also to study the concepts of connectedness and compactness.

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

CO No.	Course Outcome	Knowledge Level
CO1	Explain about Metric spaces and to construct an open ball .Also to interpret interior	K1,K3
CO2	Interpret about closed sets and to find closure. To determine limit points. Analyze about complete metric space. Discuss about Cantor's intersection theorem and Baire's Category theorem.	K2,K4
CO3	Summarize continuity. Illustrate about uniform continuity.	K3,K5
CO4	Explain about connectedness and to deduce the connected subsets of R .To obtain the relationship between connectedness and continuity	K4,K6
CO5	Illustrate about compactness and to find the connected subsets of R. Illustrate and make use of Heine Borel Theorem .To determine the relationship between compactness and continuity.	K3,K6

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	2	2	3	3	1
CO3	3	3	2	3	2
CO4	1	2	3	2	2
CO5	1	2	2	3	3
Total contribution of	10	12	13	14	11

COs to PSOs					
Weighted Percentage of COs contribution to PSOs	66.67	80	86.67	93.33	73.33

Course Content

UNIT-1:

Metricspaces –Examples –boundedsets –openball–opensets –subspaces–interiorofaset.

UNIT-2:

Closedsets–closure–limitpoints–denseset–completemetricspace–Cantor’sintersectiontheorem–Baire’scategorytheorem.

UNIT-3:

Continuity–Homeomorphism–UniformContinuity

UNIT-4:

Connectedness–Connectedsubsetsof \mathbf{R} –Connectedness andcontinuity–Contractionmappingtheorem.

UNIT-5:

Compactness–Compactmetricspaces–Compactsubsetsof \mathbf{R} –HeineBoreltheorem–Equivalent characterizations forcompactness–Compactnessand Continuity.

TextBook:

- ❖ Dr. S. Arumugan,ModernAnalysis–YesDeePublishingPvt.Ltd.Reprint(2019).

Books for Reference:

- RichardR.Goldberg–MethodsofRealAnalysis-OxfordandIBHPublishingCo.NewDelhi,Indian edition 1985.
- RVisvanathanNayak,RealAnalysis-EmeraldPublishers, Reprint1992.
- Dr.B.S.Vatsa,Introductionto Real Analysis,CBS Publishers and Distributors,New Delhi.

Semester-V

**Core-VII
STATICS**

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-IX		Statics	75	-	-	4

Contact hours per semester:75

Contact hours per week:5

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective:To provide the basic knowledge of equilibrium of a particle and to develop a working knowledge to handle practical problems.

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

CO No.	Course Outcome	Knowledge Level
CO1	Explain the forces acting at a point and to apply the parallelogram law of forces, Triangle law of forces and Lami's theorem.	K2,K4
CO2	Interpret parallel forces and moments. Analyse the resultant of two parallel forces and the resultant of two unlike unequal parallel forces.To applyVarignon's theorem.	K1,K6
CO3	Summarize equilibrium of three forces acting on a rigid body and to illustrate three coplanar forces theorem and to make use of the above theorem to solve problems	K3,K5
CO4	Explain about laws of friction.Also to determine the angle of friction and Illustrate about the equilibrium of a particle and to make use of the concepts to solve the problems.	K1,K2,K6
CO5	Interpret the equilibrium of strings.To deduce the equation of catenary and its geometrical properties.	K2,K4

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3

CO2	3	2	3	3	1
CO3	3	3	2	3	3
CO4	1	2	3	2	3
CO5	1	2	1	3	3
Total contribution of COs to PSOs	11	12	12	14	13
Weighted Percentage of COs contribution to PSOs	73.33	80	80	93.33	86.67

Course Content

UNIT-1:

Forces acting at a point – Parallelogram law of forces – Triangle law of forces – Lami's theorem

UNIT-2:

Parallel forces and moments – resultant of two parallel forces – resultant of two unlike unequal parallel forces – Varignon's theorem

UNIT-3:

Equilibrium of three forces acting on a rigid body – three coplanar forces theorem.

UNIT-4:

Friction – Laws of friction – angle of friction – equilibrium of a particle (i) on a rough inclined plane (ii) under a force parallel to the plane (iii) under any force

UNIT-5:

Equilibrium of strings – equation of the common catenary – tension at any point – geometrical properties of common catenary

Text Book:

- ❖ M.K. Venkatraman – Statics, Agasthiar Publications, Trichy (2020).

Books for reference:

- S. Narayanan, Statics S. Chand and Company, New Delhi (1985).
- K. Viswanatha Naik and M. Kari, Statics, Emerald Publishers, Chennai.
- I. Rajeswari – Mechanics - Saras Publication, Nagercoil (2016).

Semester-V

Core-VIII

INTEGRAL TRANSFORMS AND Z TRANSFORMS

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-VIII		Integral Transforms and Z transforms	75	-	-	4

Contact hours per semester:75

Contact hours per week:5

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective: To develop the knowledge of transforms and to solve problems in Fourier transforms and Z transforms.

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

CO No.	Course Outcome	Knowledge Level
CO1	Apply Fourier transforms and to explain the properties.	K2,K4
CO2	Solve problems on infinite Fourier cosine and Sine Transforms	K1,K6
CO3	Identify and solve Finite Fourier transforms	K3,K5
CO4	Illustrate Z transforms and its properties.	K1,K2,K6
CO5	Utilize inverse Z transforms to solve difference equations.	K2,K4

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	3	2	3	3	1
CO3	1	3	2	2	3
CO4	2	2	3	1	3
CO5	2	3	2	2	3
Total contribution of COs to PSOs	11	13	13	12	13
Weighted Percentage of COs contribution to PSOs	73.33	86.67	86.67	80	86.67

Course Content

UNIT-1:

Fourier Transforms–Properties of Fourier Transforms.

UNIT-2:

Infinite Fourier Cosine and Sine Transforms–Properties.

UNIT-3:

Finite Fourier Transforms.

UNIT-4:

Z-transforms–Properties.

UNIT-5:

Inverse Transforms- Introduction to difference equations and find solution using inverse Z transforms

TextBook:

- ❖ Singaravelu.A–Engineering mathematics (volumeIII) –MeenakshiAgency,Chennai(2019).

Books for Reference:

- MuthuKumaraswamy.R- Transforms and Partial Differential Equation Equations–YesDee Publications –Second Edition(2019).
- Gangatharan,Engineering Mathematics (volume I) –Prentice Hall of India Pvt.Ltd.(2007).
- Dr.C.Muthulakshmi@Saisikala and R.Ponraj- Transformsand their applications,Charulatha Publication(2020).

Semester-V
Major Elective-I
PROGRAMMING IN C

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Non Major - I		Programming in C	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective: To study the basic concepts and structure of C program and to train the students to write simple C programs.

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

CO No.	Course Outcome	Knowledge Level
CO1	Summarize about character set. Classify the keywords and identifiers. Identify the constants, variables and data types.	K3,K4
CO2	Apply different types of operators and to make use of input and output operators.	K1,K6
CO3	Compile programs by utilizing decision making and branching statements. Also to apply Decision making and looping statements while develop a program.	K2,K5
CO4	Make use of one dimensional and two dimensional arrays. Also to utilize Character arrays and strings and its functions while compiling the program	K3,K6
CO5	Illustrate user defined functions and illustrate the definitions of functions and return values and their types. Also to categorize function call, function declaration.	K2,K5

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	2	2	2	3

CO2	2	3	3	3	2
CO3	2	3	2	2	3
CO4	2	2	3	3	3
CO5	2	2	2	3	3
Total contribution of COs to PSOs	11	12	12	13	14
Weighted Percentage of COs contribution to PSOs	73.33	80	80	86.67	93.33

Course Content

UNIT-1:

Introduction – Character set, C tokens ,keywords and identifiers, Constants ,Variables andDatatypes.

UNIT-2:

Operators – Arithmetic, relational, logical assignment, increment and decrement, Conditional,Bitwise special operators, Precedence of operators,Managing input and output operators – getchar(),putchar(),scanf()andprintf().

UNIT-3:

Decision making and branching-Simple if, if else, nested if and the else if ladder statements, The switch statement,The ?: operator, The goto statement. Decision making and looping-while,Dowhile andforstatement,jumpsinloops.

UNIT-4:

Onedimensionalandtwodimensionalarrays–declaration,initializationofarrays, Multidimensionalarrays,Characterarraysandstrings:Declaringandinitializingstringvariables,Readingandw ritingofstrings,stringhandlingfunctions.

UNIT-5:

Userdefinedfunctions–

Definitionoffunction,returnvaluesandtheirtypes,functioncalls,functiondeclaration,Categoryoffunctions,Nestingof functions,recursion.

TextBook:

- ❖ E. Balaguruswamy - Programming in ANSI C –Tata McGraw Hill Publishing company limited – III Edition(2017).

Booksforreferences:

- C. ReemaThareja,ProgramminginC- OxfordUniversityPress(2018).
- Ramasamyet.al.-Programmingin C-ScetechPublication(INDIA)Pvt.Ltd.IIEdition(2015).
- AshokN.Kamathane- ProgrammingwithAnsiandTurboC– DorlingKindersley(India)Pvt.Ltd,(2009).

Semester-V
Major Elective-I
DISCRETE MATHEMATICS

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Non Major - I		Discrete Mathematics	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective: To study concepts of mathematical logics and to understand the basics of Lattices and Boolean Algebra.

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

CO No.	Course Outcome	Knowledge Level
CO1	Illustrate and use the statements, notations and connectives. Construct truth table and utilize conditional and biconditional statements.	K2, K3
CO2	Analyze and explain Predicate calculus	K1, K4
CO3	Elaborate Groups and monoids. Also to develop Group codes	K6
CO4	Construct Lattices and special lattices. Analyze and explain Boolean algebra	K5
CO5	Convert From one form to another form (Decimal, Binary, Octal, Hexadecimal). Evaluate Binary addition, subtraction multiplication and division.	K2, K6

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	1	3
CO2	3	3	3	3	2
CO3	3	3	2	1	3
CO4	2	3	3	3	3

CO5	1	3	2	3	2
Total contribution of COs to PSOs	12	14	13	11	13
Weighted Percentage of COs contribution to PSOs	80	93.33	86.67	73.33	86.67

Course Content

UNIT–1: Mathematical logic – Statements and notation, Connectives, Negation, Conjunction, Disjunction, Statement formula and truth table, Conditional and biconditional statements. Well defined formulae, tautologies.

UNIT–2: Normal forms - The theory of interference for the statement calculus, The Predicate, Theory of inference for the Predicate Calculus.

UNIT–3: Algebraic structures - Groups and monoids, Simple properties, Group codes.

UNIT–4: Lattices and Boolean algebra - Lattices as posets, Properties of lattices, special lattices, Boolean algebra, Gating networks, Minimal sum of products.

UNIT–5: Number system and codes - Decimal, Binary, Octal, Hexadecimal – Conversion from one to another – Binary addition, subtraction, multiplication and division, BCD, Weighted excess time, Gray code.

Text Book:

- ❖ J.P. Tremblay and Manohar - Discrete mathematical structures with application to Computer Science (Tata McGraw Hill) New Delhi, 43rd edition 2013.

Books for Reference:

- M. K. Venkataraman and others – Discrete mathematics - The National Publishing Pvt. Ltd. (2000).
- G. Balaji – Discrete mathematics – Balaji Publishers Chennai (2013).
- T. Veerarajan – Discrete mathematics Tata McGraw Hill – 2009.
- Garrett Birkhoff - Lattice Theory, American Mathematical Society (1948).
- M.K. Sen, B.C. Chakraborty, Introduction to Discrete Mathematics, Books and Allied (P) Ltd (2009).

Semester-V
Major Elective-I
COMBINATIONAL MATHEMATICS

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Non Major - I		Combinational Mathematics	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective: To know the basic concepts of pairings and to understand relations

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

CO No.	Course Outcome	Knowledge Level
CO1	Explain Selections and to find binomial coefficients. Classify ordered selections and unordered selections.	K1, K3
CO2	Solve pairing problems	K3
CO3	Explain recurrence and classify the types of relations using generating functions.	K2, K5
CO4	Illustrate The inclusion and exclusion principles.	K4, K6
CO5	Construct and solve block designs and square block designs.	K5

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	1	3
CO2	2	1	2	3	1
CO3	2	2	2	1	2
CO4	2	1	1	3	1
CO5	1	3	2	3	1

Total contribution of COs to PSOs	10	9	10	11	8
Weighted Percentage of COs contribution to PSOs	66.67	60	66.67	73.33	53.33

Course Content

UNIT-1:

Selections and Binomial coefficients–Permutations–Ordered selections–unordered selections–Miscellaneous Problems.

UNIT-2:

Parings Problems–Pairings within a set–Pairing between sets.

UNIT-3:

Recurrence–Fibonacci–type relations using generating functions–Miscellaneous methods.

UNIT-4:

The Inclusion–Exclusion Principles.

UNIT-5:

Block designs–square block designs.

TextBook:

- ❖ Ian C. Andersen–A first course in combinatorial mathematics –Clarendon Press, Oxford(1989).

Books for Reference:

- Ralph P. Grimaldi, B. V. Ramona –Discrete and combinatorial mathematics–an applied introduction (IV edition).

Semester-V
Major Elective-I
OPERATIONS RESEARCH -I

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Major elective		Operations Research-I	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective: To introduce the various techniques of operations research

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

CO No.	Course Outcome	Knowledge Level
CO1	Solve Linear Programming Problem by making use of Graphical method,Simplex method.	K4
CO2	Interpret the concept of duality.Classify primal and dual problems.Utilizing the concept of duality ,solve problems on dual simplex method.	K3
CO3	Solve Transportation problems by making use of North – west corner rule,Matrix-Minima method,Vogel’s Approximation rule. Evaluate Degeneracy and unbalanced transportation problems.	K2,K5
CO4	Determine the solution for Assignment problems.	K1,K6
CO5	Solve sequencing problems.	K5

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5

Cos					
CO1	3	3	3	1	3
CO2	2	1	2	3	3
CO3	2	1	2	3	2
CO4	2	3	1	3	3
CO5	3	3	2	3	3
Total contribution of COs to PSOs	12	11	10	13	14
Weighted Percentage of COs contribution to PSOs	80	73.33	66.67	86.67	93.33

Course Content

UNIT-1:

Linear Programming Problem: Mathematical formulation of LPP–Graphical method, Simplex method–Artificial variable technique.

UNIT-2:

Concept of Duality–Primal and Dual problems–Duality–Dual Simplex method.

UNIT-3:

Transportation Problem: North-west Corner rule–Matrix-Minima method–Vogel’s approximation method–MODI method–Degeneracy and unbalanced Transportation problem.

UNIT-4:

Assignment Problem: Hungarian method –Unbalanced assignment problems.

UNIT-5:

Sequencing Problem: n jobs and two machines – n jobs and three machines – 2 jobs and m machines.

TextBook:

- ❖ Kanti Swarup, P. K. Gupta and Manmohan – Operations Research – Sultan Chand and sons, (New Delhi) 12th edition (2006)

Books for Reference:

- Gupta P. K. and D. S. Hira – Operations Research – S. Chand & Sons Reprint (2012).
- B. J. Ranganathan and A. S. Srikantappa – Operations Research – Yes Dee Publishing House, Chennai (2017).
- Hamdy A. Taha – Operations Research, An Introduction - 8th Edition Prentice–Hall India (2006).
- A. C. S. Kumar, Operation Research, Yes Dee Publications, Chennai, 3rd Reprint 2019.

Semester-V
Major Elective-I
STOCHASTIC PROCESS

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Major Elective		Stochastic Process	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective: To understand the concepts of stochastic process and understand the generalization of Poisson process

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

CO No.	Course Outcome	Knowledge Level
CO1	Determine the generating functions .Also to analyze and explain Stochastic Process and specification of stochastic process	K1,K3
CO2	Interpret Markov Chains .Also to analyze the classification of states and chains. Illustrate the stability of Markov chain.	K2,K4
CO3	Classify Markov chain with denumerable states and Markov chain with continuous state space.	K2,K5
CO4	Illustrate Markov Process with discrete state space by using Poisson Process.	K1,K6
CO5	Elaborate Erlang Process.	K5

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	1	3
CO2	2	1	2	3	3

CO3	1	1	2	3	2
CO4	2	3	1	3	3
CO5	3	3	2	3	2
Total contribution of COs to PSOs	11	11	10	13	13
Weighted Percentage of COs contribution to PSOs	73.33	73.33	66.67	86.67	86.67

Course Content:

UNIT-1:

Generating functions–Laplace transform of probability distribution, Classification of distribution, Stochastic process, specification of stochastic process.

UNIT-2:

Markov chains – Definition and examples , Higher transition probabilities ,Generalisation of independent Bernoulli Trails, classification of states and chains ,Determination of Higher Transition Probabilities– stability of Markov systems.

UNIT-3:

Markov chain with Denumerable number states – Reducible chains ,Statistical inference for Markov chains, Markov chain with continuous state space, Non homogeneous chains.

UNIT-4:

Markov process with discrete state space–Poisson process, Poisson process and related distributions, Generalisation of Poisson process,Birth and Death process.

UNIT-5:

Markov process with Discrete state space–Derived Markov chains, Erlang Process.

TextBook:

- ❖ J.Medhi–Stochastic Process–New Age International Publishers Pvt.Ltd.Third Edition. 2009.

Books for Reference:

- SuddhenduBiswas – Applied Stochastic Process – New Central Agency Pvt. Ltd.,Kolkatta(2012).
- PaulG.Hoel,SidneyPort&CharlesJ.Stone–IntroductiontoStochasticprocess–WavelandPress– Boston(1987).
- V.Thangaraj, Stochastic Process and their applications,New Age International Publishers,NewDelhi,First Edition (1995).

Semester-VI
Major Elective- IV
MATH TYPE USING LATEX

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-IV	Major Elective		Math Type using Latex	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To introduce coding and decoding concepts. Also to develop the students in the field of coding theory

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

CO No.	Course Outcome	Knowledge Level
CO1	Type words, sentences and symbols not in the keyboard using Tex	K1,K3
CO2	Analyze Text environments	K2,K4,K5
CO3	Type math by making use of spacing rules, equations	K5
CO4	Type spacing of symbols building new symbols, math alphabets and symbols	K2,K6
CO5	Write latex documents by making use of abstract, sectioning, cross referencing and Bibliographies.	K4

➤ K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	1	3	3	3	3
CO2	2	1	3	2	1

CO3	2	1	2	3	2
CO4	3	2	3	3	1
CO5	3	3	3	3	3
Total contribution of COs to PSOs	11	10	14	14	10
Weighted Percentage of COs contribution to PSOs	73.33	66.67	93.33	93.33	66.67

Course Content:

Unit-I

Typing text: Words, sentences and paragraphs-symbols not on the keyboard-comments and footnotes-Changing font Characteristics-Lines, paragraphs and pages-spaces- Boxes.

(Chapter 5, section 5.1 to 5.9, pages 61 to 115)

Unit-II

Text environments: some general rules for displayed text environments-List of environments-style and size environments-proclamations(theorem-like structures)-Proof environments-Tabular environments-Tabbing environments-Miscellaneous displayed text environments.

(Chapter 6, section 6.1 to 6.8, pages 117 to 149)

Unit-III

Typing math: Math environments-spacing rules-equations--spacing rules-equations-Basic constructs-Arithmetic operations-Delimiters-Operators-Math accents-Stretchable horizontal lines-formula gallery.

(Chapter 7, section 7.1 to 7.9, pages 151 to 186)

Unit-IV

More math: Spacing of symbols building new symbols-math alphabets and symbols-vertical spacing-Tagging and grouping-Generalized fractions-Boxed formulas.

(Chapter 8, section 8.1 to 8.6, pages 187 to 206)

Unit-V

Latex documents: The structure of a document-The preamble-Abstract-Sectioning-Cross referencing-Bibliographies.

(Chapter 10, section 10.1 to 10.6, pages 245 to 270)

Text Book:

- ❖ George Gratzer, More Math into LaTeX, 4th edition, Springer, 2007.

Books for Reference:

- Helmut Kopka and Patric W. Daly, A guide to LaTeX, Fourth edition, Addison-Wesley.
- David R. Wilkins, Getting started with LaTeX, Second Edition.

Practical:

Typing texts and Tables: Chapter 4.1- Inserting Figures Chapter 5.1-Mathematical Equations: Chapter 6.3- Inserting references: Chapter 7.6-Preparing an article for mathematical journal.

Semester-VI
Core-IX
COMPLEX ANALYSIS

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-IX		Complex Analysis	75	-	-	4

Contact hours per semester:75

Contact hours per week:5

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To understand the concepts of complex variables and to learn about elementary transformations in complex variables.

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

CO No.	Course Outcome	Knowledge Level
CO1	Explain analytic functions and determine the functions of a complex variables and to utilize Cauchy Reimann equations	K2, K3
CO2	Elaborate Bilinear Transformations and classify the elementary transformations. Also to find fixed points.	K4, K5
CO3	Illustrate complex integrations and to make use of Cauchy's Integral Formula	K1, K6
CO4	Explain Series Expansions and to determine Taylor's Series, Laurent's Series. Determine zeros of an analytic function.	K2, K6
CO5	Determine residues and to make use of Cauchy's Residue Theorem. Also to evaluate definite integrals	K4, K5

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					

CO1	3	3	3	3	3
CO2	2	2	2	3	1
CO3	3	3	3	3	2
CO4	1	2	2	2	2
CO5	1	2	1	1	3
Total contribution of COs to PSOs	10	12	11	12	11
Weighted Percentage of COs contribution to PSOs	66.67	80	73.33	80	73.33

Course Content

UNIT–1: Analytic functions - Functions of a complex variable, Limits, theorems on limit, continuous function, Differentiability, The Cauchy-Riemann equations, Analytic functions, Harmonic functions.

UNIT–2: Bilinear Transformations – Elementary Transformations, Cross Ratio, Fixed Points of Bilinear Transformations, Some Special Bilinear Transformations.

UNIT–3: Complex Integration – Definite Integral, Cauchy’s Theorem, Cauchy’s Integral Formula, Higher Derivatives.

UNIT–4: Series Expansions – Taylor’s Series, Laurent’s Series, Zeros of an Analytic Function, Singularities.

UNIT–5: Calculus of Residues– Residues, Cauchy’s Residue Theorem, Evaluation of Definite Integrals.

TextBook:

- ❖ Arumugam.S and T. Issac–“Complex Analysis”–Scitech Publishing House–Chennai,(2002).

Books for Reference:

- Churchill.R. V. and J. W. Brown–“Complex variables and Applications”–McGraw Hill International Editions–IX Edition, 2013.
- Ponnuswamy.S “Foundations of Complex Analysis”, Narosa Publication House, New Delhi, II Edition 2005.
- Duraipandian.P and Lakshmi Duraipandian–“Complex Analysis”–Emerald Publications, Chennai(2001).

Semester-VI
Core-X
GRAPH THEORY

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-X		Graph Theory	75	0	-	4

Contact hours per semester:75

Contact hours per week:5

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To introduce the notion of graph theory and its applications and to learn the techniques in Graph Theory.

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

CO No.	Course Outcome	Knowledge Level
CO1	Construct graph and to explain its definition. Determine degrees. Also to perform operations on graph	K2,K3
CO2	Classify degree sequence and graphic sequence. Illustrate connectedness, compactness and connectivity.	K4,K5
CO3	Construct Eulerian Graphs and Hamiltonian graphs. Elaborate the characterizations of trees and to find centre of a tree.	K1,K6
CO4	Interpret Planar graphs and to determine chromatic numbers and chromatic index.	K2, K6
CO5	Explain Chromatic Polynomials and the properties of digraphs.	K4

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					

CO1	3	3	3	3	3
CO2	2	2	3	3	1
CO3	1	3	2	3	2
CO4	2	2	1	1	2
CO5	1	2	1	1	3
Total contribution of Cos to PSOs	9	12	10	11	11
Weighted Percentage of COs contribution to PSOs	60	80	66.67	73.33	73.33

Course Content

UNIT-1:

Definition and examples of graphs –degrees- subgraphs–isomorphism–independent sets and coverings–matrices–operations of graphs.

UNIT-2:

Degree sequences–graphic sequences– walks–trails and paths –connectedness and components–connectivity.

UNIT-3:

Eulerian graphs–Hamiltonian graphs, Trees and its characterization–centre of a tree.

UNIT-4:

Planar graphs-Definition and properties–chromatic number and chromatic index.

UNIT-5:

Chromatic polynomials, definition and basic properties of digraphs, paths and connectedness in digraphs.

Text Book:

- ❖ Arumugam.S&S.Ramachandran–Invitation to Graph Theory, Scitech Publications, Chennai, 2002.

Books for reference:

- Kumaravelu.S and Susheela Kumaravelu –Graph theory-Nagercoil, 2002.
- Narasingh Deo–Graph theory with application to engineering and computer science, Prentice–Hall of India Pvt.Ltd., New Delhi, 1979.

Semester-VI
Core-XI
NUMBER THEORY

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-XI		Number Theory	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective:To highlight the beauties in the world of numbers and to prepare the students for coding through congruence.

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

CO No.	Course Outcome	Knowledge Level
CO1	Explain Peano's theorem and to utilize mathematical induction.Also to make use of binomial theorem	K1,K5
CO2	Illustrate Division Algorithm .Determine GCD .To deduce the Diaphantine equation $ax+by=c$	K3,K5
CO3	Intrepret the fundamental theorem of arithmetic.Explain The Sieve of Eratosthenes and to use Goldbach Conjecture.	K2,K6
CO4	Summarize the basic properties of congruences and to apply Chinese Remainder Theorem	K2, K4
CO5	Elaborate Fermat's Theorem, Wilson's Theorem and to apply Kraitchik Factorization Method.	K6

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
COs					
CO1	3	3	3	3	3
CO2	2	2	3	3	1
CO3	1	3	2	3	2

CO4	2	2	1	1	2
CO5	1	2	1	1	3
Total contribution of COs to PSOs	9	12	10	11	11
Weighted Percentage of COs contribution to PSOs	60	80	66.67	73.33	73.33

Course Content

UNIT-1:

Peano's Axioms–Mathematical induction–The Binomial Theorem–Early Number Theory.

UNIT-2:

Division Algorithm–GCD–Euclidean Algorithm–The Diophantine Equation $ax+by=c$.

UNIT-3:

The fundamental Theorem of Arithmetic – The Sieve of Eratosthenes– The Goldbach conjecture.

UNIT-4:

Basic properties of congruences–Linear congruence and The Chinese Remainder Theorem.

UNIT-5:

Fermat's Theorem–Wilson's Theorem–The Fermat–Kraitchik Factorization Method.

Text Book:

- ❖ David.M.Burton –Elementary Number Theory-Tata McGraw Hill Education Pvt. Ltd- (Sixth Edition)-2007.

Books for Reference:

- Ivan Niven and H. Zuckerman-An Introduction to Theory of Numbers, Cambridge University Press-2019.
- Kumaravelu.S, and Susheela Kumaravelu-Elements of Number Theory Nagercoil, 2002.

Semester-VI
Core-XII
DYNAMICS

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-XII		Dynamics	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To provide a basic knowledge of the behaviour of objects in motion and to develop a working knowledge to handle practical problems.

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

CO No.	Course Outcome	Knowledge Level
CO1	Illustrate projectiles and to find the equation of path, range and maximum height and time of flight.	K2, K3
CO2	Elaborate about the collision of elastic bodies. Interpret law of impact and classify direct and oblique impact.	K1, K4
CO3	Determine simple harmonic motion in a straight line. Summarize the composition of SHM of the same period in the same line and along two perpendicular directions.	K2, K6
CO4	Interpret motion under the action of central forces. Derive velocity and acceleration in polar coordinates.	K5, K6
CO5	Obtain the differential equation of central orbit. Also to deduce the pedal equation of central orbit.	K3, K6

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					

CO1	3	3	3	3	3
CO2	2	2	3	3	2
CO3	3	3	2	3	2
CO4	2	2	3	1	2
CO5	2	2	2	1	3
Total contribution of COs to PSOs	12	12	13	11	12
Weighted Percentage of COs contribution to PSOs	80	80	93.33	73.33	80

Course Content

UNIT-1:

Projectiles–Equation of path–range–maximum height–time offlight.

UNIT-2:

Collision of elastic bodies–Laws of impact–direct and oblique impact.

UNIT-3:

Simple Harmonic Motion (SHM) in a straight line-Geometrical representation–composition of SHM of the same period in the same line and along two perpendicular directions.

UNIT-4:

Motion under the action of central forces– velocity and acceleration in polar co-ordinates.

UNIT-5:

Differential Equation of central orbit-pedal equation of central orbit–problems to find the law of force towards the pole when the orbit is given.

TextBook:

- ❖ Venkatraman, M.K.-A TextBook on Dynamics, Agasthiar Publication, Trichy,2020.

Books for Reference:

- Narayanan, S-Dynamics,S.Chand& company(New Delhi),16thEdition,1986.
- Duraipandian.P, LaxmiDuraipandian and MuthamizhJayapragasam-Mechanics S.Chand& Company (2003).
- I.Rajeswari–Dynamics – Saras Publication, Nagercoil, I edition (2019).

**Semester-VI
Core-XIII
NUMERICAL METHODS**

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-XIII		Complex Analysis	75	-	-	4

Contact hours per semester:75

Contact hours per week:5

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To introduce finite differences and to solve numerical problems by different methods.

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

CO No.	Course Outcome	Knowledge Level
CO1	Obtain solution for numerical algebraic and Transcendental equations by making use of various methods.	K1,K3,K4
CO2	Find finite difference for first and higher order differences. To classify forward and backward differences.	K2,K6
CO3	To apply interpolation formula in Newton's Forward and backward, Guass Forward and backward formula.	K5,K6
CO4	Make use of numerical differentiation and integration in Newton's forward & backward differences for differentiation. Also to utilize Trapezoidal rule and Simpson's 1/3 and 3/8 rule.	K3,K4
CO5	Solve Difference equations and to determine the order and degree of difference equation. Solve linear difference equation and	K1,K6

	find complementary function and to deduce particular Integral of the function.	
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K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs \ COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	3	3
CO2	2	2	3	3	1
CO3	2	3	2	3	2
CO4	2	2	2	3	2
CO5	1	2	2	2	3
Total contribution of COs to PSOs	9	12	12	14	11
Weighted Percentage of COs contribution to PSOs	73.33	80	80	93.33	73.33

Course Content

UNIT-1:

Solution of Numerical algebraic and Transcendental Equations : Bisection method– Newton’s method. Criterion of order of convergence of Newton’s method. Regula Falsi method – Gauss elimination– Gauss Jacobi– Gauss Seidel method.

UNIT-2:

Finite Difference: First and higher order differences – Forward and backward differences – Properties of Operator – Differences of a polynomial– Factorial Polynomial.

UNIT-3:

Interpolation: Newton’s Forward–backward, Gauss forward–backward interpolation formula– Bessel’s formula. Divided differences – Newton’s divided difference formula – Lagrange’s interpolation formula.

UNIT -4:

Numerical Differentiation and integration : Newton’s forward and backward differences for differentiation- Derivatives using Bessel’s formula- Trapezoidal rule- Simpson’s 1/3 rule & 3/8 rule.

UNIT-5:

Difference equations: Definitions-order and degree of difference equation- Linear difference equation- finding complementary function-particular integral-simple applications.

Text Book:

- ❖ Venkatraman.M.K-Numerical methods in Science and Engineering National Publishing Company- Edition 1998.

Books for Reference:

- Kandasamy.P.K.Thilagavathy and K.Gunavathy, Numerical Methods, S.Chand & Company Ltd.Edn.2006.
- Autar Kaw and Egwwn Enc Kalu– Numerical methods with Application A bidet. Autokaw.com 2nd Edition, 2011.
- Dr.A.Singaravelu, Statistics & Numerical Methods, Meenakshi Agency (2012).

Semester-VI

Major Elective- III
ASTRONOMY

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Major Elective- III		Astronomy	60	-	-	4

Contact hours per semester: 60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To introduce the exciting world of Astronomy to students and to understand the movements of the celestial sphere.

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

CO No.	Course Outcome	Knowledge Level
CO1	Explain Spherical Trigonometry .Also to elaborate the fundamental of spherical trigonometry, the sine, the cosine, four parts and Napier's formula.	K3,K5
CO2	Imagine the celestial sphere, Illustrate about the rising and setting of a star. Identify and Classify circumpolar stars and morning, evening stars.	K1,K4
CO3	Imagine Earth and to explain refraction. Deduce Tangent formula and Cassini's formula.	K2,K6
CO4	Illustrate Geocentric parallax and Heliocentric parallax	K3,K5
CO5	Elaborate Kepler's laws. Also to classify True anomaly, mean anomaly and eccentric anomaly and to obtain the relationship between them.	K6

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	2	3	3	3	3
CO2	2	2	3	3	1
CO3	2	3	2	3	2
CO4	2	2	2	3	2
CO5	2	1	2	2	3
Total contribution of COs to PSOs	10	11	12	14	11
Weighted Percentage of COs contribution to PSOs	66.67	73.33	80	93.33	73.33

Course Content

UNIT-1:

Spherical Trigonometry: Spherical triangle – The fundamental formulae of Spherical trigonometry, the sine, cosine, four parts and Napier formula (without proof) and simple problems.

UNIT-2:

The Celestial Sphere: Celestial co-ordinates – Diurnal motion – Rising and setting of a star sidereal time – circumpolar stars – Morning and evening stars – Twilight.

UNIT-3:

Earth – length of a day – Refraction – Tangent formula – Cassini's formula – Effects of refraction.

UNIT-4:

Geocentric parallax – Effects – Heliocentric parallax – Effects.

UNIT-5:

Kepler's laws – verification of Kepler's laws – True anomaly, mean anomaly, Eccentric anomaly – Relation between them.

Text Book:

- ❖ Kumaravelu. Sand Susheela Kumaravelu – Astronomy for degree classes, Rainbow Printers, Nagercoil (2005).

Book for Reference:

- Ramachandran. G. V – Astronomy, Mission Press, Palayamkottai, 1965.

Semester-VI

**Major Elective- III
FUZZY MATHEMATICS**

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Major Elective -III		Fuzzy Mathematics	60	-	-	4

Contact hours per semester:60

Contact hours per week :4

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To introduce fuzzy concepts to students and to facilitate the student to study fuzzy operations and fuzzy numbers

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

CO No.	Course Outcome	Knowledge Level
CO1	Explain Crisp sets and fuzzy sets and illustrate the characteristics and significance of Paradigm Shift.	K1,K2
CO2	Elaborate the Additional properties of α cuts and the extension principle for fuzzy sets.	K1,K4
CO3	Perform fuzzy set operations. Also to determine fuzzy complements, fuzzy intersections and fuzzy unions.	K5,K6
CO4	Determine fuzzy numbers and Linguistic variables. Apply arithmetic operations on intervals and on fuzzy numbers. Construct lattice of fuzzy numbers.	K2,K3,K4
CO5	Analyze and classify fuzzy decision making, individual decision making, Multi person decision making problems.	K5,K6

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	2	3	3	3	3
CO2	2	1	3	3	1
CO3	2	1	2	3	2
CO4	1	2	2	3	2
CO5	2	2	1	2	3
Total contribution of COs to PSOs	9	9	11	14	11
Weighted Percentage of COs contribution to PSOs	60	60	73.33	93.33	73.33

Course Content

UNIT-1:

Crisp Sets–Fuzzy Sets–Basic Types–Basic Concepts–Characteristics and Significance of Paradigm Shift.

UNIT-2:

Additional properties of α -cuts– representations of fuzzy sets– Extension principle for fuzzy sets.

UNIT-3:

Fuzzy set operations–Fuzzy complements–Fuzzy intersections:t-norms–Fuzzy Unions:t-conorms –Combinations of operations.

UNIT-4:

Fuzzy numbers – linguistic variables-arithmetic operations on intervals-arithmetic operations on fuzzy numbers-Lattice of fuzzy numbers-Fuzzy Equations.

UNIT-5:

Fuzzy decision making – Individual Decision Making-Multi-person decision making-fuzzy linear programming.

Text Book:

- ❖ George J. Klir and Bo Bo Yuan–
Fuzzy sets and Fuzzy Logic Theory Applications, Prentice Hall of India, 2002, New Delhi.

Book for Reference:

- George J. Klir and Tina A. Folger–Fuzzy sets, uncertainty and Information – Prentice Hall of India, 2003, New Delhi.

Semester-VI
Major Elective- III
MATHEMATICAL MODELLING

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Major Elective -III		Mathematical Modelling	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To study the mathematical models through ODE and difference equations.

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

CO No.	Course Outcome	Knowledge Level
CO1	Illustrate mathematical modelling through ODE. Classify and elaborate linear growth, non-linear and growth decay problems, Compartment models, Dynamic problems and geometrical problems.	K1, k2
CO2	Explain population dynamics, Epidemics. Analyze the compartment models in economics, medicines, arms race bullets and international trade.	K2, K3, K5
CO3	Explain mathematical modelling problem through second order ODE.	K5, K6
CO4	Illustrate mathematical modelling through difference equation.	K2, K6
CO5	Explain mathematical modelling through graphs.	K3, K6

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
COs					
CO1	2	3	3	3	3
CO2	2	1	3	3	1
CO3	2	1	2	3	2
CO4	2	2	2	3	1
CO5	2	2	1	1	3
Total contribution of COs to PSOs	10	9	11	13	10
Weighted Percentage of COs contribution to PSOs	66.67	60	73.33	86.67	66.67

Course Content

UNIT-1:

(Mathematical modeling through O.D.E(First order)): Linear growth and Decay models –Non –linear growth and Decay models – Compartment Models –Dynamics Problems–Geometrical Problems.

UNIT-2:

Population dynamics – Epidemics – Compartment Models – Economics, Medicine, Arms race, Battles and International Trade.

UNIT-3:

(Mathematical Modelling through O.D.E. (Second order)): Planetary motion – circular motion – Motion of satellites – Modelling through linear difference equations of second order.

UNIT-4:

(Mathematical Modelling through difference equations): Basic theory of difference equation with constant coefficients – Economics and Finance – Population dynamics and genetics – Probability theory.

UNIT-5: (Modelling through graphs): Solutions that can be modeled through graphs – models in terms of directed graphs, signed graphs, weighted digraphs and unoriented graphs.

Text Book:

- ❖ Kapur, J.N – Treatment as in “Mathematical Modelling” New Age International Publishers, 2004.

Books for Reference:

- Kapur, J.N – Mathematical Modelling in Biology and Medicine – East West Press – 1985.
- Singh – Mathematical Modelling, International Bookhouse – 2003.
- Frank R. Giordano, Maurice D. Weir and William P. Fox, - A first course in mathematical modelling, Thomson Learning, London and New York, 2003.
- Kapur, J.N, Mathematic modeling, New Age International Pvt., Ltd., Reprint (2007).

Semester-VI
Major Elective- IV
OPERATIONS RESEARCH-II

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Major Elective -III		Operations Research	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To introduce games and strategies. Also to understand networking problems.

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

CO No.	Course Outcome	Knowledge Level
CO1	Interpret the games and strategies. Solve two persons zero sum games. Make use of mixed strategies and dominance property.	K2,K3
CO2	Analyze the replacement of items that deteriorate with time. Illustrate replace montage of a machine taking money value into consideration and elaborate the replacement of items that completely fail suddenly and Staffing problems.	K1,K5
CO3	Explain the queueing models and to classify into (M/M/1:FCFS),(M/M/1:∞/FCFS),(M/M/S:/FCFS)	K4,K6
CO4	Compose network scheduling using PERT/CPM. Explain the rules of network construction. Make use of PERT calculation.	K2,K3
CO5	Analyse and solve inventory control problems.	K5,K6

➤ K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
COs					
CO1	2	3	3	2	3
CO2	2	1	3	2	1
CO3	2	1	2	2	2
CO4	2	2	2	2	1
CO5	1	2	1	1	3
Total contribution of COs to PSOs	9	9	11	9	10
Weighted Percentage of COs contribution to PSOs	60	60	73.33	60	66.67

UNIT-1:

Games and Strategies: Two Person Zero sum Games – The Maximin – Minimax Principle – Games without Saddle Points – Mixed Strategies – Graphical Solution of $2 \times n$ and $m \times 2$ games – Dominance Property.

UNIT-2:

Replacement of items that deteriorate with time – replace montage of a machine taking money value into consideration – replacement of items that completely fail suddenly and Staffing Problems.

UNIT-3:

Queueing models: General concept and definitions – characteristics – properties of Poisson process Models ($M/M/1:FCFS$), ($M/M/1:\infty/FCFS$), ($M/M/S:FCFS$).

UNIT-4:

Networks Scheduling by PERT/CPM: Network and basic components – Rules of Network Construction – Time Calculation in network – Critical Path Method – PERT Calculation.

UNIT-V:

Inventory Control : Introduction – Types of Inventories – Inventory decisions – Deterministic inventory Problem – EOQ problems without shortages.

Text Book:

- ❖ Kanti Swarup, P.K. Gupta and Manmohan – Operations Research – Sultan Chand & Sons – 2006, 12th Edition.

Books for Reference:

- Gupta, P.K. and D.S. Hira – Operations Research – S. Chand & Sons – VII Edition.
- B.J. Ranganath and A.S. Srikantappa – Operations Research, Yes Dee Publishing House, Chennai (2017).
- Hillier, F.S. and G.J. Lieberman – Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore, 2009.
- Hamdy A. Taha, -Operations Research, An Introduction, 8th Ed., Prentice-Hall India, 2006.
- Hadley, G. - Linear Programming, Narosa Publishing House, New Delhi, 2002.

Semester-VI
Major Elective- IV
CODING THEORY

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Major Elective -IV		Coding Theory	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To introduce coding and decoding concepts. Also to develop the students in the field of coding theory

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

CO No.	Course Outcome	Knowledge Level
CO1	Analyze and illustrate basic assumptions and correcting, detecting error patterns. Also to interpret effects of error correction and detection.	K3, K4
CO2	Elaborate linear codes and illustrate the bases for C and C ⁺ generating matrices on coding	K1, K2
CO3	Illustrate parity check matrices and determine the equivalent codes	K3, K5
CO4	Explain some bounds for codes and classify perfect codes, hamming codes, extended codes, the extended Golay code and decode them.	K4, K6
CO5	Summarize about polynomials and words, cyclic codes. Make use of polynomial encoding and decoding	K6

➤ K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	1	3	3	2	3
CO2	2	1	3	2	1
CO3	2	1	2	2	2
CO4	2	2	3	2	1
CO5	3	2	3	2	3
Total contribution of COs to PSOs	10	9	14	10	10
Weighted Percentage of COs contribution to PSOs	66.67	60	93.33	66.67	66.67

Course Content:

UNIT -1:

Introduction to coding theory, Basic assumptions, Correcting and detecting error patterns – information rate – effects of error correction and detection – finding the most likely code word transmitted.

UNIT-2:

Linear codes – subspaces independence – basis, dimension – matrices – Bases for C and C^+ generating matrices on coding.

UNIT-3:

Parity check matrices – equivalent codes – distance of a linear code – Linear codes – cosets – MLD for linear codes – Reliability of MLD for linear codes.

UNIT-4:

Some bounds for codes – perfect codes – hamming codes – extended codes – The extended Golay code – decoding the extended Golay code – Golay code.

UNIT-5:

Polynomial and words – introduction to cyclic codes – Polynomial encoding and decoding – finding cyclic codes – Dual cyclic codes.

Text Book:

- ❖ Coding theory, The essentials – Marcel Dekker, Inc. Madison Avenue, New York.

Books for Reference:

- Elwyn Berlekamp – Algebraic Coding Theory – Springer-1970
- San Ling and Chaoping Xing, coding theory A first course, Cambridge University Press, New York (2004)

Semester-VI
Major Elective- IV
PROGRAMMING IN C++

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Major Elective -IV		Programming in C++	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To introduce coding and decoding concepts. Also to develop the students in the field of coding theory

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

CO No.	Course Outcome	Knowledge Level
CO1	Illustrate and make use of the concepts of tokens, expressions and control structures	K3,K4
CO2	Utilize the functions in C++ and to apply it while writing programs	K1,K2
CO3	Interpret constructors and destructors	K3,K5
CO4	Explain and apply operator overloading while writing programs	K4,K6
CO5	Make use of inheritance and classes to compile a program	K6

➤ K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
COs					
CO1	1	3	3	2	3
CO2	2	1	3	2	1
CO3	2	2	2	2	2
CO4	2	3	3	2	3
CO5	2	3	3	2	3
Total contribution of COs to PSOs	9	12	14	10	12
Weighted Percentage of COs contribution to PSOs	60	80	93.33	66.67	80

Course Content:

Unit-I: Tokens, Expressions and control structures

Introduction, Tokens, Keywords, Identifiers and constants, Basic data types, User defined data types, storage classes, Derived data types, Symbolic constants.

UNIT-II: Functions in C++

Introduction ,The main function, function prototyping, Call by reference, Return by references, Inline functions, Default arguments, constant Arguments, Recursion, Function overloading, Friend and virtual functions, Math library functions, C structures Revisited, Specifying a class, Defining member functions, A C++ program with class, Making an outside functions inline, Nesting member functions, Private member functions, Arrays within a class, Memory allocation for objects, Static member functions, Array of objects, objects as function arguments, Friend functions, Returning objects.

UNIT-III: Constructors and Destructors

Introduction, Constructors, Parameterized constructors, Multiple constructors in a class, Constructors with default arguments, Dynamic initialization of objects, Copy constructor, , Constructing Two-dimensional arrays, constant objects, Destructors.

UNIT-IV: Operator Overloading and Type Conversations

Introduction, Defining operator overloading, Overloading unary operator, Overloading Binary operator, Overloading Binary operators using Friends, Manipulation of strings using operators, Some other operator overloading examples, Rules for Overloading Operators

UNIT-V: Inheritance: Extending Classes

Introduction, Defining Derived classes, Single inheritance, Making a private member inheritable, Multilevel inheritance, Multiple inheritance, Hierarchical inheritance, Hybrid inheritance.

Text Book:

- ❖ E. Balaguru Samy, Object Oriented Programming with C++, Tata McGraw Hill Education Private Limited, New Delhi (Fifth Print 2012).

Book for References :

- Reema Thareja, Object Oriented Programming with C++, Oxford University Press (January 2018)