

Don Bosco College of Arts and Science,
Keela Eral



Department of mathematics

Syllabus-2021-2022 onwards

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					

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
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 of Cayley 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. Ramana –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”–McGrawHill 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 False 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)

II B. COM BANKING AND E-COMMERCE (IV SEMESTER) – UNDER CBCS

PART III – MAJOR CORE - 7

QUANTITATIVE TECHNIQUES

Objectives

1. To provide basic knowledge of mathematical techniques as are applicable to business.
2. To provide logical idea to find out practical solutions for the managerial problems.
3. To provide the basic knowledge of statistical techniques as are applicable to business.
4. To enable the students to apply statistical techniques for quantification of data in business.

Unit I:

Analytical geometry- Distance between two points in a plane-slope of a straight line – equation of straight line – point of intersection of two lines – applications (1) demand and supply (2) cost-output (3) break-even analysis

Unit II:

Matrices – meaning – types – algebra of matrices – addition and subtraction – scalar multiplication – Multiplication of matrices-transpose of a matrix –Determinant – minors and co-factors –inverse of a matrix – solving simultaneous linear equations using matrix method.

Unit III:

Measures of Central Tendency – Mean – Median – Mode – Geometric Mean .Measures of Dispersion-Range – Quartile Deviation – Mean Deviation - Standard Deviation – Co-efficient of Variation. Skewness - methods of studying Skewness - Karl Pearson's Co-efficient of Skewness – Bowley's co-efficient of Skewness.

Unit IV:

Correlation – meaning – types-scatter diagram – Karl Pearson's Co-efficient of Correlation- Rank correlation – Concurrent deviation method. Regression analysis – uses- Regression line – Regression equations – least square method - deviations taken from actual mean and assumed mean method.

Unit V:

Index numbers – meaning – types – its problems – Methods of constructing index numbers – unweighted and weighted indices – Index number tests – Consumer price index numbers - Analysis of time series – Meaning – Importance – Components of time series – Secular trend, seasonal, cyclical and irregular variations – Measurement of trend - Graphic method-Semi average method – Moving average method – Method of least square.

Text / Reference Books

1. D.S. Sancheti & V.K. Kapoor, Business Mathematics Sultan Chand and Sons, New Delhi.
2. M. Manoharan & C. Elango, Business Mathematics, Palani Paramount Publications, Palani.
3. Dr. S.P. Gupta, Statistical Method, Sultan Chand & Sons, New Delhi.
4. R.S.N. Pillai & Bhagavathi, Statistics-Theory and Practice, S.S. Chand & Co.
5. M. Wilson, Business Statistics, Himalaya Publishing House, Mumbai.
6. Dr. M. Manoharan, Statistical Methods, Palani Paramount Publications, Palani.
7. G.K. Ranganath, Text book of Business Mathematics, Himalaya Publishing House, Delhi.
8. D.C. Sanchetti & B.M. Agarwal, Business Mathematics, Sultan Chand and Sons, New Delhi.

Outcomes:

1. To analyse the practical applications of Analytical Geometry in business field.
2. To know about matrix algebra, scalar multiplication and also to find out the inverse of a matrix.
3. To know the measures of central tendency and to apply to measure averages.
4. To apply the tools on measures of dispersion that are useful for estimating variations.
5. To apply the various methods for calculating correlation coefficient.
6. To apply regression analysis for estimating values for future period.
7. To understand the concepts about indices and time series.

L	T	P	C
4	2	0	4

Course Objectives:

1. To develop mathematical continuity for learning.
2. To apply mathematical concepts in finding solutions to business problems.
3. To familiarize students with the application of mathematical techniques in business decision process.

Course Outcomes:

1. Apply the concept of geometry in the field of business
2. Draw and use Venn diagrams to solve real problems in business.
3. Use derivatives in marginal analysis
4. Application of differential calculus to find the maxima and minima of a function.
5. Perform elementary matrix operation and use matrices in business decision making.

Unit I

Analytical geometry – distance between two points in a plane – slope of a straight line – equation of the straight line – point of intersection – demand and supply curves (linear) – market equilibrium – break even analysis.

Unit II

Set theory – definition – types – union, intersection, difference, and complement of sets – De Morgan’s Law – Venn diagram – simple set applications – Cartesian product

Unit III

Differential calculus – derivative of a function – differentiation – standard forms – sum, product, quotient rule – differential coefficients of simple functions (**trigonometric functions excluded**) – function of a function rule – simple application to business using marginal concept

Unit IV

Higher order derivatives – maxima and minima – simple marketing models using profit maximization, fencing and container problems only – Integral calculus – standard forms – rules of integration – Definite integral – simple applications – finding total and average cost function – producer surplus and consumer surplus.

Unit V

Matrices – definition – types – addition, subtraction, multiplication of matrices – inverse matrix – solving a system of simultaneous linear equations using matrix inversion technique – rank of a matrix.

(Marks: Theory 40% and Problems 60%)

TEXTBOOKS:

1. V.Sundaresan and S.D.Jeyaseelan, Business Mathematics, S Chand Publishers, New delhi
2. P.R Vittal , Business mathematics & Statistics , Margham publications, Chennai.
3. M. Wilson, Business Mathematics, Himalaya Publising house, Mumbai
4. S.R.Arora& Dinesh Khattar , Business Mathematics with applications, S.Chand& company ltd, New Delhi

REFERENCE BOOKS:

1. R.S,Soni Essentials of Business Mathematics &Business Statistics,Ane Books pvt ltd, New Delhi.
2. D.C Sancheti& V.K Kapoor Business Mathematics, Sultan Chand &Sons,New Delhi.
3. S.P. Gupta & P.K. Gupta, Business Statistics & Business Mathematics,Sultan Chand & sons ,New Delhi,
4. D.Bose, An Introduction to Mathematical Methods, Himalaya Publishing

WEB RESOURCES:

1. <https://www.toppr.com/guides/maths/sets/venn-diagrams/>
2. <https://www.scribd.com/doc/19613606/Applications-of-Matrices-to-Business-andEconomics>
3. <https://www.pearsonhighered.com/assets/samplechapter/0/1/3/4/0134437764.pdf>
4. <http://math.hawaii.edu/~mchyba/documents/syllabus/Math499/extracredit.pdf>

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO &PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	M	L	L	M	S	M	L	M	L
CO 2	M	S	L	S	M	S	M	M	L	L
CO 3	S	M	M	L	S	S	S	M	M	L
CO 4	S	M	L	L	M	S	S	L	M	L
CO 5	S	M	M	L	L	S	M	M	L	L

S – Strong

M – Medium

L- Low

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
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 of Cayley 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)

L	T	P	C
4	2	0	4

Course Objectives:

To enable students to

1. Understand the concepts of statistics in the context of business.
2. Apply the statistical tools in decision-making.
3. Utilize statistical analysis in Research

Course Outcomes:

1. Apply descriptive statistics in effective business decision making
2. Ascertain cause and effect relationship between business factors and predict direction of business
3. Analyse time series data to identify trend and seasonal variations to forecast and take business decisions
4. Construct and compare index numbers to analyse business and economic activities
5. Utilize statistical analysis in business projects to arrive at solutions

UNIT I MEASURE OF CENTRAL TENDENCY

Measures of Central value- characteristics of an ideal measure- Measures of Central tendency –mean, median, mode – Application in Business decisions – Measures of Dispersion – absolute and relative measures of dispersion – Range, Quartile Deviation, Mean Deviation, Standard Deviation, Co-efficient of Variation – Moments, Skewness, Kurtosis - (Conceptual framework only)

UNIT II CORRELATION ANALYSIS

Correlation analysis: Meaning and Significance – Correlation and Causation, Types of Correlation, Methods of studying Simple Correlation – Scatter diagram, Karl Pearson's Coefficient of Correlation, Spearman's Rank Correlation co-efficient.

UNIT III REGRESSION ANALYSIS

Regression Analysis – Regression Vs Correlation, Linear Regression, Regression lines, Standard error of estimates.

UNIT IV TIME SERIES ANALYSIS

Time Series-Meaning and significance – utility, components of Time series- Measurement of Trend: Method of least squares, Parabolic Trend and Logarithmic trend.

UNIT V INDEX NUMBERS

Meaning and significance, problems in construction of index numbers, methods of constructing index numbers – weighted and unweighted, test of adequacy of index numbers, chain index numbers, base shifting, splicing and deflating index numbers

(Marks: Theory 40% and Problems 60%)

TEXTBOOKS:

1. S.P.Gupta, Statistical Methods, Sultan Chand & Sons, New Delhi.
2. N.Arora,S.Arora; Statistics for Management; S.Chand and Company Ltd.; New Delhi
3. R.S.N. Pillai and Bhagavatyhi, Statistical Methods, S.Chand and Company Ltd.; New Delhi
4. Wilson, Statistics for Commerce and Management, Himalaya Publishing house, Mumbai

REFERENCE BOOKS:

1. P.R.Vittal, Business Mathematics and Statistics, Margham publications, Chennai.
2. J.K.Sharma, Business Statistics, Pearson education, New Delhi,
3. Richard.I.Levin, David.S.Rubin; Statistics for Management; Pearson Education; New Delhi
4. Divya Saxena; Business Statistics; Vayu Education of India; New

WEB RESOURCES:

1. <https://statisticsbyjim.com/basics/measures-central-tendency-mean-median-mode/>
2. <https://www.toppr.com/guides/business-mathematics-and-statistics/measures-ofcentral-tendency-and-dispersion/measure-of-dispersion/>
3. <https://www.toppr.com/guides/business-mathematics-and-statistics/measures-ofcentral-tendency-and-dispersion/measure-of-dispersion/>
4. <https://sol.du.ac.in/mod/book/view.php?id=1317&chapterid=1071>

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	M	L	L	M	S	M	L	M	L
CO 2	M	S	L	S	M	S	M	M	L	L
CO 3	S	M	M	L	S	S	S	M	M	L
CO 4	S	M	L	L	M	S	S	L	M	L
CO 5	S	M	M	L	L	S	M	M	L	L

S – Strong

M – Medium

L- Low