Curriculum Design

Sri G.V.G Visalakshi College for Women (Autonomous)

Affiliated to Bharathiar University

B.Sc. Mathematics

Scheme of Examination – CBCS & OBE Pattern

(For the students admitted from the academic year 2021-2022 onwards)

Sem	Course Code	Course Title	Ins. Hrs/ Week	Examination				Credits
				Dur. Hrs	CIA Marks	ESE Marks	Total Marks	
I	121TA1/ 121MY1/ 121HD1/ 121FR1	**Part I-** Language I	6	3	50	50	100	3
	121EN1	**Part II –** English I	6	3	50	50	100	3
		Part III						
	121M01	Core I Algebra and Calculus	5	3	50	50	100	4
	121M02	Core II Differential Equations and Laplace Transforms	5	3	50	50	100	4
	121AM1/ 121AM2	Allied I Physics I / Chemistry I	4	3	30	45	75	4
		Allied Physics Practical / Chemistry Practical	2	-	-	-	-	-
	121VEG	Part IV-Value Education Human Values and Gender Equity	2	2	50	-	50	1
II	221TA2/ 221MY2/ 221HD2/ 221FR2	**Part I-** Language II	6	3	50	50	100	3
	221EN2	**Part II -** English II	6	3	50	50	100	3
		Part III						
	221M03	Core III -Analytical Geometry of Three Dimensions	5	3	50	50	100	5
	221M04	Core IV- Operations Research with TORA	5	3	50	50	100	4
	221AM3/ 221AM4	Allied II Physics II/ Chemistry II	4	3	30	45	75	4
	221AMP/ 221AMC	Allied Physics Practical / Chemistry Practical	2	3	25	25	50	2
	221EVS	Part IV-Environmental Studies	2	2	50	-	50	1
III	321TA3/ 321MY3/ 321HD3/ 321FR3	**Part I –** Language III	6	3	50	50	100	3
	321EN3	**Part II -**English III	6	3	50	50	100	3

		Part III						
	321M05	Core V Vector Calculus and Fourier Series	3	3	50	50	100	3
	321M06	Core VI Statics	4	3	50	50	100	4
	321AM5/ 321AM6	Allied III Principles of Accountancy/ Mathematical Statistics I	6	3	50	50	100	5
	321NMC	**Part IV-** NME – Basic Mathematics for Competitive Examinations	2	2	50	-	50	2
	321MS1	**Part IV-**Skill Enhancement Course I Professional English for Mathematics	3	3	100	-	100	2
	321NGA	Part IV- General Awareness- Information security	Self Study	2	50	-	50	Grade
IV	421TA4/ 421MY4/ 421HD4/ 421FR4	**Part I –** Language IV	6	3	50	50	100	3
	421EN4	**Part II-** English IV	6	3	50	50	100	3
		Part III						
	421M07	Core VII Numerical Methods	3	3	50	50	100	3
	421M08	Core VIII Dynamics	4	3	50	50	100	4
	421AM7/ 421AM8	Allied IV Statistics for Mathematics/ Mathematical Statistics II	6	3	50	50	100	5
	421NGA	Part IV- General Awareness	2	2	50	-	50	2
	421MS2	**Part IV-** Skill Enhancement Course II Graph Theory	3	3	100	-	100	2
	421MA1/ 421MA2/ 421MA3	**Advanced Learners Course – I** Combinatorics / Statistical Quality Control/ MOOC	Self Study	3	-	100	100	4*
V	521M09	**Part III** Core IX Real Analysis I	6	3	50	50	100	5
	521M10	Core X Complex Analysis I	5	3	50	50	100	5
	521M11	Core XI Abstract Algebra	5	3	50	50	100	5
	521M12	Core XII Group Project	5	-	50	50	100	4
	521ME1/ 521ME2	Elective I: Astronomy / Elementary Number Theory	6	3	50	50	100	5
	521MS3	**Part IV -** Skill Enhancement Course III - Sequences and Series	3	3	100	-	100	2

VI	521NGO/ 521NGA	Part IV- General Awareness- Online MOOC or Swayam Courses/Life Skills	Self Study	2	50	-	50	Grade
	621M13	**Part III** Core XIII Real Analysis II	5	3	50	50	100	5
	621M14	Core XIV Complex Analysis II	5	3	50	50	100	5
	621M15	Core XV Linear Algebra	5	3	50	50	100	5
	621ME3/ 621ME4	Elective II Mathematical Cryptography/ Fuzzy and Intuitionistic Fuzzy Theory	6	3	50	50	100	5
	621PE4/ 621ME5	Elective III Computational Methods using C Programming (T & P)/ Programming with Python (T & P)	6	3	50	50	100	5
	621MS4	**Part IV-** Skill Enhancement Course IV Internship / Summer Training/Short Term Course	3	-	100	-	100	2
	621EX1/ 621EX2/ 621EX3/ 621EX4/ 621EX5	**Part V-** Extension activity NCC/NSS/YRC/RRC/ Games	-	-	50	-	50	2
	621MA4/ 621MA5/ 621MA6	**Advanced Learners Course II** Mathematics in Insurance / Introduction to Wavelet theory/MOOC	Self Study	3	-	100	100	4*
	621NGA	Part IV- General Awareness-- Professional Ethics	Self Study	2	50	-	50	Grade
						Total:	**3800**	**140**

Starred credits are treated as additional credits (Optional)

Entrepreneurship Courses

B.Sc Mathematics

Semester II

[For the students admitted from the academic year 2021 – 2022 onwards]

Course: Part III Core IV Operations Research with TORA	**Course Code: 221M04**
Semester: II	**No. of Credits: 4**
No. of hours : 75	**C:T: 65:10**
CIA Max. Marks: 50	**ESE Max. Marks:50**

(C: Contact hours, T: Tutorial)

Course Objectives:

- To gain knowledge on techniques for solving linear programming problem.
- To identify the optimum allocation of resources to respective destination.
- To assign suitable resources to respective jobs.
- To apply optimization in networks.
- To develop knowledge in basic techniques to deal with inventory

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	solve the Linear Programming Problem using graphical, simplex and duality methods	A
CO2	minimize the cost in transportation problems and assignment problems	A
ÇO3	interpret the concept of game theory	A
CO4	apply the optimization techniques in inventory control	A
CO5	demonstrate the applications of various optimization tools to the real life problems involving networks.	A

A-Apply

Syllabus:

Unit I	13 hrs
Linear Programming Problem – Graphical solution and Extension: Introduction – Graphical solution method – Some exceptional cases – General linear programming problem – Canonical and standard forms of L.P.P. Linear programming problem – Simplex method: Introduction – Fundamental properties of solutions – The computational procedure – Use of artificial variables. Chapter 3: Sections 3.1 - 3.5, Chapter 4: Sections 4.1 - 4.4 Note:Simplex method is solved using TORA	

Unit II	13 hrs
Duality in Linear Programming: Introduction – General Primal-Dual pair – Formulating a dual problem – Primal-Dual pair in matrix form – Duality and Simplex method. Transportation	

Problem: Introduction – LP formulation of the transportation problem – Existence of Solution in T.P – Duality in transportation problem – The transportation table – Loops in transportation tables – Triangular basis in a T.P – Solution of a transportation problem – Finding an initial basic feasible solution – Test for optimality – Economic Interpretation of u_j's and v_j's – Degeneracy in transportation problem – Transportation algorithm [MODI method]. Assignment Problem: Introduction – Mathematical formulation of the problem – Solution Methods of Assignment Problem.
Chapter 5: Sections 5.1 - 5.4, 5.7 Chapter 10: Sections 10.1 - 10.13, Chapter 11: Sections 11.1 - 11.3.
Note: Simplex method is solved using TORA

Unit III	13 hrs
Games and Strategies: Introduction – Two-person zero-sum games – Some basic terms – The Maximin – Minimax principle – Games without saddle points – Mixed strategies – Graphic solution of 2 x n and m x 2 games. Book 2 : Chapter 17: Sections 17.1 - 17.6	

Unit IV	13 hrs
Inventory Control – I: Introduction – Types of Inventories – Reasons for carrying Inventories – The inventory decisions – Objectives of Scientific Inventory Control – Costs associated with inventories – Factors affecting inventory control – An Inventory Control Problem – The Concept of EOQ – Deterministic inventory problems with No shortages – Deterministic inventory problems with shortages – Problems of EOQ with Price Breaks. Chapter 19: Sections 19.1 - 19.12	

Unit V	13 hrs
Network Scheduling by PERT/CPM: Introduction – Network: Basic Components – Logical Sequencing – Rules of Network Construction – Concurrent Activities – Critical path analysis – Probability considerations in PERT – Distinction between PERT and CPM. Chapter 25: Sections 25.1 - 25.8	

Book for study:

Unit	Name of the Book	Authors	Publisher
I – V	Operations Research	Kanti Swarup, P.K Gupta, Man Mohan	Sultan Chand & Sons, New Delhi, Eighteenth Edition, 2015.

Books for Reference:

S.No	Name of the Book	Authors	Publisher
1	Operations Research: Theory and Applications	J.K.Sharma	MacMillan India Ltd, Fourth Edition, 2010.
2	Operations Research: An Introduction	Hamdy A. Taha	Pearson India Pvt Ltd, 2016.

Skill Development Courses

B.Sc Mathematics

Semester I

(For the students admitted from the academic year 2021 – 2022 onwards)

Course: Part III Core I Algebra and Calculus	**Course Code: 121M01**
Semester: I	**No. of Credits: 4**
No. of hours :75	**C:T: 65:10**
CIA Max. Marks: 50	**ESE Max. Marks: 50**

(C: Contact hours, T:Tutorial)

Course Objectives:

- To impart knowledge about the convergence / divergence criteria of a given series.
- To appropriately use the Binomial, Exponential and Logarithmic series and to represent an infinite series in a closed form as the sum of infinite series.
- To develop skills for solving the algebraic equations.
- To expose the various properties of curvature of curves
- To provide a knowledge of various forms of integrals and their applications.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	test the convergency and divergency of an infinite series.	A
CO2	apply binomial, exponential and logarithmic series to determine the sum of an infinite series.	A
CO3	transform and solve algebraic equations.	A
CO4	determine the curvature of curves in different co-ordinate systems.	A
CO5	contextually acquire skill in comprehending and applying the properties of Beta and Gamma functions.	A

A-Apply

Syllabus:

Unit I	13 hrs
Convergency and Divergency of series: Definitions and elementary results – Some general theorems concerning infinite series – Series of positive terms – Comparison tests – Cauchy's condensation test – D'Alembert's Ratio test – Cauchy's Root test. Note : Only Statement of the tests are included. Book 1: Chapter 2: Sections 8 – 17	

Unit II	13 hrs
Binomial Theorem: Application of the Binomial Theorem to the summation of series. Exponential and Logarithmic series: The Exponential Theorem (statement only) – Summation – The Logarithmic series – Modification of the Logarithmic series – Series which can be summed up by the Logarithmic series. Book 1: Chapter 3: Section 10, Chapter 4: Sections 3, 5, 6, 7 and 9	

Unit III	13 hrs
Theory of Equations: Transformation of Equations – Reciprocal Equation – To increase or decrease the roots of a given equation by a given quantity – Form of the quotient and remainder when a polynomial is divided by a binomial – Removal of terms – Descartes' Rule of signs. Book 1: Chapter 6: Sections 15 - 19, 24	

Unit IV	13 hrs
Differential Calculus: Envelopes, Curvature of plane curves: Envelopes – Method of finding the envelope – Curvature – Cartesian formula for the radius of curvature – The coordinates of the center of curvature – Evolute and involute – Radius of curvature when the curve is given in polar co-ordinates – p-r equation. Book 2: Chapter 10: Sections 1.1 - 1.4, 2.1, 2.3 - 2.8	

Unit V	13 hrs
Integral Calculus: Multiple integrals: Definition of the double integral – Evaluation of the double integral – Double integral in polar co-ordinates – Triple integrals. Beta and Gamma functions: Definitions – Convergence of $\Gamma(n)$ –Recurrence formula of Gamma functions –Properties of Beta functions – Relation between Beta and Gamma functions. Book3: Chapter 5: Sections 1, 2.1, 2.2, 3.1, 3.2, 4 (Problems in 2.2, 3.1, 3.2 and 4) Chapter 7: Sections 2.1-2.3, 3, 4, 5	

Books for study:

Unit	Name of the Book	Authors	Publisher
I – III	Algebra Volume I	T. K. Manicavachagom Pillay, T. Natarajan and K. S. Ganapathy,	S.Viswanathan (printers and publishers) Pvt., Ltd.,Eleventh Revised Edition, Reprint –2014.
IV	Calculus(Major) Volume I (Differential Calculus)	S.Narayanan and T.K. ManicavachagomPillay	S.Viswanathan (printers and publishers) Pvt., Ltd., Eighteenth Edition 2012.
V	Calculus(Major) Volume II (Integral Calculus)	S.Narayanan and T.K. ManicavachagomPillay	S.Viswanathan (printers and publishers) Pvt., Ltd., Eighteenth Revised Edition 2012.

Books for Reference:

S.No	Name of the Book	Authors	Publisher
1	Mathematics for B.Sc Br–I, First Semester, Volume I	P.Kandasamy, K.Thilagavathy	S.Chand& Company Ltd, First Edition, 2004.
2	Differential Calculus	Shanthi Narayanan	Shayambal Charitable Trust, 1987.
3	Integral Calculus	Shanthi Narayanan	S. Chand & Co, 1987.

B.Sc Mathematics

Semester I

[For the students admitted from the academic year 2021 – 2022 onwards]

Course: Part III Core II Differential Equations and Laplace Transforms	**Course Code: 121M02**
Semester: I	**No. of Credits: 4**
No. of hours :75	**C:T: 65:10**
CIA Max. Marks: 50	**ESE Max. Marks: 50**

(C: Contact hours, T:Tutorial)

Course Objectives:

- To introduce the concepts involved in solving first order differential equations.
- To provide practice in solving second order differential equations.
- To enable the students to solve simultaneous linear differential equations with constant coefficients.
- To impart concepts regarding partial differential equations and their solutions.
- To introduce Laplace transform of functions and to equip the skill of solving second order differential equation with constant coefficients using Laplace transforms.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	solve first order and higher degree differential equations	A
CO2	solve the linear differential equations with constant and variable coefficients.	A
CO3	solve simultaneous differential equations.	A
CO4	formulate partial differential equations and solve first order partial differential equations.	A
CO5	solve differential equations using Laplace Transforms	A

A-Apply

Syllabus:

Unit I	13 hrs
Differential equations of the first order: Equations of the first order, but of higher degree: Equations	

solvable for dy/dx – Equations solvable for y – Equations solvable for x (particular cases of 5.2) – Clairaut's form – Extended form of Clairaut's Equations – Equations that do not contain x explicitly– Equations that do not contain y explicity – Equations homogeneous in x and y. Chapter 1: Sections 5.1 - 5.5, 6.1, 6.2, 7.1 - 7.3

Unit II	13 hrs
Linear Differential Equations with Constant Coefficients: Linear Differential Equations with Constant Coefficients– The operators D and D^{-1}- Particular Integral-Special methods of finding P.I– Linear differential equations with variable coefficients Chapter 2: Sections 1 to 4, 8	

Unit III	13 hrs
Simultaneous Differential Equations: Simultaneous equations of the first order and first degree – Solutions of $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$– Methods for solving $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$– Simultaneous linear differential equations with constant coefficients. Chapter 3: Sections 1 - 4, 6	

Unit IV	13 hrs
Partial Differential Equations: Derivation of Partial Differential Equations – Different integrals of Partial differential equations (definition only) – Standard types of first order equations – Lagrange's equation. Chapter 4: Sections 1 - 3, 5, 6	
Unit V	13 hrs
The Laplace Transforms: Definition – Results from the definition – Laplace transforms of periodic functions – Some general Theorems – Evaluation of certain integrals using Laplace transforms – The inverse transforms – Solving second order differential equations with constant coefficients using Laplace transforms. Chapter 5: Sections 1 – 8	

Book for study:

Unit	Name of the Book	Authors	Publisher
I-V	Calculus(Major) Volume III	S.Narayanan and T.K.Manicavachagom Pillay	S.Viswanathan (printers and publishers) Pvt., Ltd., 2014.

Books for Reference:

S.No	Name of the Book	Authors	Publisher
1	Advanced Engineering Mathematics	Ervin Kreyszig	Wiley Eastern Ltd., 8th edition, 2006
2	Differential Equations with applications and Historical Notes	George F. Simmons	McGrawHill,Inc, 2nd Edition 1991.

B.Sc Mathematics

Semester II

[For the students admitted from the academic year 2021 – 2022 onwards]

Course: Part III Core III Analytical Geometry of Three Dimensions	**Course Code: 221M03**
Semester: II	**No. of Credits: 5**
No. of hours :75	**C:T: 65:10**
CIA Max. Marks: 50	**ESE Max. Marks: 50**

(C: Contact hours, T: Tutorial)

Course Objectives:

- To understand the mathematical representation of the geometrical figures.
- To give a training for visualizing ideas in three dimensions.
- To give an in-depth knowledge in three dimensional figures to understand the graphical concepts.
- To make the students visualize the concepts using GeoGebra.

Course Outcomes: On completion of the course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	apply the concepts of direction ratios and direction cosines in planes and straight lines	A
CO2	use the concepts of straight lines through planes.	A
CO3	discuss the various aspects of sphere and sections of a sphere.	U
CO4	identify various types of cone and obtain their equations.	U
CO5	use various types of conicoids and solve simple geometrical problems	A

U –Understanding A-Apply

Syllabus:

Unit I	13 hrs
Planes: First degree equation–Equations of planes – General form of the equation of a plane passing through (x_1, y_1, z_1) – Equations of different planes – Intercept form of equation of a plane – coplanarity of three lines through a point – Loci related to x, y, z intercepts – Equation $P + \lambda P' = 0$. Simple Geometric figures using GeoGebra. Book 1: Chapter 3: Sections 3.1 - 3.5	

Unit II	13 hrs
Straight Lines: Equations of a straight line – Equations of the line of intersection of two planes – Conditions for various situations of a line with reference to a plane – Plane through a given line – Coplanarity of two straight lines – Shortest distance between two skew lines – Equations of the common perpendicular – Feet of the common perpendicular. Simple Geometric figures using GeoGebra. Book 1 : Chapter 4: Sections 4.1 - 4.3, 4.6, 4.9 - 4.11	

Unit III	13 hrs
Sphere: Equation of a sphere – Standard equation of a sphere – Sphere on a given diameter – Results based on properties of a sphere – Tangent plane to a sphere – Loci related to x, y, z intercepts (continued) – Equations of a circle – Centre and radius of a circle – Family of spheres through a circle – Touching spheres – Point of contact of touching spheres. Simple Geometric figures using GeoGebra. Book 1 : Chapter 5: Sections 5.1 - 5.5.2	

Unit IV	13 hrs
Cone and Cylinder: Cone – Right Circular cone – Equation of a general cone – Surface represented by a homogeneous equation – Equation obtained by homogenizing – Nature of a Quadric cone with vertex at the origin – Intersection of a cone by a plane through the vertex – General second degree cone. Simple Geometric figures using GeoGebra. Book 1 Chapter 6: Sections 6.1 - 6.5	

Unit V	13 hrs
Conicoids: Nature of conicoids – Standard equation of central conicoids – Enveloping cone - Tangent plane – Condition for tangency – Director sphere and director plane - Normal to a Conicoid – Ruled surface - Executing simple geometrical problems using GeoGebra. Book 2: Chapter 6: Sections 6.9 - 6.12, Chapter 7 : Sections 7.1 - 7.3	

Books for study:

Unit	Name of the Book	Authors	Publisher
I-IV	Analytical Geometry (3–D)	P.Duraipandian, Kayalal Pachaiyappa	Muhil Publishers, 2009.
V	Analytical Geometry (3–D)	P.Duraipandian, Laxmi Duraipandian & D.Muhilan	Emerald Publishers, 2009

Books for Reference:

S.No	Name of the Book	Authors	Publisher
1	Analytical Geometry (Three Dimensional)	T.K.Manickavasagam Pillai, T.Natarajan	Viswanathan Publications, 2010
2	Analytical Geometry of Three Dimensions	P. K.Jain Khalil Ahmed	New international Publishers

Curriculum Design

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B.Sc Mathematics

Scheme of Examination – CBCS & OBE Pattern

(For the students admitted during the academic year 2020-2021 only)

Sem	Course Code	Course Title	Ins. Hrs/ Week	Examination				Credits
				Dur. Hrs	CIA Marks	ESE Marks	Total Marks	
I	119TA1/ 119MY1/ 119HD1/ 119FR1	**Part I-** Language I	6	3	25	75	100	4
	119EN1	**Part II –** English I	6	3	25	75	100	4
		Part III						
	117M01	Core I Algebra and Calculus	5	3	25	75	100	4
	117M02	Core II Differential Equations and Laplace Transforms	5	3	25	75	100	4
	117AM1	Allied I Physics I	6	3	25	50	75	3
	119VEC	**Part IV –** Value Education	2	2	50	-	50	2
II	219TA2/ 219MY2/ 219HD2/ 219FR2	**Part I-** Language II	6	3	25	75	100	4
	219EN2	**Part II -** English II	6	3	25	75	100	4
		Part III						
	217M03	Core III Analytical Geometry	5	3	25	75	100	4
	217M04	Core IV Numerical Methods	5	3	25	75	100	4
	217AM2	Allied II Physics II	4	3	25	50	75	3
	217AMP	Allied Physics Practical	2	3	20	30	50	2
	219EVS	**Part IV**-Environmental Studies	2	2	50	-	50	2
III	**320TA3/** 319MY3/ 319HD3/ 319FR3	**Part I –** Language III	6	3	25	75	100	4
	319EN3	**Part II -**English III	6	3	25	75	100	4
		Part III						
	317M05	Core V Vector Calculus and Fourier Series	3	3	25	50	75	3
	317M06	Core VI Statics	4	3	25	75	100	4
	319AM3/ 320AM4/ **320AM5**	Allied III Principles of Accountancy/ Chemistry I /**Mathematical Statistics I**	6	3	25	75/50/75	100/75/ 100	4/3/4
	317NMC	**Part IV-** NME – Basic	2	2	50	-	50	2

		Mathematics for Competitive Examinations						
	320MS1	**Part IV-Skill Enhancement Course I Professional English for Mathematics**	3	3	75	-	75	3
IV	420TA4/ 419MY4/ 419HD4/ 419FR4	**Part I –** Language IV	6	3	25	75	100	4
	419EN4	**Part II-** English IV	6	3	25	75	100	4
		Part III						
	417M07	Core VII Discrete Mathematics	3	3	25	50	75	3
	417M08	Core VIII Dynamics	4	3	25	75	100	4
	420AM6/ **420AM7**/ **420AM8**	Allied IV Chemistry II / **Statistics for Mathematics** / **Mathematical Statistics II**	6	3	25	50/75/75	75/100/ 100	3/4/4
	420AMP	Chemistry Practical	2	3	20	30	50	2
	417NGA	**Part IV-**General Awareness and Information Security	2	2	100	-	100	2
	420MS2	**Part IV- Skill Enhancement Course II Graph Theory**	3	3	75	-	75	3
	417MA1/ 417MA2	**Advanced Learners Courses – I** Combinatorics / Statistical Quality Control	-	3	-	100	100	4*
V		**Part III**						
	517M09	Core IX Real Analysis I	6	3	25	75	100	4
	517M10	Core X Complex Analysis I	5	3	25	75	100	4
	517M11	Core XI Abstract Algebra	5	3	25	75	100	4
	517M12	Core XII Group Project	5	-	50	50	100	4
	518ME1/ 517ME2	Elective I: Programming in C(T & P) / Number Theory	6	3	25	75	100	4
	520MS3	**Part IV - Skill Enhancement Course III - Sequences and Series**	3	3	75	-	75	3
VI		**Part III**						
	617M13	Core XIII Real Analysis II	5	3	25	75	100	4
	617M14	Core XIV Complex Analysis II	5	3	25	75	100	4
	617M15	Core XV Linear Algebra	5	3	25	75	100	4
	617ME3/ 617ME4	Elective II: Operations Research/ Mathematical Cryptography	6	3	25	75	100	4
	617ME5/ 617ME6	Elective III: Fuzzy and Intuitionistic Fuzzy Theory/ Astronomy	6	3	25	75	100	4
	620MS4	**Part IV- Skill Enhancement**	3	-	75	-	75	3

		Course IV Internship / Summer Training/Short Term Course						
	617EX1/ 617EX2/ 617EX3/ 617EX4/ 617EX5	**Part V-** Extension activity NCC/NSS/YRC/RRC/ Games	-	-	50	-	50	2
	617MA3/ 617MA4	**Advanced Learners Course – II** Mathematics in Insurance/Introduction to wavelet theory	-	3	-	100	100	4*

Total: 3550 140

Starred credits are treated as additional credits (Optional)

Employability Courses

B.Sc Mathematics
Semester III
(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Core V Vector Calculus and Fourier Series	**Course Code: 317M05**
Semester: III	**No. of Credits: 3**
No. of hours :45 (Total hours)	**C:T: 39: 6**
CIA Max. Marks: 25	**ESE Max. Marks: 50**

(C: Contact hours, T: Tutorial)

Course Objectives:

The objectives of this course are

- to introduce various operations involving vectors.
- To familiarize the line, surface and volume integrals.
- to introduce the Fourier series and its various forms.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	know about the concepts of Gradient, Divergence and Curl.	**R**
CO2	relate the identities involving the operators.	**R**
CO3	evaluate Line integrals and surface integrals using Gauss divergence theorem.	**A**
CO4	evaluate surface and volume integrals using Stoke's and Green's theorem.	**A**
CO5	obtain Fourier series for various functions.	**U**
CO6	convert any mathematical function to trigonometric function.	**U**

Remembrance U –Understanding A-Apply

Syllabus:

Unit I	**8 hrs**
Gradient: Scalar and Vector point functions – Level Surfaces – Directional derivative of a scalar point function – Gradient of a scalar point function–Gradient of sum and product of functions – Gradient of f(r). Book 1: Chapter 2: Sections 2.1 - 2.6	

Unit II	**8 hrs**
Divergence & curl: Divergence and curl of a vector point function – Solenoidal and rotational vectors – Theorems on divergence and curl – Laplacian operator – Divergence and curl of a gradient – Divergence and curl of a curl – Divergence and curl of f(r)$\bar{r}$ – Scalar	

potential.
Book 1: Chapter 3: Sections 3.1 - 3.5

Unit III **8 hrs**

Integral Theorems: Integral Theorems – Green's theorem in the plane – Gauss divergence theorem – Stoke's theorem.
Book 1: Chapter 6: Sections 6.1 - 6.4

Unit IV **7 hrs**

Fourier series: Fourier series **–** Even and odd functions.
Book 2: Chapter 1: Pages 96 – 135

Unit V **8 hrs**

Fourier series: Half - range series – Half - range sine series – Half - range cosine series, Change of interval.
Book 2: Chapter 1: Pages 135 - 154

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-III	Vector Analysis	P.Duraipandian, Kayalal Pachaiyappa	Muhil Publishers, Revised Edition 2009
IV,V	Mathematics for B.Sc.. Branch–I, Volume – IV	P.Kandasamy, K.Thilagavathi	S.Chand & Company Limited, First Edition 2005

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	Vector Analysis	Dipak Chatterjee	PHI Learning Private Limited, Second Edition, 2009
2	Calculus(Major) Volume III	S.Narayanan and T.K. Manicavachagom Pillay	S.Viswanathan (printers and publishers) Pvt., Ltd., 2012.

B.Sc Mathematics

Semester III

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Core VI Statics	**Course Code: 317M06**
Semester: II	**No. of Credits: 4**
No. of hours :60 (Total hours)	**C:T: 52: 8**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

(C:Contact hours, T:Tutorial)

Course Objectives:

Objectives of this course are

- to provide a strong foundation in understanding the concepts of mechanics.
- to know about equilibrium of a particle.
- to impart knowledge about the forces acting on a particle and rigid body.

- to study about couples and moments of couples and results related to them.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	find the resultant of two or more forces acting on a particle	**A**
CO2	understand the concepts of equilibrium of a particle under three or more forces.	**U**
CO3	compute the moment of a force and a couple.	**U**
CO4	obtain the equation of the line of action of the resultant.	**A**
CO5	comprehend the effect of friction on planar motion.	**R**
CO6	identify the centre of mass for different geometrical figures.	**R**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I	**11 hrs**
Force: Newton's laws of motion – Forces – Resultant of two forces on a particle – Resultant of three forces related to a triangle acting at a point – Resultant of several forces acting on a particle. **Equilibrium of a particle**: Equilibrium of a particle – Equilibrium of a particle under three forces – Equilibrium of a particle under several forces. Chapter 2: Sections 2.1(2.1.1) - 2.2, Chapter 3: Section 3.1	

Unit II	**10 hrs**
Forces on a rigid body: Moment of a force – Moment of a force about a line **–** Scalar moment **–** Equivalent (or equipolent) systems of forces **–** Parallel forces **–** Point of application of resultant of many parallel forces **–** Varignon's theorem **–** Parallel forces at the vertices of a triangle **–** Forces along the sides of a triangle. Chapter 4: Sections 4.1, 4.3 - 4.5	

Unit III	**11 hrs**
Forces on a rigid body: Couples **–** Moment of a couple **–** Arm and axis of a couple – Resultant of several coplanar forces – Moment of a certain couple as an area – Couples in a parallel planes – Resultant of a couple and a force – Equation of the line of action of the resultant – Sum of the moments about an arbitrary point. Chapter 4: Sections 4.6 - 4.8	

Unit IV	**10 hrs**
Force: **Newton's laws of motion**: Types of forces. **A specific reduction of forces**: Problems involving frictional forces. Chapter 2: Section 2.1(2.1.2), Chapter 5: Section 5.2 (Excluding Section 5.2.1)	

Unit V	**10 hrs**
Centre of Mass: Centre of mass – Centre of gravity – Finding mass centre – Finding mass centre (not using integration) – Finding mass centre using integration – Mass centre of a nonhomogeneous solid. Chapter 6: Section 6.1(6.1.1), 6.2(6.2.1 - 6.2.3)	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-V	Mechanics	P. Duraipandian, Laxmi Duraipandian, Muthamizh Jayapragasam	S. Chand & Company Ltd., Reprint 2016.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	Statics	Dr.M.K.Venkataraman	Agasthiar book deport, Fifth edition, 1984.
2	Statics	K.ViswanathaNaik, M.S.Kasi	Emerald publishers, 2001.

B.Sc Mathematics

Semester III

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part IV – Non-Major Elective Basic Mathematics for Competitive Examinations	**Course Code: 317NMC**
Semester: III	**No. of Credits: 2**
No. of hours : 30 (Total hours)	**C:T: 26: 4**
CIA Max. Marks: 50	**ESE Max. Marks: -**

(C: Contact hours, T:Tutorial)

Course Objectives:

Objectives of this course are

- to enhance quantitative aptitude required for competitive examinations like Bank P.O., and Railways etc.
- to familiarize with different types of tests conducted by various examining bodies.
- to improve the numerical aptitude in mathematics and to increase the speed through regular practice.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	simplify fractions easily.	**R**
CO2	acquire enough knowledge to solve problems on ages and profit and loss.	**A**
CO3	solve problems in ratio and proportion and partnership.	**A**

CO4	gain knowledge in solving problems involving time and other factors.	**R**
CO5	calculate simple interest, compound interest and true discount.	**A**
CO6	improve their numerical aptitude	**A**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I	**6 hrs**
Decimal fractions – Simplification – Number series. Chapters: 3, 4, 39	

Unit II	**5 hrs**
Problems on Ages – Percentage – Profit and loss. Chapters: 8, 10, 11	

Unit III	**5 hrs**
Ratio and proportion – Partnership Chapters: 12,13	

Unit IV	**5 hrs**
Time and work – Time and distance – Problems on trains. Chapters: 15, 17, 18	

Unit V	**5 hrs**
Simple interest – Compound interest – True discount. Chapters: 21, 22, 25	

Book for study:

Unit	**Name of the Book**	**Authors**	**Publishers with Edition**
I-V	Objective Arithmetic	R.S. Aggarwal	S.Chand & Company LTD, Reprint 2009.

Books for Reference:

S.No	**Name of the Book**	**Authors**	**Publishers with Edition**
1	Quick Arithmetic	Shish Aggarwal	Sultan Chand & Company Ltd, Second edition 2007.
2	Quantitative Aptitude for Competitive Examinations	Abhijit Guha	Tata McGraw Hill Publishing Company Ltd, Fifth edition, 2014.

B.Sc Mathematics

Semester IV

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Core VII Discrete Mathematics	**Course Code: 417M07**
Semester: IV	**No. of Credits: 3**
No. of hours :45 (Total hours)	**C:T: 39:6**
CIA Max. Marks: 25	**ESE Max. Marks: 50**

(C:Contact hours, T:Tutorial)

Course Objectives:

The objectives of this course are

- to develop the ability to perceive, formulate and to solve mathematical problems related to finite systems in engineering and computer science.
- to gain confidence in applying the ideas to solve practical problems in the areas like switching theory, coding theory, artificial intelligence etc.,
- to develop appropriate interpretation of finite Mathematical systems.

Course Outcomes: On completion of the Course the student will be able to

CO	**Statement**	**Bloom's Taxonomy level**
CO1	know various connectives in logic.	**R**
CO2	construct truth table for statement formulae	**A**
CO3	convert the statement formulae to its equivalent forms.	**U**
CO4	characterize posets, semigroups and monoids.	**A**
CO5	examine the concepts of lattices and Boolean algebra.	**U**
CO6	minimize Boolean functions	**A**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I	**8 hrs**

Mathematical logic: Introduction – Statements and Notation. Connectives: Negation – Conjunction – Disjunction – Statement formulas and truth tables – Conditional and Biconditional – Well-formed Formulas – Tautologies – Equivalence of formulas – Duality law – Tautological Implications – Formulas with Distinct Truth Tables.

Chapter 1: Sections 1.1, 1.2(1.2.1-1.2.4, 1.2.6 - 1.2.12)

Unit II	**8 hrs**

Mathematical logic: Normal forms: Disjunctive normal forms – Conjunctive normal forms – Principal disjunctive normal forms – Principal conjunctive normal forms – Ordering and uniqueness of normal forms. **Set theory**: Relations and ordering: Partial ordering – Partially ordered set: Representation and Associated Terminology.

Chapter 1: Sections 1.3(1.3.1 - 1.3.5), Chapter 2: Sections 2.3(2.3.8, 2.3.9)

Unit III	**7 hrs**
Algebraic Structures: Semigroups and Monoids: Definitions and Examples – Homomorphism of Semigroups and Monoids – Subsemigroups and Submonoids. Chapter 3 : Section 3.2	

Unit IV	**8 hrs**
Lattices and Boolean Algebra: Introduction: Lattices as partially ordered sets: Definition and Examples – Some properties of lattices – Lattices as Algebraic systems – Sublattices, Direct Product, and Homomorphism – Some Special Lattices. Boolean Algebra: Definition and Examples. Chapter 4: Sections 4.1, 4.2(4.2.1)	

Unit V	**8 hrs**
Lattices and Boolean Algebra: Boolean Functions: Boolean Forms and Free Boolean Algebras – Values of Boolean Expressions and Boolean Functions. Representation andMinimization of Boolean functions: Representation of Boolean functions. Chapter 4: Sections 4.3, 4.4(4.4.1)	

Book for study:

Unit	**Name of the Book**	**Authors**	**Publishers with Edition**
I -V	Discrete Mathematical Structures with Applications to Computer Science	J.P. Tremblay and R. Manohar	Tata McGraw-Hill Edition – 1997, 47th Reprint 2015

Books for Reference:

S.No	**Name of the Book**	**Authors**	**Publishers with Edition**
1	Discrete Mathematics with Graph Theory and Combinatorics	T.Veerarajan	Tata McGraw–Hill, New Delhi, Fifth Reprint, 2008.
2	Discrete Mathematics	N.Ch.S.N.Iyengar, V.M.Chandrasekaran, K.A.Venkatesh, P.S. Arunachalam	Vikas Publishing House Pvt Ltd, Second Reprint, 2008
3	Discrete Mathematics (For B.E. Computer Science and Engineering)	Prof. V.Sundaresan, K.S.Ganapathy Subramanian, K.Ganesan	A.R. Publications (New Revised Edition, June 2008)
4	Discrete Mathematical Structures	Bernard Kolman, Robert C.Busby and Sharon Ross	Prentice Hall of India Pvt Ltd, Sixth Printing (Third Edition), 1998

B.Sc Mathematics

Semester IV

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Core VIII Dynamics	**Course Code: 417M08**
Semester: IV	**No. of Credits: 4**
No. of hours :60 (Total hours)	**C:T: 52:8**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

(C:Contact hours, T:Tutorial)

Course Objectives:

Objectives of this course are

- to visualize the physical phenomena in mathematical terms.
- to have a deep knowledge about the motion of particles under the influence of various forces.
- to impart the concept of impact of collision of bodies and solve problems based on it.
- to provide a good foundation for the students to take up any advanced course in mechanics and all related fields

Course Outcomes: On completion of the Course the student will be able to

CO	**Statement**	**Bloom's Taxonomy level**
CO1	Interpret and illustrate the basic concepts in Kinematics	**U**
CO2	gain knowledge about simple harmonic motion and its application in Physical situation.	**A**
CO3	recall various properties of a projectile	**R**
CO4	describe and evaluate direct and oblique impact of bodies.	**U**
CO5	describe the properties of the central orbits.	**R**
CO6	analyze the effects of forces on material bodies	**A**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I	**11 hrs**
Kinematics: Basic units – Velocity – Velocity of particle describing a circle – Resultant velocity – Acceleration – Rectilinear motion – Rectilinear motion with a constant acceleration – Coplanar motion – Velocity and acceleration in a coplanar motion – Angular velocity – Relative angular velocity. Chapter 1: Sections 1.1 - 1.4 (excluding Section 1.2.3)	

Unit II	**10 hrs**
Rectilinear motion under varying force: Simple harmonic motion – Projection of a particle having a uniform circular motion – Composition of two simple harmonic motions of same period – S.H.M along a horizontal line – S.H.M along a vertical line. Chapter 12: Sections 12.1 - 12.3	

Unit III	**11 hrs**
Projectiles: Forces on a projectile – Displacement as a combination of vertical and horizontal displacements – Nature of trajectory – Results pertaining to the motion of a projectile – Maximum horizontal range for a given velocity – Two trajectories with a given speed and range – Projectile projected horizontally – Projectile projected on an inclined plane – Maximum range on an inclined plane. Chapter 13: Sections 13.1, 13.2	

Unit IV	**10 hrs**
Impact: Conservation of linear momentum(principle only) – Impact of spheres – Laws of impact – Impact of two smooth spheres – Direct impact of two smooth spheres – Impact of a smooth sphere on a plane – Direct impact of a smooth sphere on a plane – Oblique impact of a smooth sphere on a plane – Oblique impact of two smooth spheres. Chapter 14: Sections 14.2 - 14.5	

Unit V	**10 hrs**
Central orbits: General orbits – Central orbit – Differential equation of a central orbit – Laws of a central force – Methods to find the central orbits – Conic as a central orbit – Kepler's Laws of planetary motion. Chapter 16: Sections 16.1 - 16.3	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-V	Mechanics	P. Duraipandian, Laxmi Duraipandian, Muthamizh Jayapragasam	S. Chand & Company Ltd., Reprint 2016.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	Dynamics	A.V. Dharmapadam	S. Viswanathan Pvt Ltd., 2006
2	Dynamics	S. Narayanan	S. Chand & Company Ltd., 16th revised edition 1986
3	Dynamics	Dr. M.K. Venkataraman	Agasthiar publications, 12th edition 2006

Entrepreneurial Courses

B.Com / B.Com(CA) / BCom(ecom)

Semester III

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Allied III – Mathematics	**Course Code: 317AB3/317AR3/317AN3**
Semester: III	**No. of Credits: 4**
No. of hours :90 (Total hours)	**C:T: 75:15**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

(C:Contact hours, T:Tutorial)

Course Objectives:

The objectives of this course are

- to provide a knowledge about mathematics in finance.
- to improve the problem solving ability
- to give practical training in converting a managerial decision making problem to linear programming problem
- to gain knowledge on techniques for solving linear programming problem.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	calculate simple, compound interest, rate of interest etc.	**A**
CO2	perform various operations on matrices.	**U**
CO3	describe the concepts in Linear Programming Problem.	**R**
CO4	solve the linear programming problem using simplex method.	**A**
CO5	minimize the cost in transportation and assignment problems.	**U**
CO6	interpret the concept of game theory.	**A**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I:	**16 hrs**
Mathematics of Finance: Basic Concepts – Simple Interest and Compound Interest – Symbols Used – Simple Interest – Formulae and Problems – Compound Interest – Formulae and Problems – Effective Rate and Nominal Rate of Interest – Depreciation – Annuities – Discounting. Book 1: Chapter 2: Sections 1 - 7, 10	

Unit II	**16 hrs**
Matrices, Determinants, Input - Output Analysis: Definition of a Matrix – Importance – Notation – Order of a Matrix – Types of Matrices – Matrix operations-I – A System of Linear Equations. Determinants – Matrix operations-II – Rank – Consistency of a System of Simultaneous Linear Equations – Miscellaneous Illustrations. Book 1: Chapter 4: Sections 1 - 12	
Unit III	**15 hrs**
Linear Programming: Linear Programming Problem – Graphical Method – Simplex Method. Book 1: Chapter 9 (Related to the above topics)	

Unit IV	**16 hrs**
Transportation Problem: Introduction – LP formulation of the transportation problem – Existence of Solution in T.P – Duality in transportation problem – The transportation table –	

Loops in transportation tables – Triangular basis in a T.P – Solution of a transportation problem – Finding an initial basic feasible solution – Test for optimality – Economic Interpretation of u_j's and v_j's – Degeneracy in transportation problem – Transportation algorithm [MODI method]. **Assignment Problem**: Introduction – Mathematical formulation of the problem – Solution Methods of Assignment Problem.

Book 2: Chapter 10: Sections 10.1 – 10.13, Chapter 11: Sections 11.1 – 11.3

Unit V	**15 hrs**

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

Book 2 : Chapter 17: Sections 17.1 - 17.6

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I ,II & III	Business Mathematics and Statistics	P.A.Navnitham	Jai Publishers, Latest Edition, May 2014.
IV & V	Operations Research	Kanti Swarup, P.K Gupta, Man Mohan	Sultan Chand & Sons, NewDelhi, Fifteenth Edition, Reprint 2010

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	An Introduction to Business Mathematics	V.Sundaresan, S.D.Jayaseelan	S.Chand & Company Ltd., New Delhi, Reprinted 1983
2	Mathematics for CA foundation	B.M.Aggarwal	Kitab Mahal Agencies, Allahabad, Fourth Edition 1998 – 1999
3	Operations Research:Theory and Applications	J.K.Sharma	MacMillan India Ltd, Second Edition, 2003

Skill Development Courses

B.Sc Mathematics

Semester III

(For the students admitted during the academic year 2020 – 2021 only)

Course: Part III Allied III Mathematical Statistics I	**Course Code: 320AM5**
Semester: III	**No. of Credits: 4**
No. of hours :90	**C:T:- 78:12**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

(C: Contact hours, T: Tutorial)

Course Objectives:

- To provide knowledge about random variables and their different distributions.
- To comprehend the characteristics of distributions.
- To create awareness of the sampling distributions and their applications.

Course Outcomes: On completion of the course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	calculate the expected values and probabilities associated with the distributions of random variables	U
CO2	evaluate expectation and variance.	A
CO3	identify the relationship between attributes	A
CO4	describe the theoretical distributions.	U
CO5	apply the special continuous probability distributions in real world problems	A

U –Understanding A-Apply

Syllabus:

Unit I:	16 hrs
Theory of probability: Random variables and Distribution functions: Introduction – Distribution function. Discrete Random Variable- Continuous Random Variable- Two- Dimensional random variable- Stochastic Independence. Chapter 5 Sections 5.1, 5.2, 5.3, 5.3.1, 5.3.2 5.4:5.4.1, 5.4.2, 5.4.3, 5.5: 5.5.1 -5.5.6.	

Unit II	15 hrs
Mathematical Expectations: Mathematical Expectations of random variable- Properties of Expectation - Properties of Variance - Covariance – Cauchy-Schwartz Inequality- Chebychev's Inequality. Chapter 6 Sections 6.1-6.7. Chapter 7 Sections 7.5.	

Unit III	15 hrs
Correlation: Introduction – Scatter Diagram- Karl Pearson‟s coefficient of Correlation- Probable Error of correlation coefficient–Rank Correlation. Regression: Introduction – Linear Regression – Regression Coefficients- Properties- Angle between two lines of regression. Chapter 10 Sections 10.1-10.4, 10.4.1,10.4.2 and 10.7:10.7.1- 10.7.3. Chapter 11 Sections 11.1, 11.2, 11.2.1, 11.2.2, 11.2.3.	

Unit IV	16 hrs
Theoretical distributions: Binomial & Poisson Distributions - Moments – Recurrence Relation for Moments – Mean Deviation about Mean, Mode, Recurrence relation for probabilities of Binomial distribution, Fitting of curve, Moment Generating Function. Chapter 8 Sections 8.4: 8.4.1-8.4.8, 8.4.12, 8.5: 8.5.1-8.5.6, 8.5.10	

Unit V	16 hrs
Special Continuous Probability Distributions: Normal Distributions- Moments – Recurrence Relation for Moments – Mean Deviation about Mean, Mode, Recurrence relation for probabilities of Normal distribution, Fitting of curve, Moment Generating Function. Chapter 9 Sections 9.1, 9.2: 9.2.1-9.2.5, 9.2.7, 9.2.10, 9.3:9.3.1,9.3.2.	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I -V	Fundamentals of Mathematical Statistics	S.C.Gupta, V.K.Kapoor	Sultan Chand and Sons, New Delhi-Eleventh thoroughly revised edition (2002), Reprint 2016.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Introduction to Mathematical statistics	Robert V.Hogg & Allen T. Craig	Pearson Education, Fifth Edition.
2.	Theory and Problems of Statistics	Murray R.Spiegel, Larry J.Stephens	Third Edition, Tata McGraw Hill Publishing Company Ltd, 2009.
3.	Mathematical Statistics	P.R. Vittal	Margham Publications, First Edition, 2010

B.Sc Mathematics

Semester III

(For the students admitted during the academic year 2020 – 2021 only)

Course: Part IV - Skill Enhancement Course I **Professional English for Mathematics**	**Course Code: 320MS1**
Semester: III	**No. of Credits: 3**
No. of hours :45	**C:T: 39:6**
CIA Max. Marks: 75	**ESE Max. Marks: -**

(C:Contact hours, T:Tutorial)

Course objective: This course aims

- To develop their competence in the use of English with particular referenceto the workplace situation.
- To enhance the creativity of the students, which will enable them to think of innovative ways to solve issues in the workplace.
- To develop their competence and competitiveness and thereby improvetheir employability skills.
- To help students with a research bent of mind to develop their skills in writingreports and research proposals.

Course Outcomes: On completion of the course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	use the mathematical term at the appropriate place	U
CO2	face interviews/present papers with more confidence	U
CO3	write research articles	A
CO4	create mathematical content for social media	A
CO5	create blogspots on important mathematical topics	A

U –Understanding A-Apply

Syllabus:

Unit I COMMUNICATION	8 hrs
Listening: Listening to audio text and answering questions - Listening to Instructions Speaking: Pair work and small group work. Reading: Comprehension passages –Differentiate between facts and opinion Writing: Developing a story with pictures. Vocabulary: Register specific - Incorporated into the LSRW tasks	

Unit II DESCRIPTION	8 hrs
Listening: Listening to process description.-Drawing a flow chart. Speaking: Role play (formal context) Reading: Skimming/Scanning- Reading passages on products, equipment and gadgets. Writing: Process Description–Compare and Contrast Paragraph-Sentence Definition and Extended definition- Free Writing. Vocabulary: Register specific - Incorporated into the LSRW tasks.	

Unit III NEGOTIATION STRATEGIES	8 hrs
Listening: Listening to interviews of specialists / Inventors in fields (Subject specific) Speaking: Brainstorming. (Mind mapping). Small group discussions (Subject- Specific) Reading: Longer Reading text. Writing: Essay Writing (250 words) Vocabulary: Register specific - Incorporated into the LSRW tasks	

Unit IV PRESENTATION SKILLS	8 hrs
Listening: Listening to lectures. Speaking: Short talks. Reading: Reading Comprehension passages Writing: Writing Recommendations Interpreting Visuals inputs Vocabulary: Register specific - Incorporated into the LSRW tasks	

Unit V CRITICAL THINKING SKILLS	7 hrs
Listening: Listening comprehension- Listening for information. Speaking: Making presentations (with PPT- practice). Reading: Comprehension passages –Note making. Comprehension: Motivational article on Professional Competence, Professional Ethics and Life Skills Writing: Problem and Solution essay– Creative writing –Summary writing Vocabulary: Register specific - Incorporated into the LSRW tasks	

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	A primer of Mathematical Writing	Steven G.Krantz	Universities Press 1997
2.	Write Mathematics Right	L.Radhakrishna	Narosa Publishing House Pvt.Ltd 2013
3.	History of Modern Mathematics	David Eugene Smith	MJP Publishers 2008

B.Sc. Mathematics

Semester IV

(For the students admitted during the academic year 2020 – 2021 only)

Course: Part III – Allied IV Mathematical Statistics-II	**Course Code: 420AM8**
Semester: IV	**No. of Credits: 4**
No. of hours :90 (Total hours)	**C:T: 78:12**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

(C: Contact hours, T: Tutorial)

Course Objectives:

- To provide knowledge about the parametric and non-parametric testing techniques.
- To utilize the probability distributions to perform Statistical inference.
- To take up research.

Course Outcomes: On completion of the course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	apply and compute maximum likelihood estimation.	A
CO2	Explain all aspects of parametric testing techniques including single and multi-sample tests for mean and proportion.	A
CO3	Determine sampling of attributes	A
CO4	describe Normal, uniform, Gamma, beta, t ,F and chi-square distributions.	U
CO5	apply the special continuous probability distributions in real world problems	A

Syllabus:

Unit I:	16 hrs
Large sample Theory: Procedure for testing of hypothesis- Test of significance for large samples- Sampling of Attributes - Test of significance for a single proportion-Test of significance for difference of proportions- Sampling of Variables- Test of significance for single mean-Test of significance for difference of mean. Chapter14: Sections 14.5,14.6,14.7,14.8:14.8.3,14.8.4	

Unit II	15 hrs
Theory of Estimation: Introduction - Characteristics of Estimators -Properties- Cramer Rao Inequality - Rao Blackwell Theorem – Method of Estimation -Method of maximum likelihood- Method of Minimum variance- Confidence Interval & Confidence limits. Chapter 17: Sections 17.2 , 17.3	

Unit III	16 hrs
Testing of Hypothesis: Statistical hypothesis- Null and alternate hypothesis –Critical region- Two types of errors- Level of Significance-Power of a test – Steps in solving Testing of hypothesis problems- Most powerful test- Uniformly Most Powerful Test –Neyman and Pearson Lemma. Chapter18: Sections 18.1, 18.2:18.2.1-18.2.7, 18.3, 18.4: 18.4.1,18.4.2, 18.5:18.5.1, 18.5.2.	

Unit IV	16 hrs
$\chi 2$ Exact sampling distribution: Introduction $\chi 2$, t, F, Z Distributions - Derivations – Applications- Relation between t and F, F and $\chi 2$, Fisher's Z-distribution. Chapter16: Sections 16.1,16.2,16.3,16.5,16.7,16.8,16.9.	

Unit V	15 hrs
Analysis of variance: F- Test- Application of F –Test – Assumptions and Techniques in Analysis of Variance- One and Two way classification Model – Experimental Designs – Introduction - Randomized Block Design - Latin Squares- Randomized block Vs Latin Squares- Latin Cubes. Chapter: 25	

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I -IV	Fundamentals of Mathematical Statistics.	S.C.Gupta, V.K.Kapoor	Sultan Chand & sons, New Delhi.11th Thoroughly Revised edition, Reprint 2016 (for units 1,2,3)
V	Statistical methods	S.P.Gupta	Sultan Chand & Sons, New Delhi. 43rd editions, 2014.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Introduction to Mathematical Statistics	Robert V.Hogg, Joseph, Mckon, AllenT.Craig	7th Edition Pearson India Ltd, 2009.
2.	Introductory Statistics	Sheldon M Ross	Introductory Statistics (3rd Edition) Elsevier, 2012

B.Sc Mathematics

Semester IV

(For the students admitted during the academic year 2020 – 2021 only)

Course: Part IV - Skill Enhancement Course II Graph Theory	**Course Code: 420MS2**
Semester: IV	**No. of Credits: 3**
No. of hours :45	**C:T: 39 : 6**
CIA Max. Marks: 75	**ESE Max. Marks: -**

(C: Contact hours, T: Tutorial)

Course Objectives:

- To enable the students to learn the basic concepts of graph theory.
- To introduce various types of graphs.
- To have a deep understanding of digraphs and their properties.
- To be familiar with matrix representation of graphs and digraphs.

Course Outcomes: On completion of the course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	find the degree sequence, connectivity and isomorphism of graphs.	U
CO2	identify various types of graphs	U
CO3	identify and differentiate Hamiltonian and Eulerian graphs.	A
CO4	explain various properties of digraphs	U
CO5	write adjacency and incidence matrix of a given labeled graph or digraph and vice versa.	A

U –Understanding A-Apply

Syllabus:

Unit I	8 hrs
Graphs: Graphs and Sub graphs – Vertex Degrees – Paths and Cycles. Chapter 2: Sections 2.1 - 2.3	

Unit II	8 hrs
Graphs: Regular and bipartite graphs. Eulerian and Hamiltonian Graphs: Exploring and Travelling. Chapter 2: Sections 2.4, Chapter 3: Sections 3.1	

Unit III	8 hrs
Eulerian and Hamiltonian Graphs: Eulerian Graphs – Hamiltonian Graphs. Chapter 3: Sections 3.2 and 3.3	

Unit IV	7 hrs
Digraphs: Digraphs and Sub digraphs – Vertex Degrees – Paths and Cycles. Chapter 4: Sections 4.1 - 4.3	

Unit V	8 hrs
Matrix Representations: Adjacency Matrices – Walks in graphs and Digraphs – Incidence Matrices. Chapter 5: Sections 5.1- 5.3	

Note: Proof of the theorems are not included

Book for study:

Unit	Name of the Book	Authors	Publisher
I-V	Graphs and Applications – An Introductory Approach	Joan M.Aldous and Robin J.Wilson	Springer - Second Indian Reprint 2014.

Books for Reference:

S.No.	Name of the Book	Authors	Publisher
1	Graph Theory	Frank Harary	Narosa Publishing House, New Delhi, Tenth Reprint 2001.
2	A First Look at Graph Theory	John Clark, Derek Allan Holton	Allied Publishers Ltd,Reprint 1995.
3	Graph Theory with Applications to Engineering and Computer Science	Narsingh Deo	Prentice – Hall of India Private Ltd, New Delhi 2005.
4	Graphs,Networks and Algorithms	Dieter Jungnickel	Springer – Verlag Berlin Heidelberg, 2005.

B.Sc. Physics and Chemistry

Semester III

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Allied III Mathematics I	**Course Code: 317AP3/317AC3**
Semester: III	**No. of Credits: 4**
No. of hours :90 (Total hours)	**C:T : 75:15**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

(C:Contact hours, T:Tutorial)

Course Objectives:

The objectives of this course are

- to become familiar with applications of Binominal, Exponential and Logarithmic expansions for finding the sum of series.
- to acquire knowledge on solving reciprocal equations and finding the roots by Newton Raphson method.
- to be familiar with the knowledge of eigen values and eigen vectors.
- to enable the students to understand the concepts of interpolation.

- to learn about trigonometric concepts

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	find the sum of binomial, exponential and logarithmic series	**U**
CO2	understand the basic concepts of theory of equations.	**U**
CO3	gain knowledge of real life applications of matrices.	**R**
CO4	understand how interpolation technique is applied in real life	**A**
CO5	know about the properties of trigonometric functions and their applications	**R**
CO6	explain the fundamentals of the mathematics and apply while creating innovations	**A**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I:	**16 hrs**

Algebra:

The Binomial Theorem: Theorem – Some Standard Expansions – The General Term – Summation of series. **Exponential theorem** – The number e – The Exponential Theorem (without Proof) – Some useful results – Summation of series. **The Logarithmic series**: Theorem–Some Standard Results – Summation of series

(Approximation Problems are Excluded)

Chapters II, III and IV.

Unit II	**16 hrs**

Theory of Equations: To diminish the roots of an equation by h. Reciprocal equations. Newton's Method of Successive Approximations.

Chapters I(Ex - 3), II and III

Unit III	**15 hrs**

Matrices:

Fundamental Concepts :Introduction-Special types of matrices-Matrices associated with a given matrix-operations-Matrix multiplication-Properties of matrix multiplication-Associated matrices-Adjoint of a square matrix-Inverse of a matrix. **Characteristic Roots and Characteristic Vectors**: Linear transformation-The characteristics equation of a transformation-Properties of the eigen vectors-Cayley Hamilton theorem.

Chapters I and IV

Unit IV	**16 hrs**

Finite Differences:

Finite Differences. Interpolation: Newton's Forward, Backward Interpolation.

Chapters I, II

Unit V	**15 hrs**
Trigonometry: **Expansion in Series. Exponential Series and Hyperbolic functions.** Chapters I and II	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-V	Allied Mathematics Volume I	P.Kandasamy, K.Thilagavathy	S. Chand and Company Limited, First Edition, Reprint 2014.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	AText book of Modern Algebra	R.Balakrishnan and M.Ramabhadran	Vikas Publishing House, Pvt Ltd. 3rd Edition 1979
2.	Numerical Methods	P.Kandasamy, K.Thilagavathy & K. Gunavathi	S.Chand and company Limited 2010.

B.Sc. Physics and Chemistry

Semester IV

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Allied IV Mathematics II	**Course Code: 417AP4/417AC4**
Semester: IV	**No. of Credits: 4**
No. of hours :90 (Total hours)	**C:T: 75:15**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

(C:Contact hours, T:Tutorial)

Course Objectives:

The objectives of this course are

- to analyze the various properties of curves using methods of calculus.
- to introduce different methods of solving ordinary and partial differential equations.
- to expose to the students the Laplace Transforms, its properties and its applications in physical and chemical sciences.
- to introduce the Fourier series and its various forms.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	understand the basic concepts of calculus.	U
CO2	find curvature of curves and distinguish the significance of curvature representation in different co-ordinate systems.	U

CO3	find the solution of higher order differential equations.	**A**
CO4	know about various methods of solving Partial differential equations.	**R**
CO5	acquire knowledge about the Laplace transforms and its inverse.	**R**
CO6	obtain the Fourier series for various function.	**A**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: 16 hrs

Calculus and Differential Geometry:

Curvature: Some important results – Radius of curvature in Cartesians – Centre and circle of curvature – Radius of Curvature in Polar Coordinates.

Evolutes, Involutes and Envelops: Evolutes and Involutes – Method to find the evolute of a given curve $y = f(x)$

Book 1 : Chapter 2, Chapter 3: Pages 345 - 351

Unit II 16 hrs

Ordinary Differential Equation: Linear equations of second and higher order.

Book 2 : Chapter 2

Unit III 15 hrs

Partial Differential Equation:

Partial Differential Equations: Introduction – Formation of differential equations – By the elimination of arbitrary constants – By the elimination of arbitrary functions – Solution of partial differential equations – To find the singular integral – To find the general integral – Methods to solve the first order partial differential equations – Type I. $F(p, q) = 0$ – Type II. Clairaut's Form. $z = px + qy + f(p, q)$ – Type III. $F(z, p, q) = 0$, $F(x, p, q) = 0$, $F(y, p, q) = 0$ – Lagrange's linear equation – Solution of the subsidiary equation by the method of multipliers.

Book 2: Chapter 1: Sections 1.1 - 1.7, 1.9 - 1.12, 1.15, 1.16

Unit IV 16 hrs

Laplace Transform:

Laplace Transforms: Definition – Laplace Transform of standard functions – Theorems (Statements only) –Inverse Laplace transforms – Problems.

Book 2: Chapter 1 (Related to the above topics): Pages 187 – 225

Unit V 15 hrs

Fourier Series and its Applications:

Fourier Series – Even and Odd functions – Half range series – Half range sine series – Half range Cosine series.

Book 3: Chapter 1: Pages 96 -145

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I	Mathematics for B.Sc.Br.–I, Second Semester, Volume II	P.Kandasamy and K.Thilagavathy	S.Chand and Company Pvt Ltd, First Edition Reprint 2015
II,III &IV	Mathematics for B.Sc.Br.–I, Third Semester, Volume III	P.Kandasamy and K.Thilagavathy	S.Chand and Company Pvt Ltd, First Edition Reprint 2015
I & V	Mathematics for B.Sc.Br.–I, Fourth Semester, Volume IV	P.Kandasamy and K.Thilagavathy	S.Chand and Company Pvt Ltd, First Edition 2005

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	Ancillary Mathematics Book II	S.Narayanan and T.K.Manicavasagam Pillay	S.Viswanathan (Printers & Publishers), Pvt. Ltd., Reprint - 2002.
2	Ancillary Mathematics, volume II	S.Arumugan, A.Thangapandi and Issac	New Gamma Publishing House, Palayamkottai, 2002.

Curriculum Design

Sri G.V.G Visalakshi College for Women (Autonomous)

Affiliated to Bharathiar University

Department of Mathematics

B.Sc Mathematics

Scheme of Examination – CBCS Pattern

(For the students admitted during the academic year 2017-2018 onwards)

Sem	Course Code	Course Title	Ins. Hrs/ Week	Examination				Credits
				Dur. Hrs	CIA Marks	ESE Marks	Total Marks	
I	**117TA1/ 117MY1/ 117HD1/ 117FR1**	**Part I** Language I	**6**	**3**	**25**	**75**	**100**	**4**
	117EN1	**Part II** English I	**6**	**3**	**25**	**75**	**100**	**4**
		Part III						
	117M01	Core I Algebra and Calculus	**5**	**3**	**25**	**75**	**100**	**4**
	117M02	Core II Differential Equations and Laplace Transforms	**5**	**3**	**25**	**75**	**100**	**4**
	117AM1	Allied I Physics I	**6**	**3**	**25**	**50**	**75**	**3**
	117EVS	**Part IV -** Environmental Studies	**2**	**2**	**50**	**-**	**50**	**2**
II	**217TA2/ 217MY2/ 217HD2/ 217FR2**	**Part I** Language II	**6**	**3**	**25**	**75**	**100**	**4**
	217EN2	**Part II** English II	**6**	**3**	**25**	**75**	**100**	**4**
		Part III						
	217M03	Core III Analytical Geometry	**5**	**3**	**25**	**75**	**100**	**4**
	217M04	Core IV Numerical Methods	**5**	**3**	**25**	**75**	**100**	**4**
	217AM2	Allied II Physics II	**4**	**3**	**25**	**50**	**75**	**3**
	217AMP	Allied Physics Practical	**2**	**3**	**20**	**30**	**50**	**2**
	217VEC	**Part IV-**Value Education	**2**	**2**	**50**	**-**	**50**	**2**

III	**317TA3/ 317MY3/ 317HD3/ 317FR3**	**Part I** Language III	**6**	**3**	**25**	**75**	**100**	**4**
	317EN3	**Part II** English III	**6**	**3**	**25**	**75**	**100**	**4**
		Part III						
	317M05	Core V Vector Calculus and Fourier Series	**3**	**3**	**25**	**50**	**75**	**3**
	317M06	Core VI Statics	**4**	**3**	**25**	**75**	**100**	**4**
	317AM3/ 317AM4	Allied III Principles of Accountancy/ Chemistry I	**6**	**3**	**25**	**75/50**	**100/75**	**4/3**
	317NMC	**Part IV-** NME – Basic Mathematics for Competitive Examinations	**2**	**2**	**50**	**-**	**50**	**2**
	317MS1	**Part IV-**Skill Enhancement Course I Graph Theory-I	**3**	**3**	**75**	**-**	**75**	**3**
IV	**417TA4/ 417MY4/ 417HD4/ 417FR4**	**Part I** Language IV	**6**	**3**	**25**	**75**	**100**	**4**
	417EN4	**Part II** English IV	**6**	**3**	**25**	**75**	**100**	**4**
		Part III						
	417M07	Core VII Discrete Mathematics	**3**	**3**	**25**	**50**	**75**	**3**
	417M08	Core VIII Dynamics	**4**	**3**	**25**	**75**	**100**	**4**
	417AM5/ 417AM6	Allied IV Mathematical Statistics/ Chemistry II	**6/4**	**3**	**25**	**75/50**	**100/75**	**4/3**
	417AMP	Allied Chemistry Practical	**2**	**3**	**20**	**30**	**50**	**2**
	417NGA	**Part IV-**General Awareness and Information Security	**2**	**2**	**100**	**-**	**100**	**2**
	417MS2	**Part IV-** Skill Enhancement Course II Graph Theory-II	**3**	**3**	**75**	**-**	**75**	**3**
	417MA1/ 417MA2	**Advanced Learners Courses – I** Combinatorics / Statistical Quality Control	**-**	**3**	**-**	**100**	**100**	**4***
V	**517M09**	**Part III** Core IX Real Analysis I	**6**	**3**	**25**	**75**	**100**	**4**
	517M10	Core X Complex Analysis I	**5**	**3**	**25**	**75**	**100**	**4**
	517M11	Core XI Abstract Algebra	**5**	**3**	**25**	**75**	**100**	**4**
	517M12	Core XII Group Project	**5**	**-**	**50**	**50**	**100**	**4**

	517ME1 & 517MP1/	Elective I	Theory	**4**	**3**	**15**	**35**	**50**	**3**
			Practicals	**2**	**3**	**15**	**35**	**50**	**1**
	517ME2	Elective I		**6**	**3**	**25**	**75**	**100**	**4**
	517MS3	**Part IV -** Skill Enhancement Course III Scilab		**3**	**3**	**75**	**-**	**75**	**3**
VI	**617M13**	**Part III** Core XIII Real Analysis II		**5**	**3**	**25**	**75**	**100**	**4**
	617M14	Core XIV Complex Analysis II		**5**	**3**	**25**	**75**	**100**	**4**
	617M15	Core XV Linear Algebra		**5**	**3**	**25**	**75**	**100**	**4**
	617ME3/ 617ME4/ 617ME5/ 617ME6	Elective II		**6**	**3**	**25**	**75**	**100**	**4**
		Elective III		**6**	**3**	**25**	**75**	**100**	**4**
	617MS4	**Part IV-** Skill Enhancement Course IV Internship / Summer Training		**3**	**-**	**75**	**-**	**75**	**3**
	617EX1/ 617EX2/ 617EX3/ 617EX4/ 617EX5	**Part V-** Extension activity NCC / NSS / YRC / RRC / Games		**-**	**-**	**50**	**-**	**50**	**2**
	617MA3/ 617MA4	**Advanced Learners Courses – II** Mathematics in Insurance/ Introduction to Wavelet theory		**-**	**3**	**-**	**100**	**100**	**4***
		Total						**3500**	**140**

***Starred credits are treated as additional credits (Optional)**

List of Electives:

Semester V-Elective-I

517ME1- Programming in C(Theory)
517MP1- Programming in C Practicals
517ME2- Number Theory

Semester VI- Elective-II / III

617ME3 - Operations Research
617ME4 - Mathematical Cryptography
617ME5 - Fuzzy and Intuitionistic fuzzy sets
617ME6 - Astronomy

Employability Courses

B.Sc Mathematics

Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Core IX Real Analysis I	**Course Code: 517M09**
Semester: V	**No. of Credits: 4**
No. of hours :90 (Total hours)	**C:T: 75:15**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

(C:Contact hours, T:Tutorial)

Course Objectives:

The objectives of this course are

- to provide a smooth transition from elementary calculus to advanced topics in the theory of real variables.
- to apply the concepts of calculus to geometrical and physical problems in higher dimensional spaces.
- to expose the properties of limit and continuity which are indispensable to the study of subjects such as optimization theory.
- to impart adequate knowledge about functional relationships between the variables which have more applications in expressing the laws of physics, chemistry, mechanics etc.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	apply the properties of real numbers.	**A**
CO2	acquire the knowledge of sets, relations and functions.	**R**
CO3	classify the countable, uncountable, open, closed and compact sets.	**U**
CO4	interpret the properties of sets in Metric spaces.	**U**
CO5	analyse the nature of sets under limits and continuity.	**A**
CO6	identify the relation between completeness and compactness of sets in metric space.	**R**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I:	**16 hrs**

The real and complex number systems: Introduction – The field axioms – The order axioms – Geometric representation of real numbers – Intervals – Integers – The unique factorization theorem for integers – Rational numbers – Irrational numbers – Upper bounds, maximum element, least upper bound – The completeness axiom – Some properties of the supremum – Properties of the integers deduced from the completeness axiom – The Archimedean property of the real number system – Rational numbers with finite decimal representation – Finite decimal approximations to real numbers – Infinite decimal

representation of real numbers – Absolute values and the triangle inequality – The Cauchy-Schwarz inequality – Plus and minus infinity and the extended real number system R – Simple problems.

Chapter 1: Sections 1.1 - 1.20

Unit II **16 hrs**

Some basic notations of set theory: Introduction – Notations – Ordered pairs – Cartesian product of two sets – Relations and functions – Further terminology concerning functions – One to one functions and inverses – Composite functions Sequences – Similar sets – Finite and infinite sets – Countable and uncountable sets – Uncountability of the real number system – Set algebra – Countable collections of countable sets – Simple problems.

Chapter 2: Sections 2.1 - 2.15

Unit III **16 hrs**

Elements of point set Topology: Introduction – Euclidean space R^n – Open balls and open sets in R^n – The structure of open sets in R^1 – Closed sets – Adherent points, Accumulation points – Closed sets and adherent points – The Bolzano-Weierstrass theorem – The Cantor intersection theorem.

Chapter 3: Sections 3.1 - 3.9

Unit IV **15 hrs**

Elements of point set Topology: The Lindel of covering theorem – The Heine-Borel covering theorem – Compactness in R^n – Metric Spaces – Point set Topology in metric spaces – Compact subsets of a metric space – Boundary of a set – Simple problems.

Chapter 3: Sections 3.10 - 3.16

Unit V **15 hrs**

Limits and Continuity: Introduction – Convergent sequences in a metric space – Cauchy sequences – Complete metric spaces – Limit of a function – Limits of complex-valued functions – Limits of vector valued functions – Continuous functions – Continuity of composite functions – Continuous complex valued and vector valued functions – Examples of continuous functions – Continuity and inverse images of open or closed sets – Functions continuous on compact sets – Topological mappings – Bolzano's theorem.

Chapter 4: Sections 4.1 - 4.15

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-V	Mathematical Analysis	Tom M.Apostol	Narosa Publishing House, Second Edition, Twentieth Reprint 2002.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Principles of Mathematical Analysis	Walter Rudin	McGraw Hill, Third Edition, 1976.
2.	Source book on Real Analysis part I	M.S.Rangachari	New Century Book House (P) Ltd, 1996
3.	Modern Analysis	Arumugam, Isaac	New Gamma Publishing House, 1994

Mathematics

Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Core X Complex Analysis I	**Course Code: 517M10**
Semester: V	**No. of Credits: 4**
No. of hours : 75 (Total hours)	**C:T: 65:10**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

(C: Contact hours, T:Tutorial)

Course Objectives:

The objectives of this course are

- to enable the students to understand the important concepts such as continuity, differentiability and analyticity of complex function with appropriate illustrations.
- to introduce analytic functions and its properties in the complex plane
- to impart adequate knowledge about power series in complex plane.
- to study about the elementary transformations

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	specify the geometric properties of the complex number system.	**R**
CO2	analyze differentiability of complex functions in various domains.	**A**
CO3	identify analytic and harmonic functions.	**R**
CO4	derive and apply bilinear transformations and cross ratio.	**A**
CO5	examine the convergence of power series.	**A**
CO6	express exponential, trigonometric, hyperbolic and logarithmic functions in terms of power series	**U**
CO7	describe the transformation of various curves and regions in the complex plane under elementary analytic functions.	**A**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I:	**13 hrs**
Complex Numbers: Introduction – Complex Numbers – Conjugation and Modulus –	

Inequalities – Square Root – Geometrical Representation of Complex Numbers – n^{th} Roots of Complex Numbers – Circles and Straight Lines – Regions in the Complex Plane – The Extended Complex Plane.

Chapter 1: Sections 1.0 - 1.9

Unit II **13 hrs**

Analytic Functions: Introduction – Functions of a Complex variable – The Cauchy-Riemann Equations – Analytic Functions – Harmonic Functions – Conformal mapping.

Chapter 2: Sections 2.0, 2.1, 2.6 - 2.9

Unit III **13 hrs**

Bilinear transformations: Introduction – Elementary Transformations – Bilinear Transformations – Cross Ratio – Fixed points of Bilinear Transformations – Some special Bilinear Transformations.

Chapter 3: Sections 3.0 - 3.5

Unit IV **13 hrs**

Power Series: Introduction – Sequences and Series – Sequences and Series of Functions – Power Series–Elementary Functions.

Chapter 4: Sections 4.0 - 4.4

Unit V **13 hrs**

Mapping by Elementary Functions: Introduction – The Mappings $\omega = z^2$, $\omega = z^n$ where n is a positive integer, $\omega = e^z$, $\omega = \sin z$, $\omega = \cos z$, $\omega = \cosh z$, $\omega = \frac{1}{2}\left(z + \frac{1}{z}\right)$.

Chapter 5: Sections 5.0 - 5.7

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V	Complex Analysis	S.Arumugam, A.Thangapandi Isaac, A.Somasundaram	Scitech publications (India) Pvt ltd, Reprint 2012

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Complex Analysis	V.Karunakaran	Narosa Publishing House, 2002.
2.	Complex Analysis	P.Duraipandian, Laxmi Duraipandian and D.Muhilan	Emerald publishers, Revised edition Reprint 2006

Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Core XI Abstract Algebra	**Course Code: 517M11**
Semester: V	**No. of Credits: 4**
No. of hours :75 (Total hours)	**C:T: 65:10**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

(C:Contact hours, T:Tutorial)

Course Objectives:

The objectives of this course are

- to introduce the basics of group theory.
- to relate different algebraic structures like rings, fields and ideals.
- to gain deep knowledge in the structure preserving mappings like homomorphism, isomorphism etc.
- to possess deep knowledge in the field of quotients of an integral domain and Euclidean rings

Course Outcomes: On completion of the Course the student will be able to

CO	**Statement**	**Bloom's Taxonomy level**
CO1	acquire knowledge about mapping and Euclidean algorithm.	**R**
CO2	acquire knowledge about the concept of rings and their basic properties.	**R**
CO3	classify the properties of different algebraic structures.	**U**
CO4	characterize the mappings between algebraic structures.	**A**
CO5	discuss the structure preserving mappings like homomorphism, isomorphism etc. .	**U**
CO6	solve the problems related to algebraic structures.	**A**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I:	**13 hrs**
Preliminary Notions: Mappings – The integers (unique factorization theorem statement only). **Group Theory**: Definition of a Group – Some Examples of Groups – Some preliminary Lemmas – Sub groups – Simple problems. Chapter 1: Sections 1.2, 1.3, Chapter 2: Sections 2.1 - 2.4	

Unit II	**13 hrs**
Group Theory: A Counting principle – Normal subgroups and quotient groups – Homomorphisms – Simple problems. Chapter 2: Sections 2.5 - 2.7	
Unit III	**13 hrs**

Group theory: Automorphisms – Cayley's theorem – Permutation groups – Simple problems. Chapter 2: Sections 2.8 - 2.10

Unit IV	**13 hrs**
Ring Theory: Definitions and examples of rings – Some special classes of rings – Homomorphisms – Ideals and quotient rings – Simple problems. Chapter 3: Sections 3.1 - 3.4	

Unit V	**13 hrs**
Ring Theory: More ideals and quotient rings – The field of quotients of an integral domain –Euclidean rings – Simple problems. Chapter 3: Sections 3.5 - 3.7	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I- V	Topics in Algebra	I.N. Herstein	Wiley India pvt limited, Second Edition Reprint 2015.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Basic Abstract Algebra	P.B.Bhattacharya, S.k.Jain, S.R.Nagpoul	Cambridge University press, Second Edition, Reprint 2004.
2.	A First Course in Abstract Algebra	John B. Fraleigh	Addition Wesley Publishing Company, Fifth printing 2003

B.Sc Mathematics

Semester VI

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Core XIII Real Analysis II	**Course Code: 617M13**
Semester: VI	**No. of Credits: 4**
No. of hours :75 (Total hours)	**C:T: 65:10**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

(C:Contact hours, T:Tutorial)

Course Objectives:

The objectives of this course are

- to impart knowledge and understanding in the advanced topics such as Riemann-Stieltjes integral, Functions of bounded variables.
- to study derivatives of higher dimensional spaces.
- to extend the mean value theorem and Taylor's formula for higher dimensional spaces which have many applications in optimization theory.
- to know the applications of the ideas that are being studied in differentiation to integral equations, differential equations and function spaces.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	explain and illustrate the connectedness of metric spaces and its relation to continuity of functions.	**U**
CO2	describe the concept of uniform continuity and compact sets.	**U**
CO3	gain a complete knowledge of derivatives and apply them appropriately .	**A**
CO4	analyze various properties of monotonic functions and functions of bounded variation.	**A**
CO5	recognize the impact of monotonicity and bounded variation in Riemann- Stieltjes Integral.	**R**
CO6	relate upper and lower integrals with Riemann- Stieltjes Integral.	**R**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I:	**13 hrs**

Limits and Continuity: Connectedness – Components of a metric space – Arcwise connectedness – Uniform continuity – Uniform continuity and compact sets – Fixed point theorem for contractions – Discontinuities of real valued functions – Monotonic functions – Simple problems.

Chapter 4: Sections 4.16 - 4.23

Unit II	**13 hrs**

Derivatives: Introduction – Definition of derivative – Derivatives and continuity – Algebra of derivatives – The chain rule – One sided derivatives and infinite derivatives – Functions with nonzero derivative – Zero derivatives and local extrema – Rolle's theorem – The Mean–Value theorem for derivatives – Intermediate value theorem for derivatives – Taylor's formula with remainder – Simple problems.

Chapter 5: Sections 5.1 - 5.12

Unit III	**13 hrs**

Functions of bounded variation and Rectifiable curves: Introduction – Properties of Monotonic functions – Functions of bounded variation – Total Variation – Additive property of Total Variation – Total Variation on [a, x] as a function of x – Functions of bounded variation expressed as the difference of increasing functions – Continuous functions of bounded variation.

Chapter 6: Sections 6.1 - 6.8

Unit IV	**13 hrs**

The Riemann-Stieltjes integral: Introduction – Notation – The definition of the Riemann-Stieltjes integral – Linear Properties – Integration by parts – Change of Variable in a Riemann-Stieltjes integral – Reduction to a Riemann integral – Step functions as integrators – Reduction of a Riemann-Stieltjes integral to a finite sum – Euler's summation formula –

Simple problems. Chapter 7: Sections 7.1 - 7.10

Unit V	**13 hrs**
The Riemann-Stieltjes integral: Monotonically increasing integrators. Upper and Lower integrals – Additive and linearity properties of upper and lower integrals – Riemann's condition – Comparison theorems – Integrators of bounded variation – Sufficient conditions for existence of Riemann-Stieltjes integral – Necessary conditions for existence of Riemann-Stieltjes integral – Simple problems. Chapter 7: Sections 7.11 - 7.17	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Mathematical Analysis	Tom M.Apostol	Narosa Publishing House, Second Edition, Twentieth Reprint 2002.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	Principles of Mathematical Analysis	Walter Rudin	McGraw Hill, Third Edition, 1976.
2	Source book on 'Real Analysis part I	M.S.Rangachari	New Century Book House (P) Ltd, 1996
3	Source book on 'Real Analysis part II	G.Rangan	New Century Book House (P) Ltd, 1998

B.Sc Mathematics

Semester VI

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Core XIV Complex Analysis II	**Course Code: 617M14**
Semester: VI	**No. of Credits: 4**
No. of hours : 75 (Total hours)	**C:T: 65:10**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

(C:Contact hours, T:Tutorial)

Course Objectives:

The objectives of this course are

- to comprehend the fundamental concepts of complex analysis.
- to apply the techniques of complex analysis to problems in mathematics and physics.
- to examine the analytic functions of complex variables which are closely connected in solving Laplace equation, to which numerous problems of mechanics and physics reduce.
- to apply residues in evaluating integrals.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level

CO1	understand the basic idea of complex integration.	**U**
CO2	derive and apply various Cauchy's integral formulae.	**A**
CO3	express a given function as a power series in the defined region.	**U**
CO4	identify and classify the singular points and the behaviour of a function in the neighbourhood of a singular point.	**R**
CO5	acquire knowledge about the residue of a function and various methods to find the same.	**A**
CO6	derive and apply Cauchy residue theorem to evaluate certain types of real definite integrals.	**A**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I:	**13 hrs**
Complex Integration: Introduction – Definite integral – Cauchy's Theorem. Chapter 6: Sections 6.0 - 6.2	

Unit II	**13 hrs**
Complex Integration: Cauchy's Integral Formula – Higher Derivatives. Chapter 6: Sections 6.3 and 6.4	

Unit III	**13 hrs**
Series Expansions: Introduction – Taylor's Series – Laurent's Series. Chapter 7: Sections 7.0 - 7.2	

Unit IV	**13 hrs**
Series Expansions: Zeros of an Analytic function – Singularities. **Calculus of Residues:** Introduction – Residues. Chapter 7: Sections 7.3 and 7.4. Chapter 8: Sections 8.0 and 8.1	

Unit V	**13 hrs**
Calculus of Residues: Cauchy's Residue Theorem – Evaluation of Definite Integrals. Chapter 8: Sections 8.2 and 8.3	

Book for study:

Unit	**Name of the Book**	**Authors**	**Publishers with Edition**
I -V	Complex Analysis	S.Arumugam, A.Thangapandi Isaac, A.Somasundaram	Scitech publications (India) Pvt ltd, Reprint 2012

Books for Reference:

S.No	**Name of the Book**	**Authors**	**Publishers with Edition**
1	Complex Analysis	V.Karunakaran	Narosa Publishing House, 2002.

2	Complex Analysis	P.Duraipandian, Laxmi Duraipandian and D.Muhilan	Emerald publishers, Revised edition Reprint 2006

B.Sc Mathematics
Semester VI
(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Core XV Linear Algebra	**Course Code: 617M15**
Semester: VI	**No. of Credits: 4**
No. of hours :75 (Total hours)	**C:T: 65:10**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

(C:Contact hours, T:Tutorial)

Course Objectives:

The objectives of this course are

- to introduce a new algebraic structure, vector space and its concepts, like linear dependence, basis, dimension etc., which have wide applications in many branches of mathematics.
- to distinguish various algebraic structures.
- to introduce many types of matrices which are useful for representing problems in an efficient way.
- to infer the relationship between the linear transformation in vector spaces and matrices.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	find basis, linear independence and dimension in a vector space.	**U**
CO2	relate the concept of dual space and the notion of an inner product space.	**R**
CO3	identify the algebra of linear transformations and the matrix of a linear transformation.	**R**
CO4	acquire knowledge about the types of linear transformations and their properties.	**A**
CO5	discuss about the types of matrices	**U**
CO6	apply the concept of characteristic roots and characteristic vectors of a square matrix.	**A**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I:	**13 hrs**
Vector Spaces and Modules: Elementary basic concepts – Linear Independence and bases – Simple problems. Book 1: Chapter 4: Sections 4.1 and 4.2	

Unit II	**13 hrs**
Vector Spaces and Modules: Dual spaces – Inner product spaces – Simple problems. Book 1: Chapter 4: Sections 4.3 and 4.4	

Unit III	**13 hrs**
Linear Transformations: The Algebra of Linear Transformations – Characteristic Roots – Matrices – Simple problems. Book 1: Chapter 6: Sections 6.1 - 6.3	

Unit IV	**13 hrs**
Linear Transformations: Hermitian, Unitary and Normal Transformations – Simple problems. Book 1: Chapter 6: Section 6.10	

Unit V	**13 hrs**
Matrices: Symmetric and Skew-Symmetric matrices – Hermitian and Skew-Hermitian matrices – Orthogonal and Unitary matrices. **Linear Transformations of Vector spaces:** Characteristic Roots and Characteristic Vectors of a square matrix– Simple problems. Book 2: Chapter 1: Sections 1.7 - 1.9. Chapter 3: Section 3.9	

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - IV	Topics in Algebra	I.N. Herstein	Wiley India Pvt limited, Second Edition Reprint 2015.
V	A Text Book of Modern Algebra	R. Balakrishnan and N. Ramabhadran	Vikas Publishing House Pvt Ltd, Third edition, 1979.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	Modern Algebra	Surjeet Singh and Qazi Zameerudin	Vikas Publishing House, Third Edition, 1979.
2	A Text book in Modern Algebra	R.S. Aggarwal	S.Chand and company Ltd, New Delhi, 1996.
3	Linear Algebra Theory & Applications	Ward Cheney, David Kincaid	Raj Press, New Delhi, Second Edition

Entrepreneurship Courses

B.Sc. Mathematics

Semester VI

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Elective II Operations Research	**Course Code: 617ME3**
Semester: VI	**No. of Credits: 4**
No. of hours : 90 (Total hours)	**C:T: 75:15**
CIA Max. Marks: 25	**ESE Max. Marks:75**

(C:Contact hours, T:Tutorial)

Course Objectives:

The prime objectives for introducing this course are:

- to gain knowledge on techniques for solving linear programming problem.

- to identify the optimum allocation of resources to respective destination.
- to assign suitable resources to respective jobs.
- to apply optimization in networks.
- to develop knowledge in basic techniques to deal with inventory

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	recall the basic concepts of Linear Programming Problems and solve them	**A**
CO2	explain the concept of Duality and its applications	**R**
ÇO3	minimize the cost in transportation problems and assignment problems	**A**
CO4	determine the appropriate order for a series of jobs to be done on a finite number of service facilities	**U**
CO5	apply the optimization techniques in inventory control.	**A**
CO6	demonstrate the applications of various optimization tools to the real life problems involving networks.	**A**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I	**15 hrs**
Linear Programming Problem – Graphical solution and Extension: Introduction – Graphical solution method – Some exceptional cases – General linear programming problem – Canonical and standard forms of L.P.P. **Linear programming problem – Simplex method**: Introduction – Fundamental properties of solutions – The computational procedure – Use of artificial variables. Chapter 3: Sections 3.1 - 3.5, Chapter 4: Sections 4.1 - 4.4	

Unit II	**15 hrs**
Duality in Linear Programming: Introduction – General Primal-Dual pair – Formulating a dual problem – Primal-Dual pair in matrix form – Duality and Simplex method. **Transportation Problem**: Introduction – LP formulation of the transportation problem – Existence of Solution in T.P – Duality in transportation problem – The transportation table – Loops in transportation tables – Triangular basis in a T.P – Solution of a transportation problem – Finding an initial basic feasible solution – Test for optimality – Economic Interpretation of u_j's and v_j's – Degeneracy in transportation problem – Transportation algorithm [MODI method]. **Assignment Problem**: Introduction – Mathematical formulation of the problem – Solution Methods of Assignment Problem. Chapter 5: Sections 5.1 - 5.4, 5.7 Chapter 10: Sections 10.1 - 10.13 Chapter 11: Sections 11.1 - 11.3	

Unit III	15 hrs
Sequencing Problem : Introduction-Problem of Sequencing-Basic terms used in Sequencing- Processing n jobs through two machines- Processing n jobs through k machines – Processing 2 jobs through k machines. Chapter 12: Sections 12.1 -12.6	

Unit IV	15 hrs
Inventory Control – I: Introduction – Types of Inventories – Reasons for carrying Inventories – The inventory decisions – Objectives of Scientific Inventory Control – Costs associated with inventories – Factors affecting inventory control – An Inventory Control Problem – The Concept of EOQ – Deterministic inventory problems with No shortages – Deterministic inventory problems with shortages – Problems of EOQ with Price Breaks. Chapter 19: Sections 19.1 - 19.12	
Unit V	**15 hrs**
Network Scheduling by PERT/CPM: Introduction – Network: Basic Components – Logical Sequencing – Rules of Network Construction – Concurrent Activities – Critical path analysis – Probability considerations in PERT – Distinction between PERT and CPM. Chapter 25: Sections 25.1 - 25.8	

Note: Only Statement of the theorems and Algorithms are included.

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V	Operations Research	Kanti Swarup, P.K Gupta, Man Mohan	Sultan Chand & Sons, New Delhi, Eighteenth Edition, 2015.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	Operations Research: Theory and Applications	J.K.Sharma	MacMillan India Ltd, Fourth Edition, 2010.
2	Operations Research: An Introduction	Hamdy A. Taha	Pearson India Pvt Ltd, 2016.

B.Sc Mathematics

Semester VI

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Elective II / III - Fuzzy and Intuitionistic Fuzzy Sets	Course Code: 617ME5
Semester: VI	**No. of Credits: 4**
No. of hours : 90 (Total hours)	**C:T:75:15**
CIA Max. Marks: 25	**ESE Max. Marks:75**

(C:Contact hours, T:Tutorial)

Course Objectives:

The objectives of this course are

- to introduce the concept of fuzziness.

- to give knowledge about applications of Fuzzy logic.
- to enable the students to apply the soft computing methodologies in their fields of work.
- to introduce the Intuitionistic fuzzy sets and their properties.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	compare fuzzy sets with crisp sets.	**U**
CO2	acquire knowledge about the fuzzy logic and defuzzification methods and apply them.	**A**
CO3	acquire knowledge about Genetic Algorithms.	**R**
CO4	express the given system using associative memories.	**U**
CO5	explain the concepts of Intuitionistic fuzzy sets and its basic properties.	**U**
CO6	apply the methods of fuzzy sets and fuzzy logic in fuzzy control systems.	**A**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I	**15 hrs**
Fuzzy Set Theory: Fuzzy versus Crisp – Crisp sets – Fuzzy sets – Crisp relations – Fuzzy relations. Book 1: Chapter 6	

Unit II	**15 hrs**
Fuzzy Systems: Crisp Logic – Predicate Logic – Fuzzy Logic – Fuzzy Rule based system Defuzzification Methods – Applications. Book 1: Chapter 7	

Unit III	**15 hrs**
Fundamentals of Genetic Algorithms: **Genetic Algorithms**: History – Basic concepts Creation of offsprings – Working Principle – Encoding – Fitness function. Book 1: Chapter 8: Sections 8.1 – 8.6	

Unit IV	**15 hrs**
Fuzzy Associative Memories: FAM – An Introduction – Single Association FAM – Fuzzy Hebb FAMs – FAM Involving a Rule Base – FAM Rules with Multiple Antecedents/Consequents – Applications. Book 1: Chapter 14	

Unit V	**15 hrs**

Intuitionistic fuzzy sets: Definition of the concept of an Intuitionistic fuzzy set– An Example – Operations and Relations over Intuitionistic fuzzy sets. Properties (upto Proposition 1.13) Book 2: Chapter 1: Sections 1.1 - 1.2

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - IV	Neural Networks, Fuzzy Logic, and Genetic Algorithm: Synthesis and Applications	S.Rajasekaran, and G.A.Vijayalakshmi Pai	PHI Learning Pvt. Ltd, New Delhi, 2010
V	Intuitionistic fuzzy sets, Theory and Applications	Krassimir T.Atanassov	Physica - Verlag Heidelberg, New York, 1999

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	Fuzzy Logic with Engineering Applications	Timothy, J.Ross	McGraw Hill, 1997

Skill Development Courses

B.Sc Mathematics

Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III - Core XII Group Project	**Course Code: 517M12**
Semester: V	**No. of Credits: 4**
No. of hours :75 (Total hours)	**P:T:65:10**
CIA Max. Marks: 50	**ESE Max. Marks: 50**

(P:Project hours, T:Tutorial)

Preamble:

This course is offered with an intention of promoting knowledge sharing and team work. It enables the students to communicate and share their expertise to enhance their Skills. Students are motivated to take up interdisciplinary projects to learn and analyse the application of mathematics in various disciplines like Physics, Chemistry, Biosciences and Social sciences.

Course Objectives: Objectives of this course are

- to develop teamwork.
- to enhance communicative capabilities.
- to provide foundation for creativity and research.
- to manage a given task efficiently in the stipulated time.

Course Outcomes: On completion of the course the student will be able to

CO	Statement	Bloom's Taxonomy level

CO1	collaborate and cooperate among themselves to execute the task.	**U**
CO2	develop communication and teamwork skills.	**R**
CO3	pool their expertise, knowledge and skills and complete the tasks.	**A**
CO4	effectively manage time, execute the plan and integrate various activities	**A**
CO5	break down a complex problem into simple components and determine solutions for the same.	**A**
CO6	prepare and present the report of the project in an organized manner.	**A**

B.Sc Mathematics

Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III – Elective I Number Theory	**Course Code: 517ME2**
Semester: V	**No. of Credits: 4**
No. of hours :90 (Total hours)	**C:T: 75:15**
CIA Max. Marks: 25	**ESE Max. Marks: 75**

(C:Contact hours, T:Tutorial)

Course Objectives:

The objectives of this course are

- to impart the basic knowledge about number theoretic concepts.
- to improve problem solving ability related to number theory.
- To enable the students to construct mathematical proofs and to provide counter examples.
- to make students familiar with basic properties and techniques of finite fields and their application to cryptography and coding theory.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	know about the basic concepts of numbers.	**R**
CO2	understand the origin of the operations of integers and algorithms relevant to it.	**U**
CO3	identify all prime numbers in a given range using the sieve of Eratosthenes.	**R**
CO4	solve congruences	**A**
CO5	test primitive roots.	**A**
CO6	apply number theory in cryptography.	**A**

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I:	**15 hrs**
Natural Numbers : Peano's axioms – Mathematical induction – Addition and	

Multiplication – order relation – Principle of well ordering. **Integers :** Addition and Multiplication – Positive and Negative integers – Trichotomy law – Absolute value – Binomial Theorem. **Divisibility :** Associates – Division Algorithm – GCD (HCF) – Euclidean Algorithm – L.C.M.- Worked Examples

Chapters 1, 2, 3

Unit II **15 hrs**

Prime and Composite Numbers : Sieve of Eratosthenes – Euclid's Theorem – Unique factorization – Fundamental theorem of Arithmetic – Postional representation of integers – number of divisors – Sum of divisors – Symbols d(n), $\sigma(n)$ – Arithmetic functions – Perfect Numbers. Related Problems in Examples 7 and 8.

Chapter 4: Pages 61 - 84

Unit III **15 hrs**

Congruences : Definition – Residue classes – Complete and least residue systems – Reduced residue systems – Casting out 9 – Magic Numbers – Divisibility tests – Linear Congruences – Solution of Congruences – Chinese Remainder Theorem. Related Problems in Examples 15 - 19.

Chapter 6

Unit IV **15 hrs**

Theorems of Fermat and Wilson : Little's Fermat's Theorem – Euler's extension – inverse modulo – Wilson's Theorem and its converse. Related Problems in Examples 20 -22.

Chapter 7: Pages 208 - 235

Unit V **15 hrs**

Primitive Roots : Exponent of an integer – Primitive roots – Number of Primitive roots – 1, 2, 4, p^{α}, $2p^{\alpha}$ alone have primitive roots – Test for primitive roots – Legendre theorem. Related Problems in Examples 26 and 27.

Chapter 9: Pages 274 - 303

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I -V	Elements of Number Theory	Kumaravelu and Susheela Kumaravelu	First Edition January 2002

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Elementary Number Theory	David M.Burton	McGraw Hill Education (India) Private Limited, Seventh Edition Eleventh reprint, 2015.

2.	An Introduction to Theory of Numbers	Ivan Niven and Herbert S. Zuckerman	Wiley Eastern Ltd, Fifth Edition, 2004 Reprint.

B.Sc Mathematics

Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part IV – Skill Enhancement Course III SCILAB	**Course Code: 517MS3**
Semester: V	**No. of Credits: 3**
No. of hours : 45 (Total hours)	**T:P:6:39**
CIA Max. Marks: 75	**ESE Max. Marks:-**

(T:Tutorial, P:Practical)

Course Objectives:

The objective of this course is to

- develop the logical and programming skills.
- provide hands on training in executing programs.
- gain skills to implement the algorithms.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	describe the basic features of the SCILAB software.	**R**
CO2	use basic structures to develop code in SCILAB to handle arrays and perform mathematical operations.	**U**
CO3	demonstrate appropriate use of graphical functions	**U**
CO4	apply the concept of structures and functions in establishing databases/ simple banking operations.	**A**
CO5	interpret and visualize application of mathematical concepts in application processing and numeric manipulations.	**A**
CO6	apply the working knowledge of SCILAB package to solve ODE's and LPP's.	**A**

R-Remembrance U –Understanding A-Apply

Syllabus:

Scilab – List of Programs	**39hrs**

1.Solving a system of linear Equations.
2.Arithmetic operations on arrays.
3.Drawing 2D and 3D plots.
4.Finding derivatives and integrals of polynomials.
5.Creating a structure for an employee data base containing employee code, name, designation and salary.
6.A function subprogram to calculate the compound interest, given the initial amount, time period of deposit, rate of interest and time of compounding.
7.Program to process the applications for admission to an engineering college and to list the candidates eligible for admission based on the following conditions:
(a) Marks in Mathematics ≥ 60

(b) Marks in Physics ≥ 55
(c) Marks in Chemistry ≥ 55
(d) Total marks ≥ 180

8.Program to reverse the digits of a number having minimum three digits.
9.Program to solve first order Ordinary Differential Equations (ODE's).
10. Solving Linear Programming Problem (LPP).

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Programming in Scilab	Vinu Dass	New Age International Private Ltd, New Delhi 2009

B.Sc Mathematics

Semester VI

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part IV-Skill Enhancement Course IV Internship / Summer Training	**Course Code: 617MS4**
Semester: VI	**No. of Credits: 3**
No. of hours : 45(Total hours)	**I:T:R: 30:6:9**
CIA Max. Marks: 75	

(I :IntershipTraining, T: Tutorial, R: Report)

Preamble:

Internship is intended to provide a proactive industry/ Subject oriented exposure at institutes of repute to the students so as to smoothly enter into a profession of their choice on completing their graduation. In this course students are expected to undergo intensive training in institutions for 30 hours, with a certification from the institute. It is followed by discussion with the faculty or other experts to prepare the reports. The reports are prepared and submitted for evaluation.

Course Objectives:

The objectives of this course are to

- enable the students to seek career alternatives before graduation.
- integrate theory and practice.
- realize their abilities in their field of study.
- inculcate work ethics and appropriate attitudes needed for a profession.
- improve communication, interpersonal and other professional skills.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	learn to use profession specific terminology.	**R**
CO2	effectively plan and utilize ICT tools to complete the task.	**U**
CO3	apply the knowledge acquired in the campus to the task.	**A**
CO4	demonstrate problem-solving and critical thinking skills.	**A**

CO5	exhibit appropriate workplace attitudes	**A**
CO6	manage and review their personal behavior and attitudes.	**U**

Curriculum Design
Sri G.V.G. Visalakshi College for Women (Autonomous)
Affiliated to Bharathiar University
M.Sc Mathematics
Scheme of Examination – OBE & CBCS Pattern
(For the students admitted from the academic year 2021-2022 onwards)

Sem	Course Code	Course Title	Ins. Hrs/ week	Examination				Credits
				Dur Hrs	CIA Marks	ESE Marks	Total Marks	
I	21MM01	Core I : Algebra	6	3	50	50	100	4
	21MM02	Core II : Real Analysis	6	3	50	50	100	5
	21MM03	Core III :Ordinary Differential Equations	6	3	50	50	100	4
	21MM04	Core IV : Advanced Operations Research	6	3	50	50	100	4
	21MME1/ 21MME2	Elective I: Differential Geometry/ Number Theory	6	3	50	50	100	4
II	21MM05	Core V: Complex Analysis	5	3	50	50	100	5
	21MM06	Core VI: Partial Differential Equations	6	3	50	50	100	4
	21MM07	Core VII: Special Functions	5	3	50	50	100	4
	21MM08	Core VIII: Numerical Analysis	6	3	50	50	100	4
	21MME3/ 21MME4	Elective II: Control Theory/ Stochastic Processes	6	3	50	50	100	4
	21MGCS	Cyber Security	2	2	50	-	50	Grade
	21MMA1/ 21MMA2	Advanced Learners Course I: LaTeX / Financial Mathematics	-	3	-	100	100	4*
III	21MM09	Core IX : Topology	5	3	50	50	100	5
	21MM10	Core X : Classical Mechanics	5	3	50	50	100	4
	21MM11	Core XI : Programming with C++	3	3	50	50	100	3
	21MMCP	Programming with C++ Practicals	3	3	50	50	100	1
	21MM12	Core XII : Mathematical Modelling	5	3	50	50	100	4

	21MME5/ 21MME6	Elective III : Graph Theory/ Coding Theory	6	3	50	50	100	4
	21MMIS	Internship /Summer School/Sports Training/Short term Course	-	-	50	-	50	2
	21MMPV	Project and Viva-Voce	3	-	-	-	-	-
IV	21MM13	Core XIII : Mathematical Methods	6	3	50	50	100	5
	21MM14	Core XIV : Functional Analysis	6	3	50	50	100	4
	21MM15	Core XV : Fluid Dynamics	6	3	50	50	100	4
	21MME7/ 21MME8	Elective IV: Statistical Methods / Transforms and Signals	6	3	50	50	100	4
	21MMPV	Project and Viva-Voce	6	-	100	100	200	8
	21MMA3/ 21MMA4/ 21MMA5	Advanced Learners Course II : Computational Mathematics Laboratory / Mathematical Biology/MOOC	-	3	-	100	100	4*
						Total	**2300**	**90**

*Starred credits are treated as additional credits which are optional.

Employability Courses

M. Sc. Mathematics
Semester I
[For the students admitted from the academic year 2021-2022 onwards]

Course: Core I Algebra	**Course Code: 21MM01**
Semester: I	**No. of Credits: 4**
No. of hours :75	**C:T:S: 52:10:13**
CIA Max. Marks: 50	**ESE Max. Marks: 50**

(C: Contact hours, T:Tutorial, S:Seminar)

Course Objectives:

- To study the advanced concepts in abstract which have wider applications in Higher analysis, Theory of numbers, Geometry etc., with the inclusion of Ring theory, Field theory etc., in the syllabi.
- To realize the importance of Sylow's theorem

- To understand and the fundamental theorem of Galois theory which speak more about the relation between the order of a group, its subgroups, prime numbers, fixed field of automorphisms of a field and splitting field.

Course Outcomes: On completion of the course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO 1	explain about another counting principle and three parts of Sylow's theorem	U
CO 2	use the properties on Polynomial rings over the rational field an commutative rings	U
ÇO 3	explain about extension fields and roots of polynomials	U
CO 4	describe the elements of Galois theory	U
CO 5	classify the properties of modules and finite fields	U

U –Understanding

Syllabus:

Unit I	13 hrs
Group Theory: Another Counting Principle – Sylow's Theorem - Direct Products. Chapter 2 (Sections 2.11 – 2.13)	

Unit II	13 hrs
Ring Theory: Polynomial Rings - Polynomials over the Rational Field--Polynomial Rings over Commutative Rings. Chapter 3 (Sections 3.9 – 3.11)	

Unit III	13 hrs
Fields: Extension Fields-– Roots of Polynomials- More about Roots. Chapter 5 (Sections 5.1, 5.3, 5.5)	

Unit IV	13 hrs
Fields: The Elements of Galois Theory Chapter 5 (Section 5.6)	

*Unit V	13 hrs
Vector Spaces and Modules: Modules -Selected Topics: Finite Fields Chapter 4 (Section 4.5) Chapter 7 (Section 7.1)	

Book for study:

Unit	Name of the Book	Authors	Publisher
I -V	Topics in Algebra	I.N.Herstein	Wiley Eastern Limited, Second Edition, Reprint2015.

Books for Reference:

S.No.	Name of the Book	Authors	Publisher
1.	A first course in Abstract Algebra	John B.Fraleigh	Addison-Wesley Publishing Company, Tenth printing, 2003.
2.	Modern Algebra	Surjeet singh and Quazi Zameeruddin	Vikas Publishing house Private Limited, Third Edition, 2005.

M. Sc. Mathematics

Semester I

[For the students admitted from the academic year 2021-2022 onwards]

Course: Core II Real Analysis	**Course Code: 21MM02**
Semester: I	**No. of Credits: 5**
No. of hours :75	**C:T:S : 52:10:13**
CIA Max. Marks: 50	**ESE Max. Marks: 50**

(C: Contact hours, T:Tutorial, S:Seminar)

Course Objectives:

- To extend the mean value theorem and Taylor's formula for higher dimensional spaces which have many applications in optimization theory.
- To provide the generalization of the study of derivatives to higher dimensional spaces.
- To study the Lebesgue integrals and General Lebesgue measure essential to solve problems in modern mathematics.

Course Outcomes: On completion of this Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	represent derivatives in higher dimensional space and derive their properties	U
CO2	intrepret the properties of measurable sets and measurable functions	A
CO3	study lebesgue integral of bounded functions	U
CO4	relate integrable functions and absolutely continuous functions with differentiation of an integral and functions of bounded variation respectively.	A
CO5	derive the results connecting measure spaces, measurable functions and signed measure	A

U –Understanding A-Apply

Syllabus:

Unit I	13hrs
Multivariable Differential calculus: Introduction – The directional derivative – Directional derivatives and continuity – The total derivative – The total derivative expressed in terms of partial derivatives – An application to complex-valued functions – The matrix of a linear function – The Jacobian matrix – The chain rule – Matrix form of the chain rule – The Mean-value theorem for differentiable functions – A sufficient condition for differentiability – A sufficient condition for equality of mixed partial derivatives Book I: Chapter 12 : Sections (12.1 – 12.13)	

Unit II	13 hrs
Lebesgue Measure: Introduction – Outer measure – Measurable sets and Lebesgue measure – A nonmeasurable set – Measurable functions – Littlewood's three Principles. Book II: Chapter 3 : Sections (1 - 6)	

Unit III	13 hrs
The Lebesgue Integral : The Riemann Integral – The Lebesgue integral of a bounded function over a set of finite measure – The integral of a nonnegative function – The general Lebesgue integral – Convergence in measure. Book II: Chapter 4: Sections (1 - 5)	

*Unit IV	13 hrs
Differentiation and Integration : Differentiation of monotone functions – Functions of bounded variation – Differentiation of an integral – Absolute Continuity. Book II : Chapter 5 : Sections(1 - 4)	

Unit V	13 hrs
Measure and Integration : Measure spaces – Measurable functions – General Convergence Theorems – Signed measure – The Radon – Nikodym Theorem. Book II: Chapter 11 : Sections (1,2,4 - 6)	

Books for study:

Units	Name of the Book	Author	Publisher
I	Mathematical Analysis	Tom M.Apostol	Narosa Publishing House, New Delhi, Second Edition, Twentieth Reprint – 2002.
II-V	Real Analysis	H.L.Royden	PHI Learning Private Limited Third Edition,Reprint 2009.

Books for Reference:

S.No	Name of the Book	Authors	Publisher
1	Measure Theory and Integration	G.de.Barra	Wiley Eastern Limited, 1981.

2	An Introduction to measure and Integration	Inder K.Rana	Narosa Publishing House, 2005.

M.Sc. Mathematics
Semester II
[For the students admitted from the academic year 2021-2022 onwards]

Course: Core V Complex Analysis	**Course Code: 21MM05**
Semester: II	**No. of Credits: 5**
No. of hours :75	**C:T:S:52:10:13**
CIA Max. Marks: 50	**ESE Max. Marks: 50**

(C:Contact hours, T:Tutorial, S:Seminar)

Course Objectives:

- To study complex line integrals and Cauchy's Theorem
- To introduce series and product developments and impart knowledge in the advanced topics such as Normal families and Conformal mappings
- To understand properties of Harmonic functions on a disc and concerned results
- To expose Elliptic functions
- To help the students to take up research activities in the field of complex analysis.

Course Outcomes: On completion of the course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO 1	explain the applications of analytic functions in the evaluation complex integrals and in Cauchy's theorem	U
CO 2	represent meromorphic functions using partial fractions and factorization	U
ÇO 3	describe equicontinuity and normality of families of analytic functions	U
CO 4	explain the properties of harmonic and subharmonic functions	U
CO 5	describe the properties of elliptic functions	U

U –Understanding

Syllabus:

Unit I	13 hrs
Complex Integration: Fundamental Theorems: Line Integrals – Rectifiable Arcs – Line Integrals as Functions of Arcs – Cauchy's Theorem for a Rectangle – Cauchy's Theorem in a Disk.-Harmonic Functions: Definition and Basic Properties – The Mean -value Property – Poisson's Formula – Schwarz's Theorem.	

Chapter 4 Sections (1.1-1.5, 6.1-6.4)

Unit II	13 hrs
Series and Product Developments: Partial fractions and Factorization: Partial Fractions – Infinite Products–Canonical Products. Entire functions :Jensen's Formula . Chapter 5 Sections (2.1-2.4, 3.1)	

Unit III	13 hrs
Series and Product Developments: Normal Families : Equicontinuity – Normality and Compactness – Arzela's Theorem – Families of Analytic Functions –The Classical Definition. Conformal mapping. Dirichlet's Problem: The Riemann Mapping Theorem: Statement and Proof- Boundary Behavior . Chapter 5 Sections (5.1- 5.5) Chapter 6 Sections (1.1- 1.4)	

Unit IV	13 hrs
Conformal Mapping. Dirichlet's Problem: A Closer Look at Harmonic Functions: Functions with the Mean-value Property – Harnack's Principle. The Dirichlet Problem: Subharmonic Functions – Solution of Dirichlet's Problem. Chapter 6 Sections (3.1, 3.2, 4.1, 4.2)	

*Unit V	13 hrs
Elliptic Functions: Simply Periodic Functions: Representation by Exponentials – The Fourier Development – Functions of Finite Order. Doubly Periodic Functions: The Period Module – Unimodular Transformations – The Canonical Basis – General Properties of Elliptic Functions.The Weierstrass Theory: The Functions $\zeta(z)$ and $\sigma(z)$- The Differential Equation. Chapter 7 Sections (1.1-1.3, 2.1-2.4, 3.1-3.3).	

Book for study:

Unit	Name of the Book	Authors	Publisher
I-V	Complex Analysis	Lars. V.Ahlfors	McGraw-Hill Education India Private Limited,New Delhi, Third Edition,Second Reprint 2013.

Books for Reference:

S.No.	Name of the Book	Authors	Publisher
1.	Complex Analysis	Serge Lang	Springer- Verlag New York, Third Edition 1993.
2.	Real and Complex analysis	Walter Rudin,	McGraw Hill Book Company, 7th reprint 2009.

M.Sc. Mathematics
Semester II
(For the students admitted from the academic year 2021-2022 onwards)

Course: Core VII Special Functions	**Course Code: 21MM07**
Semester: II	**No. of Credits: 4**
No. of hours :75	**C:T: S : 52:10:13**
CIA Max. Marks: 50	**ESE Max. Marks:50**

(C:Contact hours, T:Tutorial, S:Seminar)

Course objective :

- To give a thorough knowledge of special functions such as Legendre Polynomials, Bessel's functions, Hermite's Polynomial, Legurre and Chebychev Polynomials
- To facilitates the students to take up the SLET and NET examinations with confidence.
- To develop the mathematical models associated with real world problems.
- To the student will realize the importance of mathematics as a wonderful and power tools to better understand what he/she studies in other fields.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	obtain the general solution of Legendre's Equation, describe its properties, derive recurrence, Christoffel's and Rodrigue's formula and solve simple problems	A
CO2	derive the general solution of Hermite Polynomials, discuss its properties, and solve simple problems	U
CO3	solve Bessel's Equation, derive generating function, understand its properties obtain recurrence formula and solve simple problems	A
CO4	compute the general solution of Leguerre Polynomials, discuss its properties, and solve simple problems	U
CO5	find the solution of Chebyshev Polynomials, derive generating function, understand its properties and solve simple problems	A

U –Understanding A-Apply

Syllabus

Unit I:	13 hrs
Legendre's Equation: Legendre's Equation-Solution of Legendre's Equation-Definition of $P_n(x)$ and $Q_n(x)$ – General solution of Legendre's Equation – To show that $P_n(x)$ is the co-efficient of h^n in the expansion of $(1-2xh+h^2)^{-1/2}$ – Laplace's Definite Integral for $P_n(x)$ – Orthogonal properties of Legendre's polynomials – Recurrence formulae – Beltrami's Results – Christoffel's	

Expansion - Christoffel's Summation formula – Rodrigue's formula – Even and odd functions.
Chapter 2 (2.1-2.13).

Unit II	13 hrs

Bessel's Equation: Bessel's Equation(Def.) – Solution of Bessel's general differential equation – General solution of Bessel's Equation - Integration of Bessel's Equation in series for n = 0 – Definition of $J_n(x)$ – Recurrence formulae for $J_n(x)$ – Generating function $J_n(x)$ – A second solution of Bessel's equation.
Chapter 5.

*Unit III	13 hrs

Hermite Polynomials: Hermite Differential Equation – Solution of Hermite's equation – Hermite's Polynomials – Generating Function – Other forms for the Hermite Polynomial – To find first few Hermite polynomials – Orthogonal Properties of Hermite polynomials – Recurrence formulae for Hermite Polynomials.
Chapter 6.

Unit IV	13 hrs

Laguerre Polynomials: Laguerre's Differential equation – Solution of Laguerre's equation – Laguerre Polynomials – Generating function – Other forms for the Laguerre Polynomials – To find first few Laguerre polynomials – Orthogonal property of Laguerre Polynomials – Recurrence formulae for Laguerre Polynomials – Associated Laguerre's Equation – If v is a solution of Laguerre's equation of order n+α then $\frac{d^{\alpha}v}{dx^{\alpha}}$ satisfies Laguerre's associated equation – Associated Laguerre's Polynomials (Def.) – Associated Laguerre's Polynomials $L_n{}^{\alpha}(x)$ – Generating function – Other forms for associated Laguerre Polynomial – Orthogonal property of the associated Laguerre Polynomials – Recurrence formulae for the associated Laguerre Polynomials.
Chapter 7.

Unit V	13 hrs

Chebyshev Polynomials: Chebyshev's Differential Equation – Chebyshev Polynomials – To prove that $T_n(x)$ and $U_n(x)$ are independent solutions of Chebyshev's equation – Relation for $T_n(x)$ and $U_n(x)$ - To find first few $T_n(x)$ and $U_n(x)$ Polynomials – Generating Function – Orthogonal properties of Chebyshev polynomials – Recurrence formula for $T_n(x)$ and $U_n(x)$.
Chapter 8.

Book for study:

Unit	Name of the Book	Authors	Publisher
I-V	Special Functions	J.N. Sharma and Dr.R.K.Gupta	Krishna Prakashan Mandir, Sixteenth edition 1992-93

Books for Reference:

S.No	Name of the Book	Authors	Publisher
1.	Text book of Ordinary Differential Equations	S. G. Deo, V.Lakshmikantan,V. Raghavendra	Tata McGraw-Hill Publishing Company Ltd, New Delhi, Second Edition,16thReprint – 2010
2.	Mathematical physics	Gupta B.D.	Vikas Publishing House, Fourth Edition, 2010
3.	Mathematical Physics	Sathyaprakash	Sultan Chand & Sons ,5th Revised edition, 2011

Entrepreneurship Courses

M.Sc. Mathematics
Semester I
(For the students admitted during the academic year 2021 – 2022 onwards)

Course: Core IV Advanced Operations Research	**Course Code: 21MM04**
Semester: I	**No. of Credits: 4**
No. of hours :75	**C:T:S: 52:10:13**
CIA Max. Marks: 50	**ESE Max. Marks: 50**

(C: Contact hours, T: Tutorial, S: Seminar)

Course Objectives: This course aims

- to introduce network models.
- to understand and apply dynamic programming techniques in any multistage situation to make series of decisions.
- to specialize in inventory management, that forms the basis of supply chain management
- to specialize in queuing concepts that has wide applications like processor scheduling etc.
- to introduce non linear programming

Course Outcomes: On completion of the course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	determine the minimal spanning tree, shortest route and maximal flow in a network.	A
CO2	compute the optimum solution of a multivariable process by decomposing into a single variable sub-problems.	A
CO3	obtain the optimum inventory policies for probabilistic inventory models.	A
CO4	determine the measures of performance of various queuing systems.	A
CO5	obtain optimum solutions of non linear programming problems.	A

A-Apply

Syllabus:

Unit I	13 hrs
Network Models : Scope and Definition of Network models – Minimal Spanning Tree Algorithm – Shortest-Route Problem : Examples of the Shortest-Route Applications- Shortest-Route Algorithms-Maximal Flow Model.: Enumeration of cuts –Maximal-Flow Algorithm. Chapter 6(Sections 6.1, 6.2, 6.3(6.3.1, 6.3.2), 6.4.(6.4.1,6.4.2)).	

Unit II	13 hrs
Deterministic Dynamic Programming : Recursive Nature of Computations in DP - Forward and Backward Recursion – Selected DP Applications : Knapsack / Fly-Away / Cargo-Loading Model - Work-Force Size Model - Equipment Replacement Model - Problem of Dimensionality. Chapter 10 (Sections 10.1 – 10.3 (10.3.1 – 10.3.3), 10.4).	

Unit III	13 hrs
Probabilistic Inventory Models: Continuous Review Models – Single-Period Models.- Multiperiod Model. Chapter 14(Sections 14.1-14.3)	

*Unit IV	13 hrs
Queuing Systems :Elements of a Queuing Model – Role of Exponential Distribution – Pure Birth and Death Models (Relationship Between the Exponential and Poisson Distributions) – Generalized Poisson Queuing Model - Specialized Poisson Queues: Steady State Measures of Performance – Single - Server Models - Multiple- Server models((M/M/c):(GD/∞/∞) and (M/M/c):(GD/N/∞), $c \leq N$). Chapter 15 (Sections 15.2 – 15.6(15.6.1 – 15.6.3)) .	

Unit V	13 hrs
Classical Optimization Theory: Unconstrained Problems: Necessary and Sufficient Conditions – Constrained Problems : Equality Constraints - Inequality Constraints - Karush-Kuhn-Tucker (KKT) Conditions. Chapter 18(Sections 18.1(18.1.1), 18.2(18.2.1,18.2.2))	

Book for study:

Unit	Name of the Book	Author	Publisher
I – V	Operations Research – An Introduction	Hamdy A.Taha	Pearson Education Inc Limited, Eighth Edition, 2008.

Books for Reference:

S.No	Name of the Book	Authors	Publisher
1	Introduction to Operations Research	Frederick S. Hillier, Gerald J.Lieberman	McGraw-Hill Book Company, Eighth Edition 2007
2	Operations Research-Applications and Algorithms	Wayne.L.Winston	Thomson Asia.Pvt Ltd, Fourth edition, 2003.
3	Operations Research-Principles and Applications	G.Srinivasan	PHI Learning Private Limited,Second printing, 2008

M. Sc. Mathematics

Semester II

[For the students admitted from the academic year 2021-2022 onwards]

Course : Core VIII Numerical Analysis	**Course Code: 21MM08**
Semester: II	**No. of Credits: 4**
No. of hours :90	**C:T:S: 62:12:16**
CIA Max. Marks: 50	**ESE Max. Marks: 50**

(C: Contact hours, T:Tutorial, S:Seminar)

Course Objectives:

- To expose the students to various numerical methods available for solving algebraic and differential equations.
- To help the students to develop their skills in numerical computation.
- To expose the students to problems in physical and management sciences and in engineering.

Course Outcomes: On completion of this course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	obtain the approximation of a given function using chebyshev polynomial and its rational form	A
CO2	solve ordinary differential equations	A
CO3	solve boundary value problems	A
CO4	solve partial differential equations such as heat equation, wave equation etc.,	A
CO5	use finite element methods to solve boundary value problems.	A

A-Apply

Syllabus:

Unit I	16 hrs
Approximation of Functions: Chebyshev Polynomials - Approximation with Rational Functions - Economized Power Series.	

Book I: Chapter 4 : Sections (4.1 – 4.3).

Unit II	16 hrs
Numerical Solution of Ordinary Differential Equations: The Spring-Mass problem-A variation-The Taylor-Series Method- Euler and Modified Euler Methods- Runge-Kutta Methods-Multistep Methods- Milne's Method-The Adams-Moulton Method-Convergence Criteria - Systems of Equations and Higher-Order Equations. Chapter 6 : Sections (6.1 – 6.9).	

Unit III	15 hrs
Boundary-Value Problems : The Shooting Method – Solution through a set of Equations – Characteristic –Value problems –Derivative Boundary conditions Chapter 7: Sections (7.2 – 7.5) .	

*Unit IV	16 hrs
Boundary-Value Problems : Temperature Distribution in a slab - Solving for the Temperatures in a slab Parabolic and Hyperbolic Partial-Differential Equations: Types of Partial Differential Equations-The Heat Equation and the Wave Equation-Solution Techniques for the Heat Equation in One Dimension- Solving the Vibrating String Problem. Chapter 7: Sections (7.6 – 7.7),Chapter 8 : Sections(8.1 – 8.4).	

Unit V	15 hrs
The Finite Element Method : The Rayleigh-Ritz Method-The Collocation and Galerkin Methods – Finite Elements for Ordinary-Differential Equations – Finite Elements for Elliptic Partial-Differential Equations. Chapter 9: Sections (9.1 – 9.4).	

Book for study:

Units	Name of the Book	Author	Publisher
I -V	Applied Numerical Analysis	Curtis F.Gerald, Patrick O.Wheatley	Pearson Education, Sixth Edition, Fourth Indian Reprint – 2005.

Books for Reference:

S.No	Name of the Book	Authors	Publisher
1	Numerical methods for Scientific and engineering Computation	M.K.Jain, S.R.K.Iyengar and R.K. Jain	New Age International (P) Limited, Fourth Edition, Reprint 2004.
2	Numerical Methods Using MATLAB	John. H.Mathews, Kurtis D. Fink	PHI Learning Private Limited, New Delhi, Fourth

			Edition- 2012.

Skill Development Courses

M.Sc. Mathematics
Semester – I
[For the students admitted from the academic year 2021-2022 onwards]

Course: Core III Ordinary Differential Equations	**Course Code: 21MM03**
Semester: I	**No. of Credits: 4**
No. of hours :75	**C:T:S: 52:10:13**
CIA Max. Marks: 50	**ESE Max. Marks: 50**

(C: Contact hours, T: Tutorial, S:Seminar)

Course Objectives: This course aims

- To formulate differential equations related to real world problems
- To study various types of equations and the methods of solving them.
- To study the qualitative properties of solutions.

Course Outcomes: On completion of the course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	solve the higher order linear differential equations	A
CO2	evaluate the second order linear equations and apply the Legendre and Bessel's equations to find the solutions in Power series.	A
CO3	solve the non-homogeneous linear equations with constant co-efficients and find the solutions	A
CO4	compute solution using Picard's theorem and find the existence and uniqueness of solutions of system.	A
CO5	solve boundary value problem and applications of boundary value problem	A

A-Apply

Syllabus:

Unit I	13 hrs
Linear Differential Equations of Higher Order: Introduction – Higher Order Equations – A Modelling Problem – Linear Independence – Equations with Constant coefficients – Equations with Variable coefficients – Wronskian – Variation of Parameters – Some Standard Methods – Method of Laplace Transforms. Chapter 2: Sections (2.1 –2.10)	

Unit II	13 hrs
Solutions in Power Series: Introduction – Second Order Linear Equations with Ordinary Points – Legendre Equation and Legendre Polynomials – Second Order Equation with Regular Singular Point – Properties of Bessel Functions. Chapter 3: Sections(3.1 – 3.5)	

*Unit III	13 hrs
Systems of Linear Differential Equations: Introduction – Systems of First Order Equations – Model for Arms Competition between Two Nations – Existence and Uniqueness Theorem – Fundamental Matrix – Non-homogeneous Linear systems – Linear systems with Constant coefficients – Linear systems with Periodic Coefficients. Chapter 4: Sections (4.1 – 4.8)	

Unit IV	13hrs
Existence and Uniqueness of Solutions: Introduction – Preliminaries – Successive Approximations – Picard's Theorem – Some Examples – Continuation and Dependence on Initial Conditions – Existence of Solutions in the Large – Existence and Uniqueness of Solutions of Systems – Fixed point Method. Chapter 5: Sections (5.1 – 5.9)	

Unit V	13 hrs
Boundary Value Problems: Introduction – Sturm – Liouville Problem – Green's Function – Application of Boundary Value Problems(BVP) – Picard's Theorem. Chapter 7: Sections (7.1 – 7.5)	

Book for study:

Unit	Name of the Book	Authors	Publisher
I - V	Text book of Ordinary Differential Equations	S. G. Deo, V.Lakshmikantham, V. Raghavendra	Tata McGraw-Hill Education Private Ltd, New Delhi, Second Edition,18th Reprint – 2012

Books for Reference:

S.No	Name of the Book	Authors	Publisher
1	An Introduction to Ordinary Differential Equations	Earl.A.Coddington	Prentice Hall of India Pvt., Ltd., - 1987
2	Ordinary Differential Equations	Robert H. Martin. Jr	McGraw-Hill Book Company, Second Printing – 1985.

M.Sc. Mathematics
Semester I
(For students admitted from the academic year 2021-2022 onwards)

Course: Elective I Differential Geometry	**Course Code: 21MME1**
Semester: I	**No. of Credits: 4**
No. of hours :75	**C:T: S: 52:10:13**
CIA Max. Marks: 50	**ESE Max. Marks: 50**

(C: Contact hours, T: Tutorial, S: Seminar)

Course Objectives:

- To introduce trihedren, osculating plane and torsion in space
- To provide the knowledge of properties of curves including Frenet, Serret formulae and their applications
- To introduce fundamental forms, developable surfaces and Dupins indicatrix.
- To provide a strong grounding in the fundamental equation of surfaces and their properties

Course Outcomes: On completion of the course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO 1	determine osculating plane, torsion in space.	U
CO 2	derive the natural equation of a curve and their properties.	U
CO 3	determine fundamental forms and corresponding developable surfaces.	A
CO 4	determine the Dupins indicatrix using the fundamental forms.	A
CO 5	determine the fundamental equation of surfaces and their properties	U

U –Understanding A-Apply

Syllabus:

Unit I	13 hrs
Curves: Analytic representation – Arc length, tangent - Osculating plane – Curvature – Torsion - Formulas of Frenet. Chapter 1 (Sections 1.1 - 1.6)	

Unit II	13 hrs
Curves: Contact – Natural Equations – Helices – General solution of the natural Equations.- Evolutes and involutes. Chapter 1 (Sections 1.7 - 1.11)	

*Unit III	13 hrs
Elementary theory of surfaces: Analytic representation – First fundamental form –Normal, tangent plane - Developable surfaces. Chapter 2 (Sections 2.1 - 2.4)	

Unit IV	13 hrs
Elementary theory of surfaces: Second fundamental form – Meusnier's theorem – Euler's theorem – Dupin's indicatrix – Some surfaces. The fundamental equations: Gauss - The equations of Gauss Weingarten. Chapter 2 (Sections 2.5 - 2.8) Chapter 3 (Sections 3.1 - 3.2)	

Unit V	13 hrs
The fundamental equations: The theorem of Gauss and the equations of Codazzi – Curvilinear coordinates in space – Some applications of the Gauss and the Codazzi equations – The	

fundamental theorem of surface theory. Geometry of a surface: Geodesic (tangential) curvature - Geodesics. Chapter 3 (Sections 3.3 - 3.6) Chapter 4 (Sections 4.1 - 4.2)

Book for study:

Units	Name of the Book	Author	Publisher
I – V	Lectures on Classical Differential Geometry	Dirk J. Struik	Addison- Wesley Publishing company Inc., Second Edition , 1961.

Books for Reference:

S.No	Name of the Book	Authors	Publisher
1	Three dimensional Differential Geometry	Dr. P.P.Gupta and G.S.Malik,	Pragat Prakashan, Meerut, Tenth Edition , 2001.
2	Differential Geometry	Mittal andAgarwal	Krishna Prakashan Mandir,Twenty fifth Edition , 1997.
3	Elementary Differential Geometry	Christian Bär	Cambridge University Press, 2010.
4	Differential Geometry of Curves & Surfaces	Manfredo P. Dto Carmo	Revised and updated 2nd edition, Dover Publications, 2016.

M.Sc. Mathematics

Semester II

(For the students admitted from the academic year 2021-2022 onwards)

Course: Core VI Partial Differential Equations	**Course Code: 21MM06**
Semester: II	**No. of Credits: 4**
No. of hours :90	**C:T:S: 63:12:15**
CIA Max. Marks: 50	**ESE Max. Marks:50**

(C: Contact hours, T: Tutorial, S: Seminar)

Course Objectives:

- To provide an exposure to the various concepts of partial differential equations with the underlying principles.
- To comprehend the categories of partial differential equations, their characteristics and solutions.
- To learn different techniques of solving partial differential equations and there by interpret the solutions.
- To help the students to understand the wide range of applications with ample illustrations.

Course Outcomes: On completion of the course the student will be able to

CO	Statement	Bloom's Taxonomy level

CO1	use partial derivative techniques to predict the behavior of vibrating string, membrane and heat conduction on solids and classify them.	A
CO2	solve IBVP such as Cauchy's problem, Goursat problem and wave equation by the method of characteristics.	A
CO3	solve IBVP using the method of separation of variables.	A
CO4	obtain the solution of the Boundary value problems using Fourier integrals.	A
CO5	obtain the solution of the Boundary value problems in terms of Greens function.	A

A-Apply

Syllabus:

Unit I	16 hrs
Mathematical Models: Classical Equations – The Vibrating String – The Vibrating Membrane-Conduction of heat in solids-The Gravitational Potential. Classification of Second – Order Linear Equations: Second – Order equations in Two Independent Variables – Canonical forms – Equations with Constant Coefficients – General Solutions – Summary and Further Simplification – Exercises. Chapter 3: Sections (3.1 – 3.3, 3.5, 3.6) Chapter 4: Sections (4.1 – 4.6)	

Unit II	16 hrs
The Cauchy Problem and Wave Equations : The Cauchy Problem – Homogeneous Wave Equations – Initial Boundary – Value Problems – Equations with Non homogeneous Boundary Conditions – Vibration of Finite String with Fixed Ends – Non homogeneous Wave Equations – Solution of the Goursat Problem – Exercises. Chapter 5: Sections (5.1, 5.3 – 5.7, 5.9, 5.12)	

*Unit III	15 hrs
Method of Separation of Variables: Introduction – Separation of Variables – The Vibrating String Problem – Existence and Uniqueness of Solution of the Vibrating String Problem – The Heat Conduction Problem – Existence and Uniqueness of Solution of the Heat Conduction Problem – The Laplace and Beam Equations – Nonhomogeneous Problems – Exercises. Chapter 7: Sections (7.1 – 7.9)	

Unit IV	16 hrs
Boundary – Value Problems and Applications : Boundary –Value Problems – Maximum and Minimum Principles – Uniqueness and Continuity Theorems –Dirichlet Problem for a Circle – Dirichlet Problem for a Circular Annulus – Neumann Problem for a Circle – Dirichlet Problem for a Rectangle – Dirichlet Problem Involving the Poisson Equation –The Neumann Problem for a Rectangle – Exercises. Chapter 9: Sections (9.1 – 9.10)	

Unit V	15 hrs
Green's Functions and Boundary-Value Problems : Introduction – The Dirac Delta Function – Properties of Green's Functions – Method of Green's Functions – Dirichlet's Problem for the Laplace Operator – Dirichlet's Problem for the Helmholtz Operator – Method of Images –	

Method of Eigen functions Chapter 11: Sections (11.1 – 11.8)

Book for study:

Unit	Name of the Book	Authors	Publisher
I -V	Linear Partial Differential Equations for Scientists and Engineers.	Tyn Myint-U Lokenath Debnath	Birkhauser, Fourth Edition, Third Indian Reprint 2013.

Books for Reference:

S.No	Name of the Book	Authors	Publisher
1	Elements of Partial Differential Equations	Ian.N.Sneddon	Dover Publications, 1st Edition-2006.
2	Differential Equations for Scientists and Engineers	J.B.Doshi	Narosa Publishing House, 2010.
3	Introduction to Partial Differential Equations	K.Sankara Rao	PHI Publications, 3rd Edition-2010.

M.Sc. Mathematics

Semester II

[For the students admitted from the academic year 2021-2022 onwards]

Course: Elective II Stochastic Processes	**Course Code: 21MME4**
Semester: II	**No. of Credits: 4**
No. of hours : 90	**C:T: 63:12:15**
CIA Max. Marks: 50	**ESE Max. Marks:50**

(C: Contact hours, T:Tutorial, S: Seminar)

Course Objectives:

- To describe a Markov chain and its transition matrix
- To determine limit probabilities in Markov chains after an infinitely long period.
- To derive differential equations for time continuous Markov processes with a discrete state space.
- To classify a stochastic process according to whether it operates in continuous or discrete time and whether it has a continuous or a discrete state space, and give examples of each type process.
- To solve differential equations for distributions and expectations in time continuous processes and determine corresponding limit distributions.

Course Outcomes: On completion of the course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	explain the stochastic processes, Markov chain and stationary distributions.	U
CO2	describe the Poisson Process	U
ÇO3	calculate the time distribution of a Markov process.	A

CO4	classify the delayed and equilibrium Renewal Processes	U
CO5	determine the regenerative stochastic process	A

U –Understanding A-Apply

Syllabus:

Unit I	16 hrs
Stochastic Processes: An Introduction. Markov Chains: Definitions and Examples -Higher Transition Probabilities – Generalisation of Independent Bernoulli Trails : Sequence of Chain – Dependent Trails – Classification of States and Chains – Determination of Higher Transition Probabilities – Stability of a Markov System- Graph Theoretic Approach. Chapter 1(Section 1.5),Chapter 2 (Sections 2.1- 2.7).	

Unit II	15 hrs
Markov Processes with Discrete State Space - Poisson Process and its Extensions: Poisson Process – Poisson Process and Related Distributions – Generalisations of Poisson Process – Birth and Death Process. Chapter 3(Sections 3.1-3.4).	

Unit III	16 hrs
Markov Processes with Continuous State Space: Introduction – Brownian Motion –Wiener Process – Differential Equations for A Weiner Process – Kolmogorov Equations –First Passage Time Distribution for Weiner Process – Ornstein – Uhlenbeck Process. Chapter 4(Sections 4.1 – 4.6).	

*Unit IV	15 hrs
Renewal Processes and Theory: Renewal Process – Renewal Process in Continuous Time – Renewal Equation – Stopping Time :Wald's Equation – Renewal Theorems – Delayed and equilibrium Renewal Processes. Chapter 6(Sections 6.1 – 6.6).	

Unit V	16 hrs
Renewal Processes and Theory: Residual and Excess Lifetimes – Renewal Reward(Cumulative Renewal) Process- Alternating (or Two -Stage) Renewal Process – Regenerative Stochastic Processes: Existence of Limits – Regenerative Inventory System. Chapter 6(Sections 6.7 – 6.11).	

Book for study:

Unit	Name of the Book	Author	Publisher
I - V	Stochastic Processes	J.Medhi	New Age International (P) Limited,Publishers,New Delhi,Reprint 2015.

Books for Reference:

S.No	Name of the Book	Authors	Publisher
1	Introduction to Stochastic Processes	Tapas Kumar Chandra,Sreela	Narosa Publishing House,Pvt Ltd,2018

		Gangopadhyay	
2	Stochastic Processes (Theory For Applications)	Robert G.Gallager	Cambridge University Press, New Delhi,First South Asia Edition,2016

Curriculum Design

SRI G.V.G VISALAKSHI COLLEGE FOR WOMEN (AUTONOMOUS)

Affiliated to Bharathiar University

Department of Mathematics

M.Sc Mathematics

Scheme of Examination-CBCS Pattern

[For the students admitted from the academic year 2017 -2018 onwards]

Sem	Course Code	Course Title	Ins. Hrs/ Week	Examination				Credits
				Dur. Hrs	CIA Marks	ESE Marks	Total Marks	
I	17MM01	Core I : Algebra	6	3	25	75	100	4
	17MM02	Core II : Real Analysis	6	3	25	75	100	4
	17MM03	Core III : Ordinary Differential Equations	6	3	25	75	100	4
	17MM04	Core IV : Optimization Techniques I	5	3	25	75	100	4
	17MME1/ 17MME2	Elective I: Number theory / Differential Geometry	6	3	25	75	100	4
II	17MM05	Core V : Complex Analysis	5	3	25	75	100	4
	17MM06	Core VI : Partial Differential Equations	6	3	25	75	100	4
	17MM07	Core VII : Numerical Analysis	6	3	25	75	100	4
	17MM08	Core VIII :Optimization Techniques II	5	3	25	75	100	4
	17MME3/ 17MME4	Elective II : Control Theory/ Stochastic differential Equations	6	3	25	75	100	4
	17MGCS	Cyber Security	2	2	-	-	Grade	Grade
	17MMA1/ 17MMA2	Advanced Learners Course I: LaTeX Practicals / Statistical Methods	-	-	-	100	100	4*
III	17MM09	Core IX : Topology	5	3	25	75	100	4
	17MM10	Core X : Classical Mechanics	5	3	25	75	100	4
	17MM11	Core XI : Programming with C++	3	3	25	75	100	4
	17MMCP	Programming with C++ Practical	3	3	40	60	100	4
	17MM12	Core XII : Mathematical Modelling	5	3	25	75	100	4
	17MME5/ 17MME6	Elective III : Graph Theory / Fuzzy Topology	6	3	25	75	100	4
	17MMIS	Internship /Summer School Courses / Sports Training	-	-	50	-	50	2
	17MMPV	Project and Viva-Voce	3	-	-	-	-	-

IV	**17MM13**	Core XIII : Mathematical Methods	6	3	25	75	100	**4**
	17MM14	Core XIV : Functional Analysis	6	3	25	75	100	**4**
	17MM15	Core XV : Fluid Dynamics	6	3	25	75	100	**4**
	17MME7/ 17MME8	Elective IV : Special Functions / Operator Theory	6	3	25	75	100	**4**
	17MMPV	Project and Viva-Voce	6	-	100	100	200	**8**
	17MMA3/ 17MMA4	Advanced Learners Course II : Mathematical Biology / Subject viva voce	-	-	-	100	100	**4***
Total							**2250**	**90**

***Starred credits are treated as additional credits (Optional)**

Employability Courses

M.Sc Mathematics

Semester III

(For the students admitted during the academic year 2017 – 2018 onwards)

Course: Core IX Topology	**Course Code: 17MM09**
Semester: III	**No. of Credits: 4**
No. of hours :75(Total hours)	**C:T: S: 52:10:13**
CIA Max. Marks: 25	**ESE Max. Marks:75**

(C: Contact hours, T: Tutorial S: Seminar)

Course Objectives:

The objectives of the course are

- to understand modern pure mathematics.
- to make use of ideas and methods in Topology to analysis and Geometry.
- to lay foundation for further study in Algebraic Topology.

Syllabus:

Unit I:	**13 hrs**
Topological Spaces and Continuous Functions: Topological spaces – Basis for a Topology – The Order Topology – The Product Topology on X x Y – The Subspace Topology – Closed Sets and Limit Points – Continuous Functions. Chapter 2 (Sections 12-18)	

Unit II:	**13 hrs**
Topological Spaces and Continuous Functions: The Metric Topology. Connectedness and Compactness : Connected Spaces – Connected Subspaces of the Real Line – Components and Local Connectedness. Chapter 2 (Sections 20) Chapter 3 (Sections 23-25)	

*Unit III:	13 hrs
Connectedness and Compactness: Compact Spaces – Compact Subspaces of the Real Line – Limit point Compactness. Countability and Separation Axioms: The Countability Axioms – The Separation Axioms – Normal Spaces. Chapter 3 (Sections 26 – 28) Chapter 4 (Sections 30 – 32)	

Unit IV:	13 hrs
Countability and Separation Axioms: The Urysohn Lemma – The Urysohn Metrization Theorem – The Tietze Extension Theorem. The Tychonoff Theorem: The Tychonoff Theorem – The Stone-Cech Compactification. Chapter 4 (Sections 33 – 35) Chapter 5 (Sections 37 – 38)	

Unit V:	13 hrs
Metrization Theorems and Paracompactness: Local finiteness – The Nagata - Smirnov Metrization Theorem – Paracompactness – The Smirnov Metrization Theorem. Chapter 6 (Sections 39 – 42)	

Note : Exclude supplementary exercises.

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-V	Topology	James R. Munkres	Pearson New International Edition, Second Edition, 2015

Books for Reference:

S.No.	Name of the Book	Authors	Publishers with Edition
1	Topology	J. Dugundji	Universial Book Stall, New Dehi, 1975.
2	Topology and Modern Analysis	George F.Simmons	McGraw Hill Book Company, 13th Reprint 2010

M.Sc Mathematics

Semester III

(For the students admitted during the academic year 2017 – 2018 onwards)

Course: Core X – Classical Mechanics	Course Code:17MM10
Semester: III	No. of Credits: 4
No. of hours :75(Total hours)	C:T: S: 52:10:13
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T:Tutorial, S: Seminar)

Course Objectives:

The objectives of this course are

- to acquire knowledge in solving Mechanical problems.
- to become acquainted with Mathematical technologies and procedures which are

useful in other fields of physics.

- to understand and appreciate the working of objects like motion of planets, motion of rockets etc.,

Syllabus:

Unit I:	**13 hrs**
Introductory Concepts: The Mechanical System – Generalized Co-ordinates – Constraints – Virtual Work – Energy and Momentum. Chapter 1 : (Sections 1.1 – 1.5)	

Unit II	**13 hrs**
Lagrange's Equations: Derivation of Lagrange's Equations – Examples – Integrals of the Motion. Chapter 2 : (Sections 2.1 – 2.3)	

Unit III	**13 hrs**
Hamilton's Equations: Hamilton's principle – Hamilton's Equations – Other variational Principles – Phase space. Chapter 4: (Sections 4.1 – 4.4)	

***Unit IV**	**13 hrs**
Hamilton – Jacobi theory: Hamilton's Principal function – The Hamilton Jacobi equation – Separability. Chapter 5 : (Sections 5.1 – 5.3)	

Unit V	**13 hrs**
Canonical Transformations: Differential forms and generating functions – Special transformations – Lagrange and Poisson brackets. Chapter 6 : (Sections 6.1 – 6.3)	

Book for study:

Unit	**Name of the Book**	**Authors**	**Publishers with Edition**
I- V	Classical Dynamics	Donald T. Greenwood	Prentice Hall of India Private Ltd, New Delhi 1985.

Books for Reference:

S.No.	**Name of the Book**	**Authors**	**Publishers with Edition**
1	Classical Mechanics	Herbert Goldstein	Second Edition – Addison Wesley Publishing company, 1988.

2	John L. Synge and Byron A. Griffith	Principles of Mechanics	International Student Edition – McGraw Hill – Koga Kusha Ltd, 1970.

M.Sc Mathematics
Semester III
(For the students admitted during the academic year 2017 – 2018 onwards)

Course: Elective III - Graph Theory	**Course Code:17MME5**
Semester: III	**No. of Credits: 4**
No. of hours :90 (Total hours)	**C:T: S: 62:12:16**
CIA Max. Marks: 25	**ESE Max. Marks:75**

(C:Contact hours, T:Tutorial,S:Seminar)

Course Objectives:

The objectives of this course are

- to familiarize the various concepts in Graph Theory
- to apply the knowledge wherever it is possible.

Syllabus:

Unit I:	**15 hrs**
Graphs and Subgraphs : Graphs and Simple Graphs - Graph Isomorphism-The Incidence and Adjacency Matrices- Sub Graphs-Vertex Degrees-Paths and Connection - Cycles. Trees:Trees - Cut Edges and Bonds - Cut Vertices – Cayley's formula. Chapter 1(Sections 1.1-1.7) , Chapter 2(Sections 2.1-2.4)	

Unit II	**16 hrs**
Connectivity: Connectivity-Blocks. Euler Tours and Hamilton Cycles: Euler Tours -Hamilton Cycles. Chapter 3(Sections 3.1, 3.2) Chapter 4(Sections 4.1, 4.2)	

***Unit III**	**16 hrs**
Matchings: Matchings - Matchings and Coverings in Bipartite Graphs – Perfect Matching. Edge Colourings: Edge Chromatic Number - Vizing's Theorem. Chapter 5(Sections 5.1-5.3) Chapter 6(Sections 6.1,6.2)	

Unit IV	**16 hrs**
Independent Sets and Cliques: Independent Sets - Ramsey's Theorem.Vertex Colorings: Chromatic Number - Brook's Theorem - Hajos Conjecture-Chromatic Polynomials. Chapter 7(Sections 7.1,7.2) Chapter 8(Sections 8.1-8.4)	

Unit V	**15hrs**
Planar Graphs: Plane and planar graphs-Dual graphs - Euler's formula – Bridges - The five Color theorem and four Color conjecture – Non Hamiltonian planar graphs. Chapter 9(Sections 9.1-9.4, 9.6 & 9.7)	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I- V	Graph theory with Applications	J.A. Bondy and U.S.R. Murty	MacMillan London, First Edition ,1976.

Books for Reference:

S.No.	Name of the Book	Authors	Publishers with Edition
1	A First Look at Graph Theory	J.Clark and D.A. Holton	Allied Publishers New Delhi 1995
2	Graph Theory	Frank. Harary	Narosa Publishing House,Tenth Reprint,2001.
3	Graph Theory Modelling, Applications and Algorithms	Geir Agnarsson, Raymond Greenlaw	Pearson ,Third Impression 2011.
4	Graph Theory with Applications to Engineering and Computer Science	Narsingh Deo	Prentice Hall of India 2005.

M.Sc Mathematics

Semester IV

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Core XV – Fluid Dynamics	**Course Code:17MM15**
Semester: IV	**No. of Credits: 4**
No. of hours :90(Total hours)	**C:T: S: 62:12:16**
CIA Max. Marks: 25	**ESE Max. Marks:75**

(C: Contact hours, T: Tutorial, S: Seminar)

Course Objectives:

The objectives of this course are

- to understand the general properties of fluid motion such as continuity, pressure, dynamical equation, energy, vorticity etc.,
- to know the tensor methods applied to the flow of viscous fluids.
- to know the outline of the theory of two dimensional laminar flow in boundary layer
- to apply the aerofoil theory in aerodynamics.

Syllabus:

Unit I:	**16 hrs**
Bernoulli's equation: Introductory notions – Physical dimensions – Velocity – Stream lines and paths of the particles – Stream tubes and filaments – Density – Pressure. Equations of motion: Differentiation with respect to the time – The equation of continuity – Boundary conditions (both kinematical and Physical) – Rate of change of linear momentum – The equation of motion of an inviscid fluid. Book 1: Chapter I (Sections 1.0-1.3) Chapter III (Sections 3.10-3.31, 3.40, 3.41)	

Unit II	**15 hrs**
Equations of motion: Euler's momentum theorem – Conservative forces – Lagrangian form of the equation of motion – Steady motion – The energy equation – Rate of change of circulation – Vortex motion – Permanence of Vorticity. Book 1: Chapter III (Sections 3.42-3.53)	

Unit III	**15 hrs**
Two dimensional motion: Introduction – Two dimensional functions – Basic singularities – Method of images – Conformal transformation – The Aerofoil. Book 2: Chapter III (Sections 3.1-3.3, 3.5-3.7)	

Unit IV	**16 hrs**
Dynamics of real fluids: The equations of motion for viscous flow – Some exact solutions of the Navier-Stokes equations. Book 2: Chapter V (Sections 5.2,5.3.1-5.3.3)	

***Unit V**	**16 hrs**
The laminar boundary layer in incompressible flow: Introduction – The boundary layer equations – Analytic solutions of the boundary layer equations. Book 2: Chapter VI (Sections 6.1-6.3)	

Books for study:

Unit	**Name of the Book**	**Authors**	**Publishers with Edition**
I -II	Theoretical Hydrodynamics	L.M.Milne – Thomson	Dover Publications, New york, Fifth Edition, 1996.
III- V	Modern Fluid Dynamics	N.Curle and H.J.Davies	Volume I, D.Van Nostrand Co., London, 1968.

Books for Reference:

S.No.	**Name of the Book**	**Authors**	**Publishers with Edition**
1.	Fundamentals of fluid Mechanics	S.W.Yuan	Prentice Hall of India, Pvt. Ltd.,1988.
2.	Fluid Mechanics	John F. Douglas, Janusz M.Gasiorek and John A. Swaffield	Pearson Education Ltd., Fourth Edition, 2002.

M.Sc Mathematics

Semester IV

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Elective IV– Special Functions	Course Code:17MME7
Semester: III	No. of Credits: 4
No. of hours :90(Total hours)	C:T: S: 62:12:16
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T: Tutorial, S: Seminar)

Course Objectives:

The objectives of this course are

- to give a thorough knowledge of special functions such as Legendre Polynomials, Bessel's functions, Hermite's Polynomial, Legurre and Chebychev Polynomials
- to facilitates the students to take up the SLET and NET examinations with confidence.

Syllabus:

Unit I:	**16 hrs**
Legendre's Equation: Legendre's Equation-Solution of Legendre's Equation-Definition of $P_n(x)$ and $Q_n(x)$ – General solution of Legendre's Equation – To show the $P_n(x)$ is the co-efficient of h^n in the expansion of $(1-2xh+h^2)^{-1/2}$ – Laplace's definite integral for $P_n(x)$ – Orthogonal properties of Legendre's polynomials – Recurrence formulae – Beltrami's results – Christoffel's Expansion - Christoffel's summation formula – Rodrigue's formula – Even and odd functions. Chapter 2 (2.1-2.13)	

Unit II	**15 hrs**
Bessel's Equation . Chapter 5.	

***Unit III**	**16 hrs**
Hermite Polynomials . Chapter 6.	

Unit IV	**16 hrs**
Laguerre Polynomials. Chapter 7.	

Unit V	**15 hrs**
Chebyshev Polynomials . Chapter 8	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition

I -V	Special Functions	J.N. Sharma and Dr.R.K.Gupta	Krishna Prakashan Mandir ,Sixteenth edition 1992-93.

Books for Reference:

S.No.	Name of the Book	Authors	Publishers with Edition
1.	Text book of Ordinary Differential Equations	S. G. Deo, V.Lakshmikantan, V. Raghavendra	Tata McGraw-Hill Publishing Company Ltd, New Delhi,Second Edition,16thReprint – 2010.
2.	Mathematical Physics	Gupta B.D	Vikas Publishing House, Fourth Edition, 2010
3.	Mathematical Physics	Sathyaprakash	Sultan Chand & Sons ,5th revised edition,2011

Skill Development Courses

M.Sc Mathematics

Semester III

(For the students admitted during the academic year 2017 – 2018 onwards)

Course: Core XI - Programming With C++	**Course Code: 17MM11**
Semester: III	**No. of Credits: 4**
No. of hours :45(Total hours)	**C:T:S:30:6:9**
CIA Max. Marks: 25	**ESE Max. Marks:75**

(C: Contact hours, T:Tutorial, S: Seminar)

Course Objectives:

The objectives of this course are to

- empower the software developing skills of the student.
- enhance the ability of logical thinking.
- solve any complex real life problems with ease using computers.

Syllabus:

Unit I:	**9 hrs**
Tokens, Expressions and Control Structures: Introduction-Tokens - Keywords -Identifiers and Constants - Basic Data Types - User-Defined Data Types. Derived Data types - Symbolic Constants - Type Compatibility –Declaration of variables – Dynamic Initialization of Variables - Reference Variables – Operators in C++ - Scope Resolution Operator - Member Dereferencing Operators - Memory Management Operators – Manipulators - Type Cast Operator - Expressions and their Types – Special Assignment Expressions – Implicit Conversions – Operator Overloading – Operator Precedence – Control Structures. Chapter 3: (Sections 3.1 – 3.24).	

Unit II:	**9 hrs**
Functions in C++: Introduction – The Main Function – Function prototyping – Call by Reference – Return by Reference – Inline functions – Default Arguments – const Arguments Function overloading – Friend and Virtual Functions – Math Library Functions. Classes and Objects: Introduction – C Structures Revisited – Specifying a Class –Defining Member Functions – A C++ Program with Class – Making an Outside Function Inline – Nesting of Member Functions – Private Member Functions– Arrays within a Class – Memory Allocation for Objects – Static Data Members – Static Member Functions –Arrays of Objects – Objects as Function Arguments – Friendly Functions – Returning Objects – const Member functions – Pointers to Members – Local classes. Chapter 4 (Sections 4.1 – 4.11) Chapter 5 (Sections 5.1 – 5.19)	

***Unit III:**	**9 hrs**
Constructors and Destructors : Introduction - Constructors – Parameterized Constructors – Multiple Constructors in a Class - Constructors with Default Arguments – Dynamic Initialization of Objects – Copy Constructor – Dynamic Constructors –Constructing Two-Dimensional Arrays – const Objects - Destructors. Operator Overloading and Type Conversions: Introduction – Defining Operator Overloading - Overloading Unary Operators –Overloading Binary Operators – Overloading Binary Operators using Friends- Manipulation of Strings Using Operators– Rules for Overloading Operators Chapter 6(Sections 6.1 – 6.11) Chapter 7(Sections 7.1 – 7.7)	

Unit IV:	**9 hrs**
Inheritance: Extending Classes: Introduction – Defining Derived Classes –Single Inheritance – Making a Private Member Inheritable–Multilevel Inheritance –Multiple Inheritance – Hierarchical Inheritance – Hybrid Inheritance – Virtual Base Classes – Abstract Classes – Constructors in Derived Classes – Member Classes:Nesting of Classes. Pointers, Virtual Functions and Polymorphism: Introduction – Pointers to Objects – this Pointer – Pointers to Derived Classes – Virtual Functions – Pure Virtual Functions Chapter 8(Sections 8.1 – 8.12) Chapter 9 (Sections 9.1 - 9.7)	

Unit V:	**9 hrs**
Working with Files : Introduction – Classes for File Stream Operations – Opening and Closing a File – Detecting end-of-file – More about Open(): File Modes – File Pointers and their Manipulations - Sequential Input and Output Operations – Updating a File: Random Access – Error handling During File Operations – Command-line Arguments. Chapter 11(Sections 11.1 - 11.10)	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-V	Object Oriented Programming with C++	E.Balagurusamy	Tata McGraw Hill Publishing Company Limited. NewDelhi. Fourth Edition –Tenth

			Reprint 2010.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	C++ - How to Program	Deitel and Deitel	Prentice- Hall, 1998.
2	Object Oriented Programming in Turbo C++	Robert Lefore	Waite Group Publications – 1999.

M.Sc Mathematics

Semester III

(For the students admitted during the academic year 2017 – 2018 onwards)

Course: Core XI - Programming With C++ Practical	**Course Code: 17MMCP**
Semester: III	**No. of Credits: 4**
No. of hours :45(Total hours)	**P:T:30:15**
CIA Max. Marks: 40	**ESE Max. Marks:60**

(P: Practical,T:Tutorial)

Course Objectives:

The objectives of this course are to

- provide complete knowledge of Object Oriented Programming through C++
- enhance the programming skills of the students by giving practical assignments to be done in labs.
- learn how to write inline functions for performance.
- overload functions and operators in C++.

Syllabus:

List of programs	**30 hrs**

1. Sorting of Numbers(without using function)
2. Sorting of numbers (using function)
3. Numerical Integration by 1/3 rd Simpson's rule.
4. Solving First Order Ordinary Differential Equation using
   (i) Runge- Kutta Second order method.
   (ii) Runge- Kutta Fourth order method.
5. Solving First Order Ordinary Differential Equation using Adam's Predictor –Corrector method.
6. Generating Fibonacci series using recursion.
7. Finding the Addition, Subtraction, Multiplication and Division of Complex numbers.
8. Read the following information from the keyboard:
   - Employee name, Employee code, Designation, Years of experience, Age, Basic pay, Dearness allowance, HRA, deductions and execute the following features:

(i) Insert a new entry
(ii) Delete an entry
(iii) List a table with employee details
(iv) List a table with salary details
(v) Sort the entries

9. Preparing a Mark Sheet of a University Examination with the following information:
   a) Name of the Student, Roll Number, Subject Code, Subject Name,
   b) Internal Marks and External Marks.

   The program should carry out the following tasks:
   a) Sort the students list by Name.
   b) Sort the students list by Rank. .
10. Simulation of a simple Banking System in which initial balance and the rate of interest are read from the keyboard and these values are initialized using the constructor member function.

    The program should consist of following methods:
    a. To initialize the balance and rate of interest using the constructor member function.
    b. To make deposit.
    c. To withdraw an amount from the balance.
    d. To find the Compound interest based on the rate of interest.
    e. To know the balance amount
    f. To display the menu options.
11. Swapping two variables of various data types, namely integers, floating point numbers and character types using function overloading.
12. Performing Simple arithmetic operations of two complex numbers using operator overloading.
13. Run Time Polymorphism using Virtual function
14. Creating a base class with data members, name, roll number and sex and a derived class with members, height and weight and declaring the derived class as an array of objects and using the member functions to display the contents of the array on the screen.
15. Illustration of how class objects can be written to and read from the disk files.

M.Sc Mathematics

Semester III

(For the students admitted during the academic year 2017 – 2018 onwards)

Course: Core XII - Mathematical Modelling	**Course Code:17MM12**
Semester: III	**No. of Credits: 4**
No. of hours :75 (Total hours)	**C:T: S: 52:10:13**

CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T: Tutorial, S: Seminar)

Course Objectives:

The objectives of the course are to

- create awareness about various real life situations that can be modeled through mathematical models
- give a panoramic view of application of mathematics in Mathematical , Physical and Social sciences
- choose the appropriate technique among the available to obtain the desirable solutions.

Syllabus:

Unit I:	**13 hrs**
Mathematical Modelling through Ordinary Differential Equations of First order: Mathematical Modelling through Differential Equations-Linear Growth and decay Models-Non- Linear Growth and decay Models- Compartment Models- Mathematical Modelling in Dynamics through Ordinary Differential Equations of First Order. Chapter 2 (Sections 2.1-2.5)	

Unit II	**13 hrs**
Mathematical Modelling Through Systems of Ordinary Differential Equations of the First Order: Mathematical Modelling in Population Dynamics- Mathematical Modelling of Epidemics Through Systems of Ordinary Differential Equations of First Order - Compartment Models through Systems of Ordinary Differential Equations - Mathematical Modelling in Economics based on Systems of Ordinary Differential Equations of First Order. Chapter 3(Sections 3.1-3.4)	

***Unit III**	**13 hrs**
Mathematical Modelling Through Difference Equations:The Need for Mathematical Modelling Through Difference Equations:Some Simple Models-Basic Theory of Linear Difference Equations with Constant Coefficients- Mathematical Modelling Through Difference Equations in Economics and Finance. Chapter5(Sections 5.1-5.3)	

Unit IV	**13 hrs**
Mathematical Modelling Through Partial Differential Equations: Situations giving rise to Partial Differential Equations Models – Mass-Balance Equations:First Method of Getting PDE Models Momentum – Balance Equations:The Second Method of Obtaining Partial Differential Equations Models – Variational Principles:Third Method of Obtaining Partial Differential Equation Models –Model for Traffic on a Highway. Chapter 6(Sections 6.1-6.4, 6.6)	

Unit V	**13 hrs**
Mathematical Modelling Through Graphs: Situations that can be Modelled Through Graphs – Mathematical Models in Terms of Directed Graphs – Mathematical Models in Terms of Signed Graphs – Mathematical Modelling in Terms of Weighted Digraphs – Mathematical Modelling in Terms of Unoriented Graphs. Chapter 7 (Sections 7.1-7.5)	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I- V	Mathematical Modelling	J.N Kapur	Wiley Eastern Limited, Second Edition, 2015.

Books for Reference:

S.No.	Name of the Book	Authors	Publishers with Edition
1	Mathematics for Economists	B.C. Mehra and G.M.K. Madani	Sultan Chand and Sons, Sixth Edition, 1988.
2	Differential Equations with applications and Historical Notes	George. F. Simmons	McGrawHill,Inc,2nd Edition1991.
3	Dynamics	M.K.Venkataraman	Agasthiar book deport, 13th edition 2009.

M.Sc Mathematics

Semester III

(For the students admitted during the academic year 2017 – 2018 onwards)

Course: Internship/Summer School Courses/ Sports Training	**Course Code: 17MMIS**
Semester: III	**No. of Credits: 2**
No. of hours : -	**I:T:R : -**
CIA Max. Marks: 50	**ESE Max. Marks: -**

I:Internship Training, T: Tutorial, R:Report)

Course Objectives:

Internship

The students have to select a school and take up teaching practice for a period of 10 days during their holidays to enhance their teaching ability and submit a report.

Summer School Courses

Students can attend Summer school programmes offered by Institutions of National reputation to enrich their knowledge and submit a report.

Sports Training

Students who are selected for District/State/National teams can attend sports camps. The certificate given by the concerned authorities can be treated as equivalent to the internship report.

M.Sc Mathematics

Semester IV

[For students admitted from the academic year 2017-2018 onwards]

Course: Project and Viva-Voce	**Course Code:17MMPV**
Semester: III & IV	**No. of Credits: 8**
No. of hours :45(Total hours)(III Semester) **No. of hours :90(Total hours) (IV Semester)**	**C:T:30:15(III Semester)** **C:T:60:30(IV Semester)**
CIA Max. Marks:100	**ESE Max. Marks: 100**

(C:Contact hours, T:Tutorial)

An individual project work has to be carried out in an emerging area/research articles from journals and a report must be submitted.

Course Objectives:

The objectives of this course are to

- create awareness of applications of Mathematics in physical, chemical and social sciences.
- develop, practice, and improve group communication skills
- apply effective research and organizational skills in preparing information
- plan and manage time
- refine understanding through discussion and explanation.
- tackle more complex problems than they could on their own.
- pool knowledge and skills.

Internal Assessment components:

Semester	**Evaluation**	**Marks**
III	Review of Literature and Analysis	50
IV	Report Submission and Viva-voce	50

Blue Print for End Semester Examination

Semester	**Evaluation**	**Marks**
IV	Project Report	50
IV	Viva-voce	50

M.Sc Mathematics

Semester IV

(For the students admitted during the academic year 2017 – 2018 onwards)

Course: Core XIII - Mathematical Methods	**Course Code:17MM13**
Semester: IV	**No. of Credits: 4**
No. of hours :90(Total hours)	**C:T: S:63:12:15**
CIA Max. Marks: 25	**ESE Max. Marks:75**

(C:Contact hours, T:Tutorial, S:Seminar)

Course Objectives:

The objectives of this course are

- to provide easy and effective means for solutions of integral equations arising in various fields of science and engineering.
- to solve differential and integral equations using integral transforms that are not solvable by standard methods
- to find extrema of functionals defined over a class of functions.

Syllabus:

Unit I:	**16 hrs**
Introduction: Definition,Regularity conditions, special kinds of Kernels – Eigen values and Eigen functions – Convolution Integral – The inner or scalar product of two functions. Integral Equations with Seperable kernels: Reduction to a system of algebraic equations – Examples. Fredholm alternative – Examples – An approximate method. Method of successive Approximations: Iterative scheme – Examples – Volterra integral equations – Examples. Book 1: Chapter 2 (Sections 2.1 – 2.5), Chapter 3 (Sections 3.1 – 3.4)	

Unit II	**15 hrs**
Applications to Ordinary Differential Equations: Initial value problems – Boundary value problems – Examples. Singular Integral Equations: The Abel integral equation – Examples. Integral Transform Methods: Laplace transform – Application to Volterra integral equations with convolution type kernals – Examples. Book 1: Chapter 5 (Sections 5.1 – 5.3), Chapter 8 (Sections 8.1 – 8.2) Chapter 9 (Sections 9.3-9.5)	

***Unit III**	**15 hrs**
Fourier transforms: Fourier transforms – Fourier cosine transforms – Fourier sine transforms- Fourier transform of derivatives. The calculation of the Fourier transforms of some simple functions – The Fourier transforms of rational functions – The convolution integral – Parseval's theorem for cosine and sine transforms. Book 2: Chapter 2 (Sections 2.3-2.10)	

Unit IV	**16 hrs**
Hankel Transforms: Introduction – Elementary Properties of Hankel Transforms- The Hankel Inversion Theorem- Hankel Transforms of Derivatives of Functions- The Hankel Transforms of Some Elementary Functions- The Parseval Relation for Hankel Transforms- Relations Between Fourier and Hankel Transforms. Book 2: Chapter 5 (Sections 5.1-5.7)	

Unit V	**16 hrs**
The Methods of Variations in Problems with Fixed Boundaries: Variations and its Properties-Euler equation – Functionals of the Form $\int_{x_0}^{x_1} F(x, y_1, y_2, \ldots y_n, y_1', y_2', \ldots y_n')dx$ – Functionals dependent on higher – order derivatives – Functionals dependent on the functions of several independent variables – Variational problems in parametric form. Book 3 : Chapter 6 (Sections 1 – 6)	

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-II	Linear Integral Equations –Theory and Technique	RamP.Kanwal	Academic press, Inc 1971
III	The Use of Integral Transforms	Ian.N.Sneddon	Tata Mc-Graw Hill Publishing Company Ltd.
IV- V	Differential Equations and the Calculus of variations	L.Elsgolts	MIR Publishers, second printing – 1973.

Books for Reference:

S.No.	Name of the Book	Authors	Publishers with Edition
1	Integral Equations	L.I.G. Chambers	A Short Course, International Text book company Ltd., 1976
2	Calculus of Variations with Applications	A.S Gupta	Prentice Hall of India Private Ltd., New Delhi, 1997.

M.Sc Mathematics

Semester IV

(For the students admitted during the academic year 2017 – 2018 onwards)

Course: Core XIV– Functional Analysis	**Course Code:17MM14**
Semester: IV	**No. of Credits: 4**
No. of hours :90(Total hours)	**C:T: S: 63:12:15**
CIA Max. Marks: 25	**ESE Max. Marks:75**

(C: Contact hours, T: Tutorial, S: Seminar)

Course Objectives:

The objectives of this course are

- to give a foundation in Banach spaces, operators, finite dimension spectral theory and Banach algebras.
- to apply the knowledge of above concepts in various branches of pure and applied mathematics.
- to enable the students to establish a relationship between isolated mathematical theories pertaining to different branches with the concepts in functional analysis.

Syllabus:

Unit I:	**16 hrs**
Banach spaces: The definition and some examples- Continuous linear transformations – The Hahn - Banach theorem – The natural imbedding of N in N** - The open mapping theorem. Chapter 9(Sections 46 – 50)	

Unit II	**15 hrs**
Banach spaces: The conjugate of an operator. Hilbert spaces: The definition and some simple properties – Orthogonal complements – Orthonormal sets. Chapter 9(Section 51) Chapter 10(Sections 52 – 54)	

***Unit III**	**15 hrs**
Hilbert spaces: The conjugate space H* – The adjoint of an operator – Self - adjoint operators – Normal and Unitary operators – Projections. Chapter 10(Sections 55-59)	

Unit IV	**16 hrs**
Finite- Dimensional Spectral Theory: Matrices – Determinants and the Spectrum of an operator – The Spectral theorem Chapter 11(Sections 60-62)	

Unit V	**16 hrs**
General Preliminaries on Banach algebras: The definition and some examples – Regular and singular elements – Topological divisors of zero – The spectrum – The formula for the spectral radius. Chapter 12(Sections 64-68)	

Book for study:

Unit	**Name of the Book**	**Authors**	**Publishers with Edition**
I-V	Introduction to Topology and Modern Analysis	G.F.Simmons	TATA McGraw -Hill Education Private Ltd, Twenty fifth Reprint 2015

Books for Reference:

S.No.	**Name of the Book**	**Authors**	**Publishers with Edition**
1	Functional Analysis	Dr.D.Somasundaram	S.Viswanathan Pvt Ltd., 1994
2	Functional Analysis	B.V.Limaye	Wiley Eastern Limited, Second edition, 2004.
3	Functional Analysis with applications	A.H.Siddiqui	Tata McGraw Hill Publishing Co. Ltd., 2007.
4	Functional Analysis	M.Thamban Nair	Prentice Hall of India Pvt Ltd., 2002