PG & RESEARCH DEPARTMENT OF MATHEMATICS

PREAMBLE

UG: Programme Profile and the Syllabi of Courses offered in the I and II Semester along with Evaluation Components III&IV (With Effect From 2021- 2024 Batch Onwards).

PG: Programme Profile and the Syllabi of Courses offered in the I and II Semester along with Evaluation Components III&IV (With Effect From 2021- 2023 Batch Onwards)

PROGRAMME PROFILE B.Sc. (Mathematics)

Programme Specific Outcomes (PSO)

Upon Completion of the Programme, the Students will able to

- Interpret the effective use of Mathematical Skills to solve Quantitative Problems from a wide Array of Authentic Contexts.
- Apply Mathematical Arguments in Axiomatic and Non-axiomatic Systems.
- Demonstrate the Effective written Communication of Mathematical concepts.
- Formulate and Develop Mathematical Arguments in a Logical Manner.

Semester	Part	Category	Course code	Course Title	Previous course code	Contact Hrs/ Week	Credit Min/Max
I	I	Languages / AECC – II Tamil / Hindi/ French	UTAL107/ UTAL108/ UHIL102/ UFRL102	Basic Tamil-I/ Advanced Tamil-I/ Hindi-I / French-I	UTAL105/ UTAL106/ UHIL101/ UFRL101	5	3/4
	II	Communicative English / AECC – I	UENL109/ UENL110	English for Communicative (Stream – I) / English for Communicative (Stream –II)	-	5	3/4
	III	Major Core (I)/ DSC (I)	UMAM104	Differential Calculus	-	6	4
	III	Major Core (II)/ DSC (II)	UMAM107	Algebra and Trigonometry	-	6	4
	III	Allied – I (GE)	UMAA115	Mathematical Statistics - I	-	6	4
	III	PE	UPEM101	Professional English	-	6	4
	IV	Value Education (VE)				2	1
					TOTAL	**36**	**23/25**
II	I	Languages / AECC – II Tamil/ Hindi/ French	UTAL207/ UTAL208/ UHIL202/ UFRL202	Basic Tamil II/ Advanced Tamil-II/ Hindi-II / French-II	UTAL205/ UTAL206/ UHIL201/ UFRL201	5	3/4
	II	Communicative English / AECC – I	UENL209 / UENL210	English for Communicative (Stream – I) / English for Communicative (Stream –II)	-	5	3/4
	III	Major Core III / DSC (III)	UMAM207	Vector Calculus	-	6	5
	III	Major Core IV / DSC(IV)	UMAM208	Analytical Geometry	UMAM105/ UMAM106	5	5
	III	Allied – II (GE)	UMAA207	Mathematical Statistics - II	-	6	4
	III	PE	UPEM201	Professional English II	-	6	4
	IV	Non Major Elective			-	3	2
	V	Extension Programme/ Physical Education			-	-	1/2
					TOTAL	**36**	**27/30**
III	I	Languages / AECC – II Tamil/ Hindi/ French	UTAL307/ UTAL308/ UHIL302/ UFRL302	Basic Tamil II/ Advanced Tamil-II/Hindi-II / French-II	UTAL305/ UTAL306/ UHIL301/ UFRL301	5	3/4

III	II	Communicative English / AECC – I	UENL309/ UENL310	English for Communicative (Stream – I) / English for Communicative (Stream –II)	-	5	3/4
	III	Major Core V / DSC(V)	UMAM306	Differential Equation	UMAM302/ UMAM301	5	4
	III	Major Core VI / DSC (VI)	UMAM308	Discrete Mathematics	UMAM206/ UMAM606	6	6
	III	Allied – III (GE)	UCSA303	Mathematical Programming using C	-	3	2
	III	Allied - III (GE) Practical	UCSR305	Mathematical Programming using C Practical	-	3	2
	IV	Online Course (NPTEL / SP)			-	3	1/2
	IV	Value Education (VE)			-	2	1
					TOTAL	**33**	**23/26**
IV	I	Languages / AECC – II Tamil/ Hindi/ French	UTAL407/ UTAL408/ UHIL402/ UFRL402	Basic Tamil II/ Advanced Tamil-II/ Hindi-II / French-II	UTAL405/ UTAL406/ UHIL401/ UFRL401	5	3/4
	II	Communicative English / AECC – I	UENL409/ UENL410	English for Communicative (Stream – I) / English for Communicative (Stream –II)	-	5	3/4
	III	Major Core VII / DSC (VII)	UMAM407	Integral Transforms	UMAM405	4	4
	III	Major Core VIII / DSC (VIII)	UMAM406	Mechanics	UMAM401	5	4
	III	Allied – IV (GE)	UPHA402	Electronics for Mathematics	-	3	2
	III	Allied – IV Practical	UPHR402	Electronics for Mathematics Practical	-	3	2
	IV	Soft Skill			-	2	1
	IV	Non Major Elective			-	3	2
	V	Extension Programme/ Physical Education			-	-	-/2
					TOTAL	**30**	**21/25**
V	III	Major Core IX / DSC (IX)	UMAM507	Modern Algebra	UMAM501	6	5
	III	Major Core X / DSC (X)	UMAM512	Real Analysis I	UMAM508	6	5
	III	Major Core XI / DSC (XI)	UMAM506	Numerical Methods		6	5
	III	Major Elective	UMAO501	Graph Theory	UMAM205/ UMAM402	5	4
			UMAO502	Number Theory	UMAM506/ UMAM502		
	III	Major Core XII/ DSC (XII)	UMAP501/ UMAR511	Project/ R Programming	-	5	5
	IV	Value Education (VE)				2	1
					TOTAL	**30**	**25**
VI	III	Major Core XIII/ DSC (XII)	UMAM614	Linear Algebra	UMAM604/ UMAM610	5	5
	III	Major Core XIV/ DSC (XIV)	UMAM615	Real Analysis II	UMAM607/ UMAM611	6	6
	III	Major Core XV/ DSC(XV)	UMAM602	Complex Analysis	UMAM509	6	6
	III	Major Core XVI/ DSC(XVI)	UMAM613	Operations Research	UMAM603/ UMAM608	6	6
	III	Major Elective	UMAO607	Mathematical Modeling	UMAM404	5	4
			UMAO606	Mathematics for Construction Craft	-		
			UMAO607	Mathematics in Space Science	-	5	4
	III	Comprehensive Viva	UMAM601		-	-	1
	IV	Soft Skill			-	2	1
	V	Extension Programme/ Physical Education			-	-	-/2
					TOTAL	**30**	**29/31**
					GRAND TOTAL	**195**	**148/162**

COURSES OFFERED TO OTHER DEPARTMENTS-UG ALLIED

Class & Major	Semester	Category	Course Code	Course Title	Previous course code	Contact Hrs/ week	Credit Min/ Max
I B Com & I BCom (CA)	I	Allied	UMAA112	Business Mathematics	-	6	4
I B.Sc PHY			UMAA114/UMAA310	Allied Mathematics I	UMAA106	6	4
I BCA			UMAA110	Mathematical Methods I	-	6	4
I B.Sc (CS)			UMAA113	Statistical Methods	-	6	4
I B.Sc (CS)	II		UMAA218	Mathematics for Computer Science	-	6	4
II BCA			UMAA216	Mathematical Methods II	-	6	4
I B.Sc PHY			UMAA222	Allied Mathematics II	UMAA212	6	4
II B.Sc Chem	III		UMAA310/UMAA114	Allied Mathematics I	UMAA304	6	4
II B.Sc BIO			UMAA305	Bio-Statistics	-	6	4
II BBA/ II B.Com/ II B.Com CA			UMAA301	Business Statistics	UMAA211/ UMAA403/ UMAA107	6	4
II B.Sc Chem	IV	Allied	UMAA406	Integral Calculus, Laplace Transform And Ordinary Differential Equations	-	6	4
II BBA			UMAA410	Quantitative techniques for Business	UMAA505	6	4

NON-MAJOR ELECTIVE

Semester	Part	Category	Course Code	Course Title	Previous Course Code	Contact Hrs/ Week	Credit
II	IV	Non Major Elective	UMAR201	Statistics using Excel	-	3	2
			UMAE204	Basic Mathematics for Science	-	3	2
			UMAE202	Mathematics for Business and Decision Making	-	3	2
			UMAE206	Numerical Methods using C++	UIDE302/ UMAE302	3	2
			UMAE209	Operations Research for Managers	UMAE306/ UMAE402	3	2
			UMAE207	Statistical Data Analysis through SPSS	UMAA501/ UMAE305	3	2
			UMAE208	Applied Mathematics	UMAE309/ UMAE502	3	2
IV	IV	Non Major Elective	UMAE404	Mathematics for Career Development	-	3	2

EXTRA CREDIT EARNING PROVISION

Semester	Part	Category	Course code	Course Title	Contact Hrs/ Week	Credit	
						Min	Max
II	III	Self Study paper	UMAI201	Summer Internship	-	-	1
IV	III	Self Study paper	UMAI401	Summer Internship	-	-	1
VI	III	Self Study paper	UMAS601 UMAS602 UMAS603 UMAS604	Fourier Transforms Simulation Number Theory Project	2	-	2

EXPERIENTIAL LEARNING (Mandatory)

Course Mapping				Collaborating Agency – MSME		
Semester	Course code	Course Title	Assessment	Course Title	Hour/ Days/ Month	Mode of Evaluation
I	UMAA115	Mathematical Statistics - I	Component IV	Applied Statistics Certification	2 Days	Reflection

SKILL ORIENTATION PROGRAMME
(Only for Interested students) – Extra Credit Earning Provision

Semester	Category	Course Code	Course Title	Collaborating Agency	Hour/ Days/ Month	Mode of Evaluation	Credits (Min/Max)
II	Core	UMAT201	Statistics Process Control	MSME	4 Days	Reflection	1

DIFFERENTIAL CALCULUS
UMAM104

Semester : I **Credit : 4**
Category : Major Core I / DSC I **Hour/Week : 6**
Class & Major : I- B.Sc Mathematics **Total Hour: 78**

Objectives
To enable the students
- Understand Functions, Limits, Derivative, Continuous and Inverse Trigonometrically Functions.
- Solve Problems with continuous change in quantities.
- Determine the Limit existing, Continuous, Differentiable functions.

Learning Outcomes
On completion of the course, the student will be able to
- Explain the relationship between the function and the notion of Derivative.
- Compare and Contrast the ideas of Continuity and Differentiability.
- To solve Algebraic Equations and Inequalities.

UNIT I **15 Hour**
Functions – Shifting Graphs – Trigonometric Functions.

UNIT II **15 Hour**
Rules for Finding the Limits - Definition of Limits and its Extension – Continuity.

UNIT III   **16 Hour**

The Derivative of a Function – Differentiation Rules – Rates of Change – Derivatives of Trigonometric Functions - The Chain Rule.

UNIT IV   **16 Hour**

Extreme values of Functions – Mean value theorem – The first Derivative test for Local Extreme Value – Graphing with y' and y" – Limits as $x \to \pm\infty$, Asymptotes, and Dominant Terms.

UNIT V   **16 Hour**

Inverse Trigonometric Functions – Derivatives of Inverse Trigonometric Functions; Integrals – Hyperbolic Functions – First Order Differential Equations.

Text Book

- Thomas Finney. (2014). *Calculus and Analytic Geometry.* Addison –Wesley. India. (13ᵗʰ Ed.).

Reference Book

- Tom. M. Apostol. (1966). *Calculus Volume –I.* (2ⁿᵈ Ed.).

ALGEBRA& TRIGONOMETRY
UMAM107

Semester : I	**Credits : 4**
Category : Major Core II / DSC II	**Hour/Week: 6**
Class & Major : I B.Sc Mathematics	**Total Hour : 78**

Objectives:
To enable the students
- Understand the Expansions of Trigonometric Functions.
- Analyse the Mathematical Series and their Usage.
- Solve Logarithmic and Exponential Equations with any Base.

Learning Outcomes
On completion of the course, the student will be able to
- Write the Expansions of Trigonometric Functions in a Clear and Logical Manner.
- Solve Problems in Summation of Series, Matrices.
- Evaluate and Demonstrate Mathematical Reasoning.

UNIT I   **15 Hour**

Summation of series using Binomial - Exponential and Logarithmic Series (Theorems without Proofs) - Approximation using Binomial & Exponential Series and Logarithmic Series Simple Problems.

UNIT II   **16 Hour**

Symmetric - Skew Symmetric, - Hermitian - Skew Hermitian - Orthogonal and Unitary Matrices - Cayley-Hamilton Theorem (without Proof) - Eigen Values - Eigen Vectors–Similar Matrices - Diagonalisation of a Matrix.

UNIT III   **16 Hour**

Expansions of $\cos n\theta$, $\sin n\theta$ - Expansion of $\tan n\theta$ in terms of $\tan \theta$ - Expansion of $\tan(A+B+C+\dots)$ - Formation of Equations.

UNIT IV   **16 Hour**

Powers of sines and cosines of θ in terms of Functions of Multiples of θ - Expansions of $\sin \theta$ and $\cos \theta$ in a Series of Ascending Powers of θ - Expansion of Inverse Circular Functions.

UNIT V   **15 Hour**

        Hyperbolic Functions Definition – Relation between Hyperbolic Functions - Inverse Hyperbolic Functions.

Text Books

- Manicavachagom Pillay, T. K. Natarajan,T. and Ganapathy, K.S. (2004). *Algebra Volume I & II*. S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai.
- Narayanan, S. and Manicavachagom Pillay, T.K. (2004). *Trigonometry.* S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai.

Reference Books

- Kandasamy, P. Thilagavathy, K. (2004). *Mathematics for B.Sc. Vol-I, II, III & IV*. Company Ltd. New Delhi.
- Arumugam, S. (2003). *Algebra*. New Gamma Publishing House. Palayamkottai.
- Singaravel, A. (2003). *Algebra and Trigonometry Vol.-I*. Meenakshi Agency. Chennai.
- Vittal, P.R. (2004). *Trigonometry.* Margham Publications. Chennai.

MATHEMATICAL STATISTICS – I
UMAA115

Semester : I	**Credit: 4**
Category : Allied	**Hour/Week: 6**
Class &Major : I B.Sc Mathematics	**Total Hour: 78**

Objectives
To enable the students

- Identify the basic concepts of Mathematical Statistics.
- Understand the Statistical Characteristics, Discrete and Continuous Distributions and their Properties.
- Analyse the Statistical Applications.

Learning Outcomes
On completion of the course, the student will be able to

- Acquire a Good Knowledge of various Concepts of Probability.
- Analyse the Concepts of Probability and Statistics.
- Apply Laws of Probability to Concrete Problems.

UNIT I   **15 Hour**

        Concept of Sample Space - Events - Definition of Probability (Classical, Statistical and Axiomatic) - Addition and Multiplication laws of Probability - Independence of Events - Conditional Probability - Baye's Theorem (Statements only)- Simple Problems.

UNIT II   **16 Hour**

        Random Variables (Discrete and Continuous) - Distribution Function - Expectation and Moments - Moment Generating Function - Probability Generating Function - Cumulant Generating Function - Simple Problems.

UNIT III   **15 Hour**

        Characteristic Function - Properties - Uniqueness and Inversion Theorem (Statement only) Chebychev's Inequality - Simple Problems

UNIT IV   **16 Hour**

        Concept of Bivariate Distribution - Correlation - Karl Pearson's Coefficient of Correlation - Rank Correlation - Linear Regression.

UNIT V   **16 Hour**

Standard Distributions: Discrete Distributions - Binomial, Poisson, Hyper Geometric and Negative Binomial Distributions - Continuous Distributions Normal, Uniform, Exponential.

Text Book

- Gupta, S.C. & Kapoor, V.K. (2008). *Fundamentals of Mathematical Statistics*. Sultan &Sons. New Delhi.

Reference Books

- Hogg, R.V. & Craig, A.T. (1998).*Introduction to Mathematical Statistics*. Macmillan. New York.
- Mood, A.M. Graybill, F.A. & Boes, D.G. (1974). *Introduction to Theory of Statistics.* McGrawHill. New York.

VECTOR CALCULUS
UMAM207

Semester : II	**Credits : 5**
Category : Major Core III / DSC	**Hour/Week : 6**
Class & Major : I B.Sc Mathematics	**Total Hour : 78**

Objectives:
To enable the students

- Acquire Knowledge on Applications of Definite Integrals.
- Understand the Concepts of Beta and Gamma Functions.
- Analyse the Basics of Integration and their Applications.

Learning Outcomes
On completion of the course, the student will be able to

- Acquire Knowledge of Vector Differentiation and Integration.
- Recognise Irrotational and Solenoidal Vector Fields.
- Evaluate Line and Surface Integrals.

UNIT I   **14 Hour**

Vector Point Functions – Scalar Point Functions – Derivative of a Vector & Derivative of Sum of Vectors – Derivative of Product of a Scalar and Vector Point Function – The vector Operator "del" – Gradient.

UNIT II   **16 Hour**

Divergence – Curl, Solenoidal, Irrotational Vectors – Laplacian Operator.

UNIT III   **16 Hour**

Integration of Point Function – Line Integral – Surface Integral-Problems

UNIT IV   **16 Hour**

Volume integral – Gauss Divergence Theorem (Statement Only) – Problems.

UNIT V   **16 Hour**

Greens Theorem and Stoke's Theorem (Statements Only) – Problems.

Text Book

- Duraipandian, P. and Laxmi, D. (2005). *Vector Analysis* (Revised Ed.). Emerald Publishers. Chennai.

Reference Book
- Susan, J.C. (2012). *Vector Calculus*. Pearson Education. Boston. (4th Ed.).
- Anil Kumar Sharma. (1993). *Text Book of Vector Calculus*. Discovery Publishing House. New Delhi.

ANALYTICAL GEOMETRY
UMAM208

Semester	: II	Credit : 5
Category	: Major Core IV / DSC IV	Hour/Week : 5
Class & Major	: I B.SC Mathematics	Total Hour : 65

Objectives
To Enable the Students
- Identify the Fundamental aspects of Conics, Straight Lines, Sphere and Cone.
- Analyse the equations, properties of the Sphere, Cone and Cylinder.
- Apply the Geometrical Problems of Curves, Straight Lines, Cone and Sphere.

Learning Outcomes
On completion of the course, the student will be able to
- Learn Sketching of Various Curves.
- Understand the various Concepts of Analytical Solid Geometry.
- Implement Arithmetical and Geometric Operations involving Vectors in the Plane.

UNIT I   **13 Hour**
General Equation of a Plane – Equation of a Plane in the Normal Form – Angle between Planes – Plane through three given Points – Equation of a Plane through the Line of Intersection of Two Planes.

UNIT II   **13 Hour**
Symmetrical form of a Straight Line – Image of a Point with respect to a Plane – Image of a Line with respect to a Plane – Length and Equation of the Shortest Distance between two Skew Lines - Coplanar Lines.

UNIT III   **13 Hour**
Equation of the Sphere – Length of the Tangent – Tangent Plane – Section of a Sphere by a Plane – Orthogonal Spheres – Equation of a Sphere through a given Circle.

UNIT IV   **13 Hour**
Equation of a Cone with a given Vertex and a given Guiding Curve - Equation of a Cone with its Vertex at the Origin - Condition for the General Equation of the Second Degree to represent a Cone - Right Circular Cone – Enveloping Cone - Tangency of a Plane to a Cone.

UNIT V   **13 Hour**
Equation of a Cylinder with a given Generator and a given Guiding Curve - Right Circular Cylinder - Enveloping Cylinder – Enveloping Cylinder as a Limiting form of an Enveloping Cone.

Text Book
- Manickavachagom Pillay, T.K. & Natarajan, T. (2004). *Analytical Geometry (Three Dimensions)*. S. Viswanathan Printers & Publishers Pvt. Ltd. Chennai.

Reference Books

- Duraipandian, P. and Laxmi, D. (2010). *Analytical Geometry-2D.* Asia Publishing Company. Bombay.
- Duraipandian, P. and Laxmi, D. (2010). *Analytical Geometry-3D.* Emerald Publishers. Chennai.
- Thomas, G.B. and Finney, R.L. (2018). *Calculus and Analytic Geometry.* Addison Wesley (9th Ed.). Mass. India.

MATHEMATICAL STATISTICS II
UMAA207

Semester : II	**Credit** : 4
Category : Allied - II	**Hour/Week :** 6
Class &Major : I B.Sc Mathematics	**Total Hour** : 78

Objectives:
To enable the students
- Classify Sampling Theory Significance Tests and Testing of Hypothesis.
- Acquire Knowledge of the usage of Correlation and Regression.
- Design and Execute Experiments.

Learning Outcomes
On completion of the course, the student will be able to
- Apply Statistics for Mathematical Problems
- Formulate a Problem in Statistical Terms and Perform Analysis of Data.
- Analyse and Apply Theoretical Results in Statistical Questions.

UNIT-I   **16 Hour**

Statistical Population Census and Sampling Survey - Parameter and Statistics - Sampling and Sampling Distribution and Standard Error. Sampling Distributions - Students 't', chi - Square and F distributions.

UNIT-II   **16 Hour**

Test of significance - Large Sample Test for Proportion, Mean and Standard Deviation - Exact test based on 't', Chi - square and F- distribution with respect to Population Mean, Variance and Correlation Coefficient - Tests of Independence of Attributes - Goodness of Fittests.

UNIT-III   **16 Hour**

Point Estimation - Concept of Unbiasedness, Consistency, Efficiency and Sufficiency - Cramer- Rao Inequality - Methods of Estimation - Maximum Likelihood Estimation - Method of Moments.

UNIT-IV   **16 Hour**

Test of Hypothesis: Null and Alternate Hypothesis - Type I and Type II error - Power of the test - Neymann Pearson lemma - Likelihood Ratio Test - Concept of Most Powerful test (Statement and Results only) - Simple Problems

UNIT-V   **16 Hour**

Analysis of Variance - One - way and Two-way Classification - Basic Principles of Design of Experiments - Randomization, Replication, Local Control, Completely Randomized Design, Randomized Block Design and Latin Square Design.

Text Book
- Gupta, S.C. & Kapoor, V.K. (2008). *Fundamentals of Mathematical Statistics*. Sultan & Sons. New Delhi.

Reference Books
- Hogg, R.V. & Craig, A.T. (1998). *Introduction to Mathematical Statistics*. Macmillan. New York.
- Mood, A.M. Graybill, F.A.& Boes, D.G. (1974). *Introduction to Theory of Statistics*. McGrawHill. New York.

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BUSINESS MATHEMATICS
UMAA112

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Semester : I	**Credit: 4**
Category : Allied	**Hour/Week** : 6
Class &Major : I B.Com/B.Com(CA)	**Total Hour:78**

Objectives
To enable the students
- Know the Usage of Mathematics in Business.
- Learn Computational Skills.
- Apply Analytical skills to Solve Problems.

Learning Outcomes
On completion of the course, the student will be able to
- Understand the Basics of Marketing Mathematics.
- Apply the Knowledge in Mathematics in Solving Business Problems.
- Demonstrate the Mathematical Skills in Economics and Business.

UNIT-I   **15 Hour**
       Basic Calculus – Rules for Differentiation – Maxima and Minima and their Applications to Business.

UNIT-II   **16 Hour**
       Commercial Arithmetic –Simple and Compound Interest –Annuties-Sinking Funds-Discount and Present Values of Perpetuity.

UNIT-III   **16 Hour**
       Simple Marketing Models-A Simple Advertising Budget Model-A Simple Inventory Model-Determination of Optimum Warehouse Torritories.

UNIT-IV   **15 Hour**
       Matrix – Operations on Matrices– Inverse of a Square Matrix (not more than 3rd order).

UNIT-V   **16 Hour**
       Solving Simultaneous Equations using Matrix Method- Integration and their Applications to Business.

Text Book
- Sundaresan, V. Jeyaseelan, S.D. (2003). *An Introduction to Business Mathematics*. S. Chand and Co. Pvt. Ltd. New Delhi.

Reference Book
- Aggarwal, B.M. (2003). *Business Mathematics and Statistics Fundamentals*. Sultan Chand and Sons Pvt. Ltd. New Delhi.

ALLIED MATHEMATICS - I
UMAA114/UMAA310

Semester	: I	**Credit**	: 4
Category	: Allied	**Hour/Week**	: 6
Class &Major	: I B.Sc Physics	**Total Hour**	: 78

Objectives

To enable the students

- Know the Applications of Differential Calculus.
- Understand Higher Order Differentiation.
- Apply Numerical Techniques by solving the theory of equations.

Learning Outcomes

On completion of the course, the student will be able to

- Understand the Usage of Logarithmic Series and Exponential Series.
- Apply Methods of Functions of Complex Variables for Calculations of Integrals.
- Expand Functions in Taylor's Series.

UNIT-I   **16 Hour**

Binomial Theorem for Rational Index-Exponential and Logarithmic Series – Summation and Simple Approximations related to Binomial, Exponential and Logarithmic Series.

UNIT-II   **15 Hour**

Cayley Hamilton Theorem – Verification – Finding Inverse of a Matrix using Cayley Hamilton Theorem-Eigen Values and Eigen Vectors (Simple Problems only for Matrices of Order upto3 X 3).

UNIT-III   **15 Hour**

Successive Differentiation-Leibentiz Theorem and its Applications– Jacobian- Concept of Polar Coordinates Radius of Curvature in Cartesian Coordinates.

UNIT-IV   **16 Hour**

Complex Numbers-Applications of De-Movire's Theorem-Expansions of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$,- Expansions of $\sin^n\theta$, $\cos^n\theta$-Expansion of $\sin\theta$, $\cos\theta$, $\tan\theta$ in Powers of θ.

UNIT-V   **16 Hour**

Hyperbolic Functions-Inverse Hyperbolic Functions -Relation between Circular and Hyperbolic Functions-Logarithm of Complex Numbers.

Text Books

- Narayanan and Manichavaschagam Pillay. (1996). *Algebra Volume I.* Viswanathan.S (Publishers & Printers). Pvt. Ltd. Chennai.
- Narayanan and Manichavachagam Pillay. (1994). *Calculus.* Volume I. Viswanathan. S. (Publishers & Printers) Pvt. Ltd. Chennai.
- Narayanan, S. & Manicavachan Pillay, T.K. (1994). *Trignometry.* Vishwanathan.S Printers & Publishers Pvt Ltd. (9th Ed.). Chennai.

Reference Book

- Kandasamy, P. Thilagavathy, K. *(*2012). *Allied Mathematics.* S. Chand. (Publishers & Printers). Pvt. Ltd. Chennai.

MATHEMATICAL METHODS – I
UMAA110

Semester   : I   Credit   : 4
Category   : Allied   Hour/Week : 6
Class & Major: I BCA   Total Hour : 78

Objectives:
To enable the students
- Know the Basic Concepts of Set Theory and Relations.
- Express themselves to the Fundamentals of Differentiation.
- Apply Binary Operators in Automation.

Learning Outcomes
On completion of the course, the student will be able to
- Understand the Relations between Sets and their Property.
- Draw and Interpret Venn Diagrams of Set Relations and Operations.
- Apply set Theory to Solve Real Life Problems.

UNIT-I   16 Hour

Proposition- Logical operators- Conjunction- Disjunction- Negation- Conditional and Bi-Conditional Operators- Converse- Inverse- Contra Positive- Logically Equivalent- Tautology and Contradiction-Arguments and Validity of Arguments.

UNIT-II   10 Hour

Sets- Set Operations- Venn Diagram- Properties of Sets- Number of Elements in a Set Cartesian Product.

UNIT-III   16 Hour

Equivalence Relation- Equivalence Class- Partially and Totally Ordered sets- Functions- Types of Functions- Composition of Functions.

UNIT-IV   16 Hour

Types of Binary Operations- Commutative- Associative- Distributive and Identity Boolean Algebra- Simple Properties - Finite State Machine.

UNIT-V   20 Hour

Derivation-Differential Coefficient of a Sum (or Difference) – Product Rule-Quotient Rule Successive Differentiation- Partial Differentiation- Applications of Differentiation- Tangent and Norma- Angle between Two Curves- Maximum and Minimum Values[Second Derivatives Test].

Text Books
- Venkataraman, M.K, (2003). *Discrete Mathematics*. National Publishing Company. Chennai.
- Narayanan, S. & Manicavacham Pillay, T.K. (2003). *Differential Calculus Volume I*. Viswanathan. S. (Publishers and Printers). Pvt. Ltd. Chennai.

Reference Books
- Balaji, G. (2006). *Discrete Mathematics.* G.Balaji Publishers. Chennai.
- Kandasamy, P. Thilagavathi, K. Gunavathi, K. (2003). *Engineering Mathematics-I*. S. Chand & Company Ltd. Chennai.

STATISTICAL METHODS
UMAA113

Semester : I	**Credit** : 4
Category : Allied	**Hour/Week** : 5T+1P
Class &Major :I BCA	**Total Hour** : 78

Objectives:

To enable the Students

- Acquire Knowledge of the Distributions of Univariate and Bivariate.
- Understand the Significance of Statistical techniques.
- Apply Statistical Techniques for analyzing, and Interpreting Numerical data.

Learning Outcomes

On completion of the course, the student will be able to

- Understand Key terminology, Concepts Tools and Techniques used in Business Statistical Analysis.
- Analyse the Issues Surrounding Sampling and Significance.
- Analyse the Underlying Assumptions of Analysis Tools.

UNIT – I (12+2) Hour

Diagrammatic and Graphical Representation of StatisticalData-Significance of Diagrams and Graphs-Types of Diagrams-One Dimensional Diagrams, Two Dimensional Diagrams–Pictograms and Cartograms. Graphs of Frequency Distribution-Histogram, Frequency Polygon, Frequency Curve-Ogive Curves.

UNIT - II (13+3) Hour

Measures of Central Tendency-Requisites of a Good Average-Types of Average-Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean and their Merits and Demerits-Graphical determination of Median, Quartiles, Deciles, Percentiles and Mode.

UNIT - III (13+3) Hour

Measures of Dispersion-Range, Quartile deviation, Mean deviation, Standard deviation, and their Relative Measures, Combined Standard Deviation, Coefficient of Variation-Merits and Demerits of these Methods-Lorenz curve. Skewness-Measures of Skewness-Karl Pearson's Coefficient of Skewness - Bowley's Coefficient of Skewness, Kelly's Co-efficient of Skewness-Moments-Measures of Skewness based on Moments and Measure of Kurtosis.

UNIT - IV (15+3) Hour

Correlation Analysis-Significance or the Study of Correlation- Types of Correlation-Methods Studying Correlation-Scatter Diagram Method, Graphical Methods, Karl Pearson's co-Efficient of Correlation, Spearman's Rank Correlation Coefficient, Concurrent Deviation Method-Properties of Coefficient of Correlation.

UNIT - V (12+2) Hour

Regression Analysis-Uses of Regression Analysis-Regression Lines-Regression Equations-Properties of Regression Coefficient.

Practical

- Presentation of Data-Diagrams &Graphs.
- Calculation of Measures of Central Tendency-Mean, Median, Mode, Geometric Mean, Harmonic Mean.
- Calculation of Measures of Dispersion-Range, Quartile deviation, Mean Deviation,

- Standard Deviation and its relative Measures and Skewness
- Karl Pearson's Correlation Coefficient.
- Regression equation of X on Y &Y on X.

Text Book
- Gupta, S.P. (2011). *Statistical Methods.* Sultan Chand and Sons. Chennai.

Reference Books
- Gupta, S.C. and Kapoor, V.K. (2006). *Elements of Mathematical Statistics*. Sultan Chand and Sons. Chennai.
- Snedecor, G.W. and Cochran W.G. (1967). *Statistical Methods*. Oxford Press and IBH. Chennai.

MATHEMATICS FOR COMPUTER SCIENCE
UMAA218

Semester : II	**Credit** : 4
Category : Allied	**Hour/Week** : 6
Class & Major : I B.SC Computer science	**Total Hour** : 78

Objectives
To enable the Students
- Acquire Knowledge in Mathematics.
- Understand the Techniques of Various Branches of Mathematics.
- Apply the Mathematical Techniques in their Respective Subjects.

Learning Outcomes
On completion of the course, the student will be able to
- Understand the Core Branches of Mathematics.
- Apply Knowledge of Computing and Mathematics Appropriate to the Discipline.
- Analyse and Define the Computing Requirements Appropriate to its Problem.

UNIT-I   **15 Hour**
Binomial Series – Statement of Binomial Theorem for any Index – A Few Important Expansions – Application of the Binomial Theorem to the Summation of Series. Exponential Series – Summationof Seriesusing Exponential Series – LogarithamicSeries.

UNIT-II   **16 Hour**
Higher Derivative – n^{th}Derivative – Formation of Equation Involving Derivative– Leibnitz Formula for the n^{th}Derivative of a Product (statement only). Radius of curvature (Cartesian Formula only) Jacobian.

UNIT-III   **15 Hour**
Expansion of Cos $n\theta$ and Sin $n\theta$- Powers of sines and cosines of θ in terms of Function of Multiple of θ - Expansion of $\cos^n\theta$ when n is the Positive Integer – Expansion of $\sin^n\theta$ when Positive Integer- Logarithm of Complex Number.

UNIT-IV   **16 Hour**
Definite Integral – Properties of Definite Integrals – Integration by Parts using Bernouli's formula – Double Integral.

UNIT-V   **16 Hour**
Definition – Inverse Laplace transform – Solving Second Order Differential Equations using Laplace Transform.

Text Books
- Narayanan, S. Hanumantha Rao, R.Manicavachagom Pillay.(2008). *Ancillary Mathematics Volume –I.* S. Viswanathan (Printers & Publishers) Pvt.Ltd. Chennai.
- Narayanan, S. Hanumantha Rao, R. Manicavachagom Pillay. (2008). *Ancillary Mathematics Volume –II.* S. Viswanathan (Printers & Publishers) Pvt. Ltd. Chennai.

Reference Books
- Narayanan, S. Manickavachagom Pillay, T.K. (1996). *Algebra Volume I.* Vishwanathan. S. (Printers & Publishers). Pvt Ltd. Chennai.
- Narayanan, S. Manickavachagom Pillay, T.K. (1994). *Calculus Volume I.* Vishwanathan. S (Printers & Publishers). Pvt Ltd. Chennai.
- Narayanan, S. Manickavachagom Pillay, T.K. (1994). *Trigonometry.* (9thEd.). Vishwanathan. S. (Printers & Publishers). Pvt Ltd. Chennai.

MATHEMATICAL METHODS – II
UMAA216

Semester : II	**Credit** : 4
Category : Allied	**Hour / Week** : 6
Class &Major :I BCA	**Total Hour** : 78

Objectives
To enable the students
- Understand the Basic Concepts of Matrices.
- Explore the Fundamentals of Integration.
- Apply the Technique of Differentiation in Vectors.

Learning Outcomes
On completion of the course, the student will be able to
- Determine Gradient Vector Fields and Find Potential Functions.
- Evaluate Line Integrals Directly and by the Fundamental Theorem.
- Solve Problems in Mathematical Applications using the Integral.

UNIT-I 13 Hour

Multiplication of Matrices- Singular and Non-Singular Matrices- Adjoint of a Matrix-Inverse of a Matrix Symmetric and Skew –Symmetric-Hermitian and Skew - Hermitian-Orthogonal and Unitary matrices-Rank of a matrix.

UNIT-II 15 Hour

Solution of Simultaneous Linear equations by Matrix Inversion Method- Test for Consistency and Inconsistency of Linear equations(Rank Method) Characteristic Roots and Characteristic Vectors-Cayley – Hamilton Theorem.

UNIT-III 15 Hour

Integration by Substitution- Integration of rational and Irrational Function of the Form

$$\frac{1}{ax^2+bx+c}, \frac{1}{\sqrt{ax^2+bx+c}}, \sqrt{ax^2+bx+c}, \frac{px+q}{ax^2+bx+c}, \frac{px+q}{\sqrt{ax^2+bx+c}}.$$

UNIT-IV 17 Hour

Definition and Properties of Definite Integrals- Reduction formulae for

$$\int x^n e^{ax} dx, \int \sin^n x dx, \int \cos^n x dx, \int x^m (1-x)^n dx,$$

UNIT-V   **18 Hour**

Vector Functions-Derivatives of Vectors-Gradient-Divergence and Curl, Properties of Curl, Properties of a Gradient Functions-Directional Derivative-Solenoidal and Irrotationals.

Text Book

- Manicavachagom Pillay. Natarajan, Ganapathy. (2003). *Vector Analysis.* S.Viswanathan Printers and Publishers Pvt. Ltd. Chennai.

Reference Book

- Duraipandian, P. Dr. Udayabaskaran, S. (1997). *Allied Mathematics – Volume I.* Muhil Publishers. Chennai.

ALLIED MATHEMATICS -II
UMAA222

Semester	: II	Credit	: 4
Category	: Allied	Hour/Week	: 6
Class &Major	: I B.Sc Physics	Total Hour	: 78

Objectives
To enable the students

- Acquire Knowledge in Mathematics.
- Analyse the Sequence and Series of a Function.
- Apply the Techniques of Various Branches of Mathematics.

Learning Outcomes
On completion of the course, the student will be able to

- Use Integrals in Various Fields.
- Analyze the Computing Requirements Appropriate to its Solution.
- Apply Knowledge of Computing and Mathematics Appropriate to the Discipline.

UNIT-I   **15 Hour**

Standard Integrals-Properties of Definite Integrals.

UNIT-II   **16 Hour**

Integration by Parts – Double Integrals – Applications of Double Integrals to Find Areas.

UNIT-III   **16 Hour**

Sequence and Series- Functions of a Complex Variable- Analytic Functions- Cauchy Riemanns Equations- Harmonic Functions- Construction of Analytic Functions.

UNIT-IV   **16 Hour**

Laplace Transform of Functions – Inverse Laplace Transforms – Application of Laplace Transforms in Solving Differential Equations.

UNIT-V   **15 Hour**

Formation of Partial Differential Equation – Second Order Differential Equations with Constant Co-efficients –Homogeneous Linear Differential Equations of the Second Order with Variable Co-efficients.

Text Books

- Manicavachagom Pillai, T.K. (2010). *Ancillary Mathematics Integral Calculus*. Viswanathan.S Publishers & Printers Pvt. Ltd. Chennai.
- Narayanan, S. Manicavachagom Pillai, T.K. (1994). *Complex Analysis,*Vishwanathan. S Printers & Publishers. Pvt. Ltd. Chennai.

STATISTICS USING EXCEL
UMAR201

Semester : II   **Credit : 2**

Category : Non Major Elective   **Hour/Week : 3**

Class &Major : I UG   **Total Hour : 39**

Objectives:

To enable the students

- Understand the Basic Concepts of Collection, Classification and Tabulation of Data.
- Summarize and Visualize result of Data Analysis in Spreadsheets.
- Represent the various Measures using MS Excel.

Learning Outcomes

On completion of the course, the student will be able to

- Use Excel Functions to Summarize Quantitative Data Graphically
- Perform Basic Operations and Formatting.
- Implement Different Formulae and Functions in Spreadsheets.

List of Practicals:

1. Entering Data, Labels and Values.
2. Presentation of Data – Diagrams and Graphs.
3. Measures of Location and Dispersion (absolute and relative).
4. Computation of Correlation Coefficient for Raw and Grouped Data.
5. Rank Correlation Coefficient.
6. Computation of Regression Equations for Raw Data.
7. Computation of Regression Equations for Grouped Data.
8. Curve Fitting by the Method of Least Squares a. $y=ax+b$ b. $y=ax^2+bx+c$
   c. $y=ae^{bx}$ d. $y=ax.b$
9. Fitting of Binomial, Poisson, Normal Distributions and Tests of Goodness of Fit.
10. Large Sample Tests with regard to Population Mean, Proportion, Standard Deviation.
11. Exact Tests with Respect to Mean, Variance and Coefficient of Correlation.
12. Test for Independence of Attributes Based on Chi-Square Distribution.

Reference Books

- Vittal, P.R. (2016). *Mathematical Statistics.* Margham Publications. India.
- Gupta, S.P. (2011). *Statistical Methods*. Sultan Chand & Sons Publications. India.

E-LEARNING RESOURCES:

- http://www.mathforum.org
- http://www.opensource.org
- http://www.khanacademy.org
- http://in.ixl.com
- http://www.learningwave.

BASIC MATHEMATICS FOR SCIENCE
UMAE204

Semester : II	**Credit** : 2
Category : Non Major Elective	**Hour/ Week** : 3
Class &Major : I UG	**Total Hour** : 39

Objectives

 To enable the students

- Understand the Basic Concepts of Matrices and Trigonometry.
- Explore the Concepts of Fundamentals of Differentiation and Integration.
- Apply the Appropriate Methods to Solve the Problems.

Learning Outcomes
On completion of the course, the student will be able to

- Develop and Maintain Problem-Solving Skills.
- Use Mathematical Ideas to model Real-World Problems.
- Understand the Foundations of Mathematics.

UNIT-I   **8 Hour**

Multiplication of Matrices-Singular and Non-Singular matrices-Adjoint of a Matrices-Inverse of a Matrices-Symmetric and Skew Symmetric-Hermitian and Skew Hermitian-Orthogonal and Unitary Rank of a Matrix.

UNIT-II   **9 Hour**

Solution of Simultaneous Linear Equations by Matrix Inversion Method-Test for Consistency and Inconsistency of Linear Equations(Rank Method).

UNIT-III   **8 Hour**

Derivation-Differential Coefficient of a sum (or difference)-Product Rule-Quotient Rule, Function of Function Rule.

UNIT-IV   **7 Hour**

Definition-Standard Formulae.

UNIT-V   **7 Hour**

Integration by Parts - Simple Problems.

Text Books

- Narayanan, S. Manicavachagom, Pillay. & Natarajan, Ganapathy. (1991). *Vector Analysis.* Vishwanathan.S Printers & Publishers Pvt. Ltd. Chennai.
- Kandhasami, Thilagavathy. (2004). *Allied Mathematics Volume-II.* S.Chand & Co Pvt. Ltd. New Delhi.
- Dr.Venkatraman. M.K. ManoramaSridhar. (2005).*Allied Mathematics.* Agasthiar Publications Pvt. Ltd. Trichy.

MATHEMATICS FOR BUSINESS AND DECISION MAKING
UMAE202

Semester : II	**Credit** : 2
Category : Non Major Elective	**Hour/Week** : 3
Class &Major : I UG	**Total Hour** : 39

Objectives
To enable the students
- Acquire Knowledge on the Scientific Methods for obtaining Optimal Solution.
- Understand the Basic concepts of Mathematics and their Application in Business.
- Analyze a Problem and Apply it to Real Life Problems with Effective Application.

Learning Outcomes
On completion of the course, the student will be able to
- Understand the Basics of Marketing Mathematics by Solving relevant Problems.
- Apply the Principles of Simple / Compound Interest to Solve relevant Problems in Financial Applications.
- Execute Maximin or Minimax Criterion –Savage Criterion – Hurwitz Criterion in Decision Making.

UNIT-I   **8 Hour**

Set and set operation – Venn diagrams- Elements of Co-ordinate systems – Slope intercept form of equation of the Straight Line.

UNIT-II   **9 Hour**

Matrices; Fundamental Ideas about Matrices and their Operational Rules – Matrix Multiplication – Inverse of Square Matrices of not more than 3×3 Order-Basic of Calculus-Rules of Differentiation – Integration and their Applications to Business.

UNIT-III   **8 Hour**

Simple and Compound Interest – Annuities – Sinking Funds – Discounts and Present Values.

UNIT-IV   **7 Hour**

Introduction – Decision Making Environment –Maximin or Minimax Criterion –Savage Criterion –Hurwitz Criterion.

UNIT-V   **7 Hour**

Pure Strategy (Saddle point) – Dominance Property – Mixed Strategies (2×2 Games, $2 \times n$ Games or $m \times 2$ Games, 3×3 Games) – Two-Person Zero Sum Games.

Text Books
- Gupta, P.K. Hira, D.S. *Operations Research.* S. Chand & Company Ltd. New Delhi.
- Kanthi Swarup, P. K. Gupta, Manmohan. (2006). *Operation Research*, S. Chand & Co. Pvt Ltd. New Delhi.
- Sundharesan. and Jayaseelan. (2003). *An Introduction to Business Mathematics.* S. Chand and Co Pvt. Ltd. New Delhi.

NUMERICAL METHODS USING C++
UMAE206/UMAE302

Semester : II	**Credit** : 2
Category : NME	**Hour/Week** : 3
Class &Major : II UG	**Total Hour** : 39

Objectives
To enable the students
- Acquire Knowledge on C++.
- Understand the Various Tools in Solving Numerical Problems.
- Apply the Methods to Solve Problems using the Language.

Learning Outcomes
On completion of the course, the student will be able to
- Select and Apply the Appropriate Numerical Method for a variety of Common Problems.
- Develop Specialized Computer Programs to Solve Engineering Problems.
- Validate and Document Numerical Solutions.

UNIT-I **9 Hour**
Variables-Input and Output—If Statement-Logical Operators-Nested If and Switch Statements – For Statement – While statement –Arrays – Pointers – Library Functions – User Defined Function.

UNIT-II **8 Hour**
Gauss – Elimination method – Pivoting – Gauss –Jordan Elimination method – Gauss – Seidal Iteration method

UNIT-III **8 Hour**
Bisection Method – Newton's Method – Interpolation – Newton's Divided Difference Formula – Lagrange's Interpolation – Newton's Forward and Backward Difference Formula. (Application of C++ Programming is included for Units III & IV).

UNIT-IV **7 Hour**
Numerical Differentiation – Numerical Integration – Newton's Cotes Method – Trapezoidal Rule – Simpson's Rule.

UNIT-V **7 Hour**
Initial Value Problem – Euler's Method – Runge – Kutta Method – Boundary Value Problem.

Text Books
- James, M. Ortega. Andrew, S. Grimshaw. (1999). *An Introduction to C++ and Numerical Method.* Oxford University Press. New York.
- Jain, M.K. Iyengar S.R.K. and Jain, R.K. (1999). *Numerical Methods for Scientific and Engineering Computation.* Wiley Eastern Ltd. New Delhi.

Reference Books
- Balagurusamy, E. (1996). *Object Oriented Programming with C++.* Tata McGraw Hill Publishing Company Ltd. New Delhi.
- Froberg, C.E. (1972). *Introduction to Numerical Analysis.* Addison-Wesely Publishing Company. India.

OPERATIONS RESEARCH FOR MANAGERS
UMAE207/UMAE 402/UMAE306

Semester: IV   **Credit : 2**
Category: NME   **Hour/Week : 3**
Class &Major : II UG   **Total Hour   : 39**

Objectives
To enable the students
- Understand the Various Techniques of Research.
- Analyse the Various Applications in Management Techniques.
- Solve Real Life Problems in Business and Management.

Learning Outcomes
On completion of the course, the student will be able to
- Understand the Input–Process and Output Framework.
- Examine the types of Transformation Processes Occurring within Operations.
- Analyse the Roles and Responsibilities of Operations Managers and the Challenges they Face.

UNIT-I   **7 Hour**
Mathematical Formulation of the Problem- Graphical Solution Method- General Linear Programming Problem- The Computational Procedure- Simple Problems.

UNIT-II   **9 Hour**
General Transportation Problem-The Transportation Table-Loops in Transportation Tables-Solution of a Transportation Problem-Finding an Initial Basic Feasible Solution-Test for Optimality-Degeneracy in Transportation Problem-Transportation Algorithm (MODI Method). Simple Problems.

UNIT-III   **8 Hour**
Mathematical Formulation of the Problem- the Assignment method- Special Cases in Assignment Problem. Simple Problems.

UNIT-IV   **8 Hour**
 Two-Person Zero-Sum Games- Some Basic Terms- The Maximin- Minimax Principle- Games Without Saddle Points-Mixed Strategies- Graphic Solution of 2x n and m x 2 Games- Dominance Property. Simple Problems.

UNIT-V   **7 Hour**
Network and Basic Components- Logical Sequencing- Rules of Network Construction-Critical Path Analysis- Simple problems.

Text Book
- Kanti, Swaroop, Gupta, P.K. and Manmohan. (2003). *Operation Research*. Sultan Chand & Sons. New Delhi.

Reference Books
- Kapoor, V.K. (1996). *Introduction to Operation Research*. Sultan Chand & Sons.
- Sharma, S.D. (1995) *Operation Research*. Kedar Nath Ram Nath & Co.
- Taha, A. Hamdy. (2000). *Operation Research-An Introduction*. Prentice Hall of India Pvt Ltd. (6thEd.). New Delhi.

STATISTICAL DATA ANALYSIS THROUGH SPSS
UMAE208/UMAA501/UMAE 305

Semester : III	**Credit** : 2
Category : NME	**Hour/Week** : 2T+1P
Class &Major : II UG	**Total Hour** : 39

Objectives
To enable the students

- Understand the Techniques of Statistical Data Analysis.
- Analyse Data using Various Statistical Techniques to Evaluate Research Results through SPSS.
- Implement the Concept of Test Reliability in Correlation.

Learning Outcomes
On completion of the course, the student will be able to

- Understand How to Enter and Reorganize Information within SPSS
- Understand How to Effectively Summarize Research Finds using SPSS through the Use of Appropriate Indexes and Tables.
- Understand the Basic Principles Behind Inferential Statistics.

UNIT-I (5+2) Hour

Essential Terminology for all SPSS Users – Getting to SPSS for Windows – the Components of Window – SPSS for Windows Screens – Crucial Preliminaries – Entering Data into SPSS – Editing Data – Saving Data File – Retrieving Data File.

UNIT-II (7+2) Hour

Merging Data Files – Adding Scores to Existing Cases – Add Variables – Running a Simple Analysis and Obtaining the Output.

UNIT-III (4+3) Hour

Checking the Data – BoxPlots of Score Distributions – Listing of the Data using Case Summarizes – Graphs – Bar, Line, Pie Chart, Scatter Plots and Histograms.

UNIT-IV (4+3) Hour

Frequency Distributions– Measures of Frequency Distributions – Cross Tabulations – Obtaining Two Sample Chi-Square Tests – Log Linear Analysis – Parametric Statistical Tests – Comparing Means – Paired and Unpaired t-Test.

UNIT-V (6+3) Hour

Correlation and Multiple Regression – Analyzing Nominal and Ordinal Data – Nonparametric Analysis – Wilcoxon, Mann-Whitney and Kruskal Wallis Tests – the Concept of Test Reliability – Assessing Test Reliability.

Text Book

- Rajathi, A. and Chandran, P. (2010). *SPSS for You*. MJP Publishers.

Reference Books

- Clifford, E. Lunenburg. (2000). *Data Analysis by Resampling: Concepts and Applications.*
- Dusbury Thomson Learning. Australia.
- Everitt, B.S. and Dunn, G. *Applied Multivariate Data Analysis*. Amold London. (2001).
- Jeremy, J. Foster.(2001).*Data Analysis using SPSS for Windows*. New Edition Version 8-10. Sage publications. London.

PRACTICALS

- Entering Data, Labels, Values.
- Presentation of Data – Diagrams & Graphs.
- Measures of location.
- Measures of Dispersion.
- Karl Pearson's Correlation Coefficient.
- Spearman's Rank Correlation.
- Regression Equation of X on Y.
- Regression Equation of Y on X.
- Cross Tabulation.
- Test for Single Mean.
- Test for Difference between Two Sample Means – Independent Samples.
- Test for Difference between Two Sample Means – Dependent Samples.
- Test for Difference between Two Sample Variances.

Non-parametric Test
- Chi- Square Test of Goodness of Fit.
- Chi-Square Test for Independence of Attributes.

APPLIED MATHEMATICS
UMAE209/UMAE309

Semester : III	**Credit** : 2
Category : NME	**Hour/Week** : 3
Class & Major : II UG	**Total Hour** : 39

Objectives:
To enable the Students
- Understand the Properties of Matrix, Partial Differential Equations and Graphs.
- Apply the Concept of Linear Algebra and Graph Theory for Scientific Computing.
- Analyze Numerical Problems in Science Applications.

Learning Outcomes
On completion of the course, the student will be able to
- Understand Mathematical Ideas Easily in Writing with Precision, Clarity and Organization by using Proper Terminology.
- Apply Numerical Techniques in Solving Problems.
- Acquire Proficiency in the Use of Technology in Learning and Investigating Mathematical Ideas by using Problem-Solving Skills.

UNIT - I LINEAR ALGEBRA   10 Hour

Linear System of Equations – Gauss Elimination - Rank of Matrix – Inverse of a Matrix Gauss Jordan Elimination- Applications.

UNIT - II LINEAR ALGEBRA (CONTD.)   10 Hour

The Matrix Eigen Value Problem – Eigen Value and Eigen Vectors- some Applications of Eigen Value Problems.

UNIT- III NUMERICAL APPLICATIONS   10 Hour

Solution of Equations by Iterations – Newton Rapson Method- Interpolation –Lagrange's Interpolation – Spline Interpolation.

UNIT – IV MEASURE THE RATE OF RETURN OF AN INVESTMENT   10 Hour
Basic Concepts of PDE –Modeling – Wave Equation –Heat Equation -Applications.

UNIT – V APPLICATIONS OF GRAPHS   12 Hour
Graphs and Digraphs- Computer representation of Graphs – Shortest Paths Problems-Spanning Tree-Applications.

Text Books
- Erwin, Kreyszig. (2016). *Advanced Engineering Mathematics.* Wiley Publications. Tenth Edition.

Reference Books
- Grewal, B.S. (2015). *Higher Engineering Mathematics.* Khanna Publications. (43rd Ed.).

III & IV EVALUATION COMPONENTS OF CIA

Semester	Category	Course code	Course Title	Component III	Component IV
I	Major Core I / DSC I	UMAM104	Differential Calculus	Assignment	Poster Presentation
	Major Core II / DSC II	UMAM107	Analytical Geometry	Assignment	Poster Presentation
	Allied I	UMAA115	Mathematical Statistics - I	Assignment	Problem Solving
II	Major Core III / DSC III	UMAM207	Vector calculus	Assignment	Seminar
	Major Core IV / DSC IV	UMAM208	Algebra and trigonometry	Assignment	Problem Solving
	Allied II	UMAA207	Mathematical Statistics - II	Assignment	Problem Solving
	Non Major Elective	UMAE210	Statistics Using Excel	Assignment	Project

III & IV EVALUATION COMPONENTS OF CIA-ALLIED

Semester	Category	Course code	Course Title	Component III	Component IV
I	ALLIED	UMAA112	Business Mathematics	Assignment	Seminar
		UMAA114 / UMAA310	Allied Mathematics -I	Assignment	Seminar
		UMAA110	Mathematical Methods I	Assignment	Problem Solving
		UMAA113	Statistical Methods	Assignment	Seminar
II		UMAA218	Mathematics for computer Science	Assignment	Seminar
		UMAA216	Mathematical Methods II	Assignment	Problem Solving
		UMAA222	Allied Mathematics -II	Assignment	Seminar

III & IV EVALUATION COMPONENTS OF CIA-NME

Semester	Category	Course code	Course Title	Component III	Component IV
II	Non Major Elective	UMAR201	Statistics using Excel	Term Paper	Project
		UMAE204	Basic Mathematics for Science	Assignment	Problem Solving
		UMAE202	Mathematics for Business and Decision Making	Assignment	Problem Solving dc
		UIDE302/ UMAE302/ UMAE206	Numerical Methods using C++	Assignment	Assignment
		UMAE207	Operation Research For Managers	Assignment	Assignment
		UMAA501/ UMAE305 UMAE208	Statistical Data Analysis through SPSS	Assignment	Assignment
		UMAE309/ UMAE209	Applied Mathematics	Assignment	Assignment

PROGRAMME PROFILE M.Sc. (Mathematics)

PREAMBLE

PG : Programme Profile, list of Courses offered to the other Departments and the Syllabi of Courses offered in the I and II Semesters (With Effect From 2021-2023 Batch onwards)

PSO 1 : Understanding of Advanced Concepts, Principles and Techniques from Pure & Applied Topics in Mathematics and Application of Problem-Solving Skills.

PSO 2 : Development of Abstract Mathematical Thinking and Mathematical Intuition.

PSO 3 : Assimilation and Communication of detailed Technical Arguments.

PSO4 : Proficiently to Construct and Formulate Logical Arguments, Conjectures and Construction of Rigorous Proof by Abstracting Principles.

PSO 5 : Ability to carry out extended Investigation of Mathematical Work as various Projects Independently.

Semester	Category	Course Code	Course Title	Previous course code	Contact Hrs/ Week	Credit Min/ Max
I	Major Core I / DSC I	PMAM108	Abstract Algebra	PMAM107	6	4
	Major Core II/ DSC II	PMAM102	Real Analysis	-	6	4
	Major Core III / DSC III	PMAM103	Ordinary Differential Equations	-	6	4
	Major Core IV / DSC IV	PMAM105	Calculus Of Variations And Integral Equations	-	6	4
	Major Core V / DSC V	PMAM106/ PMAM407	Fuzzy Analysis	-	6	4
				TOTAL	**30**	**20**
II	Major Core VI/ DSC VI	PMAM210	Linear Algebra	PMAM209	5	4
	Major Core VII / DSC VII	PMAM202	Measure and Integration	-	5	4
	Major Core VIII / DSC VIII	PMAM206	Partial Differential Equations	-	5	4
	Major Core IX / DSC IX	PMAM207	Classical Mechanics	-	5	4
	Major Core X / DSC X	PMAM208	Operations Research	-	5	4
	Non Major Elective			-	5	4
	Service Learning	PMAX201/ PMAX202	Mathematics for High School Students \Elementary Mathematics for Higher Secondary Students	-	-	1
	Online Course	PMAS201	Spoken Tutorial /NPTEL	-	-	- /2
				TOTAL	**30**	**25 / 27**
III	Major Core XI / DSC XI	PMAM305	Complex Analysis	-	6	4
	Major Core XII / DSC XII	PMAM310	Fluid Dynamics	-	6	4
	Major Core XIII / DSC XIII	PMAM311	Topology	PMAM314	6	4
	Major Core XIV / DSC XIV	PRMC301	Research Methodology	-	5	4
	Major Core XV/DSC XV	PMAI312	Number Theory and Cryptography	-	5	4
	Major Core XVI/ DSC XVI	PMAP401	Project	-	2	-
				TOTAL	**30**	**20**
IV	Major Core XVII / DSC XVII	PMAM405	Functional Analysis	-	6	5
	Major Core XVIII / DSC XVIII	PMAM410	Probability theory	-	6	5
	Major Core XIX / DSC XIX	PMAM409	Numerical Analysis	-	7	5
	Major Core XX / DSC XX	PMAM403	Differential Geometry	-	6	5
	Major Core XXI / DSC XXI	PMAP401	Project	-	4	5
	Library				1	-
				TOTAL	**30**	**25**
				GRAND TOTAL	**120**	**90/ 92**

PROGRAMMES OFFERED TO OTHER DEPARTMENTS – PG

Semester	Category	Course Code	Course Title	Contact Hrs/ Week	Credit Min/ Max
I	Non Major Elective	PMAE101	LaTeX and MaTLab	3	4
	Practical		LaTeX and MaTLab	2	
	Non Major Elective	PMAE102	Operations Research	5	4
II	Non Major Elective	PMAE202	NET/SET/ Competitive Exam	5	4
		PMAE203	Discrete mathematics	5	4

EXTRA CREDIT EARNING PROVISION

Semester	Category	Course code	Course Title	Hrs/ Week	Credit Min /Max
III	Self-Study Paper	PMAS301/	Difference Equation	2	-/1
		PMAS302	Combinatorial Analysis	2	-/1

ABSTRACT ALGEBRA
PMAM108

Semester : I   **Credit : 4**
Category : Core I   **Hour/Week : 6**
Class &Major : I M.Sc Mathematics   **Total Hour : 78**

Objectives
To enable the students
- Understand Computational Skills in Abstract Algebra.
- Analyze the Basics of Algebraic Structures.
- Execute Working Knowledge on Galois.

Learning Outcomes
On completion of the course, the student will be able to
- Understand the Connection and Transition of Advanced Mathematics.
- Acquire Important Mathematical Concepts in Abstract Algebra.
- Solve Problems using Algebraic Techniques.

UNIT-I   **16 Hour**
        Another Counting Principle- Class Equation for Finite Groups and its Applications- Sylow's Theorem- Direct Products-Finite Abelian Groups.

UNIT-II   **15 Hour**
        Dual Spaces - Inner Product Space - Modules.

UNIT-III   **20 Hour**
        Extension Fields – Transcendence of e-Roots of Polynomials.

UNIT-IV   **15 Hour**

Trace and Transpose – Determinants, Hermitian, Unitary, Normal Transformations.

UNIT-V   **12 Hour**

Elements of Galois Theory - Finite Fields – Wedderburn's Theorem on Finite Division Rings.

Text Book

- Herstein, N. (2000). *Topics in Algebra.* Wiley Eastern Limited. New Delhi.

Reference Books

- Bhattacharya, P.B. Jain, S.K. & Nagpaul, S.R. (1997). *Basic Abstract Algebra.* Cambridge University Press. New York.
- Malik, D.S. Mordeson,J.N. & Sen, M.K. (1997). *Fundamental of Abstract Algebra.* McGraw Hill. New York.
- Artin, M. (1991). *Algebra.* Prentice Hall of India. New Delhi.

REAL ANALYSIS
PMAM102

Semester : I	**Credit: 4**
Category : Core II	**Hour/Week: 6**
Class &Major : I M.SC Mathematics	**Total Hour:78**

Objectives
To enable the students

- Understand the Functions of Bounded Variation, Riemann- Stieltjes Integration, Convergence and its Variations.
- Apply the Convergence of Sequence of Functions in Real Life Situations.

Learning Outcomes
On completion of the course, the student will be able to

- Understand the Theory of Sequences and Series, Continuity, Differentiation and Integration.
- Describe the Fundamental Properties of the Real Numbers.
- Apply Analytical Skills in Constructing Rigorous Mathematical Arguments.

UNIT-I   **16 Hour**

Double Sequences – Double Series – Rearrangement Theorem for Double Series- A Sufficient Condition for Equality of Iterated Series – Multiplication of Series – CesaroSummability– Infinite Products. Power Series – Multiplication of Power Series – The Taylor's Series Generated by a Function – Bernstein's Theorem - Able'sLimit Theorem– Tauber's Theorem.

UNIT-II   **16 Hour**

Point Wise Convergence of Sequences of Functions – Examples of Sequences of Real Valued Functions – Definitions of Uniform Convergence – Uniform Convergence and Continuity _ The Cauchy Condition for Uniform Convergence – Uniform Convergence of Infinite Seriesof Functions– Uniform Convergence and Riemann– Stieltjes integration – Non Uniform Convergence and Term -by- Term Integration – Uniform Convergence Differentiation – Sufficient Condition for Uniform Convergence of a Series – Mean Convergence.

UNIT-III   **16 Hour**

Introduction – Orthogonal system of functions – the theorem on best approximation – The Fourier Series of a Function Relative to an Orthonormal System – Properties of Fourier

Coefficients – The Riesz-Fischer Theorem – The Convergence and Representation Problem in Trigonometric Series – The Riemann – Lebesgue Lemma – The Dirichlet Integrals – An Integral Representation for the Partial Sums of Fourier Series – Riemann's Localization Theorem – Sufficient Condition for Convergence of a Fourier Series – Consequence of FejesTheorem – The Weierstrass Approximation Theorem.

UNIT-IV   15 Hour
Introduction – The Directional Derivative – Directional Derivative and Continuity – The Total Derivative - The total Derivative Expressed in Terms of Partial Derivatives – The Matrix of Linear Function – The Jacobian Matrix – The Chain Rule – Matrix form of Chain Rule – The Mean – Value Theorem for Differentiable Functions – A Sufficient Condition for Differentiability Condition for Equality of Mixed Partial Derivatives – Taylor's Theorem for Functions of R^n to R^1.

UNIT-V   15 Hour
Functions with Non zeroJacobian Determinants – The Inverse Function Theorem – The Implicit Function Theorem – ExtermaReal Valued Function of Severable Variables – Extremum Problems with Side Conditions.

Text Books
- Barra, G. de. (1981). Measure Theory and Integration. Wiley Eastern Ltd. New Delhi.
- Tom,M.Apostol. (1974). Mathematical Analysis. Addison – Wesley Publishing Company Inc, New York.

Reference Books
- Burkill, J.C. (1951.). *The Lebesgue Integral.* Cambridge University Press. New York.

ORDINARY DIFFERENTIAL EQUATIONS
PMAM103

Semester : I	**Credit: 4**
Category : Core II	**Hour/Week: 6**
Class &Major : I M.SC Mathematics	**Total Hour: 78**

Objectives
To enable the students
- Develop a Strong Background on Finding Solutions to Linear Differential Equations with Constant and Variable Coefficients and also with Singular Points.
- Apply the Existence and Uniqueness of the Solutions of First Order Differential Equations.
- Understand and Develop Analytical Skills.

Learning Outcomes
On completion of the course, the student will be able to
- Effectively Write Mathematical Solutions in a Clear and Concise Manner.
- Locate and Use Information to Solve First and Second Order Ordinary Differential Equations.
- Demonstrate Ability to Think Critically by Determining and using Appropriate Techniques for Solving a Variety of Differential Equations.

UNIT-I   16 Hour
Second Order Homogeneous Equations-Initial Value Problems-Linear Dependence and Independence - Wronskian and a Formula for Wronskian – Non-homogeneous Equation of Order Two.

UNIT-II   **15 Hour**

Homogeneous and Non-homogeneous Equation of Order n – Initial Value Problems-Annihilator Method to Solve Non-homogeneous Equation- Algebra of Constant Coefficient Operators.

UNIT-III   **16 Hour**

Initial Value Problems – Existence and Uniqueness Theorems – Solutions to Solve a Non-homogeneous Equation – Wronskian and Linear Dependence – Reduction of the Order of a Homogeneous Equation – Homogeneous Equation with Analysis Coefficients – The Legendre Equation.

UNIT-IV   **15 Hour**

Euler Equation – Second Order Equations with Regular Singular Points – Exceptional Cases – Bessel Function.

UNIT-V   **16 Hour**

Equation with Variable Separated – Exact Equation – Method of Successive Approximations – the Lipschitz Condition – Convergence of the Successive Approximations and the Existence Theorem.

Text Book
- Coddington, E.A. (1987). *An Introduction to Ordinary Differential Equations.* Prentice-Hall of India Ltd. New Delhi.

Reference Books
- Lebedev. N.N (1965). *Special Functions and their Applications*. Prentice Hall of India. New Delhi.
- Reid, W.T. (1971). Ordinary Differential Equations. John Wiley and Sons. New York.
- Raisinghania, M.D. (2001). *Advanced Differential Equations.* S. Chand & Company Pvt. Ltd. New Delhi.

CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS
PMAM105

Semester : I	**Credit: 4**
Category : Core VII	**Hour/Week: 6**
Class & Major : II M.SC Mathematics	**Total Hour: 78**

Objectives
To Enable the Students
- Analyze the Problem solving Skills.
- Determine Variational problems and Integral Equation.

Learning Outcomes
On completion of the course, the student will be able to
- Understand the Fundamental concepts of the space relative minimum of an Integral.
- Recognize difference between Volterra and Fredholm Integral Equations, First kind and Second kind, Homogeneous and Inhomogeneous etc.
- Apply different methods to solve Integral Equations.

UNIT I   **16 Hour**

Variational Problems with Fixed Boundaries: The Concept of Variation and its Properties – Euler's Equation- Variational Problems for Functionals – Functionals Dependent on Higher

order Derivatives – Functions of Several Independent Variables – Some Applications to Problems of Mechanics.

UNIT-II   **12 Hour**

Variational Problems with Moving Boundaries: Movable Boundary for a Functional Dependent on Two Functions – One-Side Variations.

UNIT- III   **17 Hour**

Integral Equation: Introduction – Types of Kernels – Eigen Values and Eigen functions – Connection with Differential Equation – Solution of an Integral Equation – Initial Value Problems – Boundary Value Problems.

UNIT-IV   **17 Hour**

Solution of Fredholm Integral Equation: Second Kind with Separable Kernel – Orthogonality and Reality Eigen Function – Fredholm Integral Equation with Separable Kernel – Solution of Fredholm Integral Equation by Successive Substitution – Successive Approximation – Volterra Integral Equation – Solution by Successive Substitution.

UNIT-V   **16 Hour**

Hilbert – Schmidt Theory: Complex Hilbert Space – Orthogonal System of Functions- Gram Schmit Orthogonalization Process – Hilbert – Schmit Theorems – Solutions of Fredholm Integral Equation of First Kind.

Text Books
- Gupta, A.S. (2005). *Calculus of Variations with Application.* Prentice Hall of India. New Delhi.
- Sudir, K. Pundir. and Rimple, Pundir. (2005). *Integral Equations and Boundary Value Problems.* Pragati Prakasam. Meerut.

References Books
- Hildebrand, F.B. (1968). *Methods of Applied Mathematics.* Prentice – Hall of India Pvt. New Delhi.
- Kanwal, R.P. (1971). *Linear Integral Equations, Theory and Techniques.* Academic Press. New York.
- Elsgolts, L. (1973). *Differential Equations and Calculus of Variations.* Mir Publishers. Moscow.

FUZZY ANALYSIS
PMAM106

Semester : I
Category : Core V
Class & Major : I M.Sc. Mathematics

Credit: 4
Hour/Week: 6
Total Hour: 78

Objectives
To enable the students
- Understand the concepts of Fuzzy Set, Fuzzy Subset and Fuzzy Logic.
- Distinguish Fuzzy Logic from Classical Logic.
- Apply Fuzzy Logic whenever Uncertainty Arises.

Learning Outcomes
On completion of the course, the student will be able to
- Analyse Statistical Data by using Fuzzy Logic Methods.
- Apply Statistical Methods against Fuzzy Logic Methods.
- Demonstrate Fuzzy Logic Methods.

UNIT-I 16 Hour
Crisp sets – Fuzzy Sets – Additional Properties of Alpha Cut – Representations of Fuzzy sets – Extensions Principle for Fuzzy Sets.

UNIT-II 16 Hour
Types of Operations – Fuzzy Complements – Fuzzy Intersections – Fuzzy Unions – Combinations of Operations– Aggregation Operations.

UNIT-III 16 Hour
Fuzzy Numbers– Linguistic Variables– Arithmetic Operations on Intervals – Arithmetic Operations on Fuzzy Numbers – Lattice of Fuzzy Numbers – Fuzzy Equations.

UNIT-IV 16 Hour
Crisp versus Fuzzy Relations – Binary Fuzzy Relations-Binary Relations on a Single Set –Fuzzy Equivalence Relations– Sup-i-Compositions of Fuzzy Relations-inf-ω_I Compositions of Fuzzy Relations.

UNIT-V 14 Hour
Classical Logic-Multi valued Logics-Fuzzy Propositions-Fuzzy Quantifiers.

Text Books
- George, J. Klir. and Yuan, Bo. *Fuzzy Sets and Fuzzy Logic-Theory and Applications.* Prentice. India.

Reference Books
- Timothy, J.Ross. (2004). *Fuzzy Logic with Engineering Applications.* John Wiley & Sons Pvt. Ltd. The Atrium, Southern Gate Chichester, West Sussex PO198SQ, England.
- Kaufman, A. (1975). *Introduction to the theory of Fuzzy subsets* Volume – I. Academic Press. New York.

LINEAR ALGEBRA
PMAM210

Semester : II   **Credit** : 4

Category : Core VI   **Hours/Week** : 5

Class & Major : II M.Sc Mathematics   **Total Hour** : 65

Objectives
To Enable the Students
- Understand Linear Transformation on n-dimensional Vector Spaces.
- Analyse various Algebraic Structures.
- Estimate Computational Skills in Linear Algebra.

Learning Outcomes
On completion of the course, the student will be able to
- Recognize and Comprehend Proofs of Formal Statements.
- Generalize the Concepts of a Real (complex) Vector Space to an Arbitrary Finite-Dimensional Vector Space.
- Investigate Properties of Vector Spaces and Subspaces by using Linear Transformations.

Unit I   **13 Hour**

Vector spaces – Linear Transformations – Representation of Transformations by Matrices –Linear Functionals – Algebra of Polynomials –Determinants – Properties of Determinants-Characteristic Polynomials – Characteristic Values- Characteristic Vectors- Minimal Polynomials.

Unit II   **13 Hour**

Invariant Subspaces – Direct Sum Decompositions - Diagonalization of Linear Operators – Primary Decomposition Theorem.

Unit III   **13 Hour**

Cyclic Vectors - Cyclic Subspaces - Cyclic Decomposition Theorem – GeneralisedCayley – Hamilton Theorem - Rational Form - Jordan Canonical Form.

Unit IV   **13 Hour**

Bilinear Forms – Positive – Definite, Symmetric and Hermitian Forms – Sylvester`s Theorem.

Unit V   **13 Hour**

Spectral Representation of Symmetric, Hermitian and Normal Operators – Applications.

Text Book
- Hoffman, K. and Kunze, R. (2005). *Linear Algebra.* Pearson Education. Prentice-Hall of India.

Reference Books
- Michael Artin. (1994). *Algebra.* Prentice-Hall of India. New Delhi.
- Friedberg, S.H. Insel, A.J. and Spence, L.E. (2002). Linear Algebra. (4thEd.). Pearson.

MEASURE AND INTEGRATION
PMAM202

Semester	:II	Credit : 4
Category	: Core VI	Hour/Week : 5
Class &Major	: I M.SC	Total Hour : 65

Objectives
To enable the students
- Understand basics of Knowledge in Lebesgue Measure.
- Acquire in depth Knowledge in Multivariable Differential Calculus.

Learning Outcomes
On completion of the course, the student will be able to
- Understand basic notions in Topological Spaces and the n-dimensional space.
- Describe the Construction and Apply the Lebesgue Integral.
- Apply Lebesgue Decomposition and the Radon-Nikodym theorem.

UNIT-I   **13 Hour**

Lebesgue Outer Measure – Measurable Sets – Regularity – Measurable Functions – Boreland Lebesgue Measurability.

UNIT-II   **13 Hour**

Integration of Non Negative Functions – The General Integral – Riemann and Lebesgue Integrals.

UNIT-III   **13 Hour**

Measures and Outer Measures- Completion of a Measure- Measure Spaces- Integration with respect to Measure - L^p Spaces- Completeness of L^p.

UNIT-IV   **13 Hour**

Signes Measures- Hahn, Jordan Decompositions- The Randon Nikodym Theorem- Some Applications of the Nikodym Theorem.

UNIT-V   **13 Hour**

Measurability in a Product Space- The Product measure and Fubini'sTheorem- Lebegue measure in Euclidean Space.

Text Book

- Barra, G. de. (1981). *Measure Theory and Integration.* Wiley Eastern Ltd. New Delhi.

Reference Books

- Natanson, I.P. *(1960). Theory of Functions of a Real Variable Vol.I& II.* Cambridge University Press. New York.
- Royden, H.L. (2003). *Real Analysis.* Prentice- Hall of India Pvt Ltd. New Delhi.
- GanapathyIyer, V. (1977). *Mathematical Analysis.* Tata McGraw Hill Publishing Company Ltd. New Delhi.

PARTIAL DIFFERENTIAL EQUATIONS
PMAM206

Semester : II	**Credit** : 4
Category : Core VII	**Hour/Week** : 5
Class &Major : I M.Sc Mathematics	**Total Hour** : 65

Objectives:
To enable the students
- Understand the Physical Behavior of the Mathematical Model.
- Discuss the Solution of Higher Order Partial Differential Equations.

Learning Outcomes
On completion of the course, the student will be able to
- Demonstrate the Ideas of Differential Equations in a Coherent and Meaningful Manner for Solving Real World Problems.
- Analyze the Solution to Explain the Underlying Physical Processes.
- Formulate Physical Problems as PDE using Conservation Laws.

UNIT – I   **16 Hour**
Formation of PDE -Solution of PDE First order – Integral Surfaces – Cauchy Problem Order Equation – Orthogonal Surfaces – First Order Non- Linear – Characteristics – Compatible System – Charpit'sMethod. Fundamentals Classifications and Canonical forms of PDE.

UNIT - II   **13 Hour**
First Order Non- linear – Characteristics – Compatible System – Charpit's Method.

UNIT – III   **10 Hour**
Introduction- Classification of Second Order PDE-Canonical Forms - Adjoint Operators.

UNIT – IV   **13 Hour**
Derivation of One- Dimensional Wave Equation -Solution of One- Dimensional Wave Equation by Canonical Reduction – IVP – D' Almembert'sSolution – Vibrating String – Forced Vibration – IVP and BVP for Two Dimensional Wave Equation.

UNIT – V   **13 Hour**
Derivation of Laplace and PoissionEquation – BVP – Separation of Variables - Dirichlet's Problem and Newmann Problem for a Rectangle – Elementary Solution of Diffusion Equation – Dirac-Delta Function – Separation of Variables Method.

Text Book
- Shankar Rao, S. (2005). *Introduction to Partial Differential Equations*. Prentice Hall of India. (2nd Ed.). New Delhi.

Reference Books
- McOwen, R.C. (2005). *Partial Differential Equations*. Pearson Education. (2nd Ed.). New Delhi.
- Raisinghania, M.D. (2001). *Advanced Differential Equations*. S.Chand & Company Ltd. New Delhi.
- Sneddon, I.N. (1983). *Elements of Partial Differential Equations*. McGraw hill. New Delhi.

CLASSICAL MECHANICS
PMAM207

Semester : II	**Credit : 4**
Category : Core VIII	**Hour/Week : 5**
Class & Major : I M.Sc Mathematics	**Total Hour :65**

Objectives:
To enable the students
- Understand the Structure of Classical Mechanics and to Outline some of its Applications in Physics.
- Apply Lagrange's and Hamilton's Principle.

Learning Outcomes
On completion of the course, the student will be able to
- Define Mechanical Concepts related to Discrete and Continuous Mechanical Systems.
- Describe the Vibrations of Discrete and Continuous Mechanical System.
- Derive Planar and Spatial Motion of a Rigid Body.

UNIT - I   **16 Hour**
Mechanics of a Particle - Mechanics of a System of Particle-Constraints-D'Alembert's Principle and Lagrange's Equations-Simple Applications of the Lagrangian Formulation.

UNIT – II   **10 Hour**
Hamilton's Principle-Some Techniques of the Calculus of Variations-Derivation of Lagrange's Equations from Hamilton's Principle-Extension of Hamilton's Principle to Nonholonomic Systems.

UNIT - III   **13 Hour**
Advantages of Variational Principle Formulation-Conservation Theorems and Symmetry Properties-Energy Function and the Conversion of Energy.

UNIT - IV   **10 Hour**
The Hamilton –Jacobi Equation for Hamilton's Principle Function - The Harmonic oscillator Problem as an example of the Hamilton Jocobi Method - The Hamilton –Jacobi Equation for Hamilton's Characteristic Function-Seperation of Variables in the Hamilton-Jacobi Equation-Ignorable Coordinates and the Kepler Problem.

UNIT - V   **16 Hour**
The Equations of Canonical Transformations- Examples of Canonical Transformations-The Symplectic Approach Canonical Transformations-Poisson Brackets and Other Canonical Invariants-Equations of Motions, Infinitesimal Canonical Transformations, and Conservation Theorems in the Poisson Brackets Formulation-The Angular Momentum Poisson Brackets Relations-Liouville's Theorem.

Text Book
- Green Wood, D. (1985). *Classical Mechanics.* Prentice Hall of India. New Delhi.

Reference Book
- Herbert Goldstein. Charles Poole. John Safko. (2000). *Classical Mechanics.* Addison Wesley. (3rd Ed). India.

OPERATIONS RESEARCH
PMAM208

Semester   : II **Credit   :4**
Category   : Core IX **Hour/Week : 5**
Class &Major : I M.SC Mathematics **Total Hour : 65**

Objectives
To enable the students
- Understand Queuing Systems, Network Schedule, Sensitivity and Decision Analysis.
- Use Algorithms for Solving Problems.

Learning Outcomes
On completion of the course, the student will be able to
- Understand the Characteristics of Decision-Making Environments.
- Solve Transportation Models and Assignment Models.
- Design New Simple Models like CPM, MSPT to Improve Decision – Making Skills.

UNIT - I   **12 Hour**

Graphical Sensitivity Analysis - Algebraic Sensitivity Analysis–Right-Hand Side of the Constraints - Algebraic Sensitivity Analysis–Objective-Function Coefficients - Sensitivity Analysis with TORA, Excel Solver, and AMPL.

UNIT - II   **14 Hour**

Illustrative Application - Integer Programming Algorithms**:** Branch-and-Bound (B&B) Algorithm Cutting-Plane Algorithm.

UNIT - III   **12 Hour**

Network Representation - Critical Path Computations - Construction of the Time Schedule - PERT Calculations.

UNIT – IV   **16 Hour**

Generalized Poisson Queuing Model - Specialized Poisson Queues: Steady-State Measures of Performance - Single-Server Models - Multiple-Server Models - Machine Servicing Model–$(M/M/R) : (GD/K/K), R<K$ - Pollaczek-Khintchine (P-K) Formula.

UNIT - V   **11 Hour**

Decision Making under Certainty–Analytic Hierarchy Process (AHP) - Decision Making under Risk - Expected Value Criterion - Variations of the Expected Value Criterion - Decision under Uncertainty.

Text Book
- Hamdy, A. Taha. (2010). *Operations Research.* Prentice Hall. India.

Reference Book
- Kapoor, V.K. (1996). *Introduction to Operations Research.* Sultan Chand & Sons. New Delhi.

MATHEMATICS FOR HIGH SCHOOL STUDENTS /ELEMENTARY MATHEMATICS FOR HIGHER SECONDARY STUDENTS
PMAX 201/PMAX202

Semester : II	**Credit: 1**

Category : Service Learning
Class and Major : I M.Sc. Mathematics

Objectives
To enable the students
- Acquire Indepth Knowledge in Matrices and Complex Numbers.
- Inculcate Innovative Teaching Methods.
- Apply the Technique of Differentiation.

Learning Outcomes
On completion of the course, the student will be able to
- Understand Mathematics and to Teach Easily.
- Apply National and State Standards for Mathematics education to develop content-Appropriate Lessons.
- Use and Compare Different Assessment Techniques.

UNIT: I MATRICES
Introduction to Matrix - Adjoint of the Matrix-Inverse of the Matrix - Rank of the Matrix - Consistency of the Linear Equations.
Activity: Lecture, Chart Presentation

UNIT: II VECTOR ALGEBRA
Vectors - Angle between Two Vectors - Scalar Product - Vector Product - Product of Three Vectors - Lines and Planes.
Activity: Lecture, Chart Presentation

UNIT III COMPLEX NUMBERS
The Complex Number System - Conjugate of the Complex Numbers - ordered Pair of Representation - Modulus of the Complex Numbers - De-Moivre's Theorem and its Applications Roots of the Complex Numbers.
Activity: Lecture, Chart Presentation.

UNIT: IVANALYTICAL GEOMETRY
Conic: Parabola-Ellipse-Hyperbola. Parametric forms of Conics.
Activity: Lecture, Model Presentation.

UNIT: V DIFFERENTIAL CALCULUS
Derivative as Measure – Rate of Change – Velocity – Acceleration – Related Rates Derivative as a Measure of Slope.
Activity: Lecture, Power Point Presentation

Reference Books
- Narayanan.Manicavachagom Pillay, T.K. (1996). *Algebra VolumeI*. Viswanathan. S Publishers & Printers. Pvt.Ltd. Chennai.
- Narayanan. Manicavachagom Pillay, T.K. (1994). *Trignometry*. Viswanathan. S Publishers & Printers. Pvt. Ltd. Chennai.
- Narayanan. Manicavachagom Pillay, T.K. (1997). *Vector Algebra*. Viswanathan. S Publishers & Printers. Pvt. Ltd. Chennai.
- Narayanan. Manicavachagom Pillay, T.K. (1993). *Analytical Geomentry of 2D*. Viswanathan.S Publishers & Printers. Pvt. Ltd. Chennai.

LATEX AND MATLAB
PMAE 101/PMAE209

Semester   : I   **Credit :**   4
Category   : Non Major Elective   **Hour/Week :**   5
Class &Major   : I PG   **Total Hour   :** 65

Objectives:
To enable the students
- Understand Documentation in Computer.
- Develop Computer Skills.

Learning Outcomes
On completion of the course, the student will be able to
- Use LaTeX file in Project Works.
- Write Mathematical Document in LATeX File.

UNIT I DOCUMENTATION   **10 Hour**
Document Layout and Organization-Document Class- Page Style- Parts of the Document- Text Formatting- TeX and its Offspring- What's Different in Latex 2€-Distinguishing Latex 2€ and Basics of Latex File.

UNIT II COMMANDS   **15 Hour**
Commands and Environment-Commands Names and Argument- Environments-Contents,-Fine – Tuning Text- Word Division- Labeling-Referencing- Displayed Text-Changing Font- Centering and Indenting- Lists-Generalised Lists- Theorem-like Declaration -Tabulator Stops- Boxes.

UNIT III TABLES   **15 Hour**
Tables- Printing Literal Text- Footnodes and Marginal Notes-Drawing Pictures using Latex-Mathematical Formulas-Mathematical Environment- Main elements of Math Mode-Mathematical Symbols- Addition elements- Fine – Tuning Mathematics.

UNIT IV MATLAB   **12 Hour**
Introduction-Basics of MATLAb- Input-Output- File Types-Platform Dependence-General Commands-Interactive Computation: Matrices and Vectors.

UNIT V FUNCTIONS   **13Hour**
Matrix and Array Operation-Creating and using Inline Functions-Using Built –in Functions and On-Line Help-Saving and Loading Data-Plotting Simple Graphs-Basics Programming in MATLAB-Creating cps Files using MATLAB.

Text Books
- Daly, P.W. (1999). *A Guide to LaTeX* by H.Kopka. Adison Wesley. London.
- Rudra Pratap. (2003). *Getting Started with MATLAB – A Quick Introduction for Scientists and Engineers*. Oxford University Press. New York.

OPERATIONS RESEARCH
PMAE102/PMAE208

Semester : I   **Credit: 4**
Category : NME   **Hour/Week : 5**
Class & Major: I PG   **Total Hour : 65**

Objectives:
To enable the students
- Identify various Techniques of Research.
- Discuss Real Life Problems in Business and Management.
- Apply Management Techniques.

Learning Outcomes
On completion of the course, the student will be able to
- Examine the Types of Transformation Processes Occurring within Operations.
- Define the Roles and Responsibilities of Operations Managers.
- Reflect on Your Own Operations Management Responsibili**es.**

UNIT-I   **13 Hour**
Mathematical Formulation of the Problem- Graphical Solution Method -General Linear Programming Problem - The Computational Procedure- Use of Artificial Variable Techniques- Big- M Method Simple Problems.

UNIT-II   **13 Hour**
General Transportation Problem-The Transportation Table-Loops in Transportation Tables-Solution of a Transportation Problem-Finding an Initial Basic Feasible Solution-Test for Optimality-Degeneracy in Transportation Problem-Transportation Algorithm(MODI Method). Simple Problems.

UNIT-III   **13 Hour**
Mathematical Formulation of the Problem- the Assignment Method- Special Cases in Assignment Problem. Simple Problems.

UNIT-IV   **13 Hour**
Two-person Zero-Sum Games- Some Basic Terms- The Maximin - Minimax Principle- Games Without Saddle Points-Mixed Strategies- Graphic Solution of $2 \times n$ and $m \times 2$ Games- Dominance Property. Simple Problems.

UNIT-V   **13 Hour**
Network and Basic Components- Logical Sequencing- Rules of Network Construction- Critical Path Analysis- Probability Considerations in PERT- Distinction between PERT and CPM. Simple Problems.

Text Book
- Kanti Swaroop,Gupta P.K. and Manmohan. (2003).*Operations Research.* Sultan Chand &Sons. New Delhi.

Reference Books
- Kapoor, V.K. (1996). *Introduction to Operations Research*. Sulthan Chand & Sons. New Delhi.
- Taha, A Handy. (2000). *Operations Research-An Introduction*. Prentice Hall of India Pvt. Ltd. New Delhi.

DISCRETE MATHEMATICS
PMAE203

Semester	: **II**	**Credit : 4**
Category	: **Non-Major Elective**	**Hour/Week : 5**
Class & Major	: **I PG**	**Total Hour : 65**

Objectives:

To enable the students

- Understand the concepts of Set Theory and Finite Automata.
- Apply recursive functions in a computer environment.

Learning Outcomes

On completion of the course, the student will be able to

- Understand Logical Proofs in Discrete Mathematics.
- Apply Advanced Principles of Counting.
- Determine Equivalent Logic Expressions.

UNIT-I   **15 Hour**

Introduction – TF Statements – Connectives – Atomic and Compound Statements – Well formed Formulae.

UNIT-II   **15 Hour**

Tautology – Tautology Implications and Equivalence of a Formulae. Replacement Process.

UNIT-III   **15 Hour**

Functionally Complete Sets of Connectives and Duality law – Normal forms Principles of Normal Forms –Lattices – Some Properties of Lattices – Hasse Digrams– Notations- Boolean Algebras – Boolean Polynomials.

UNIT-IV   **10 Hour**

Basic concepts – Digraph, Incidence and Degree-Subgraph - Isomorphism.

UNIT-V   **10 Hour**

Introduction – Finite Automata - Definition of Finite Automation - Representation of Finite Automation-Acceptability of a String by Finite Automata.

Text Book

- Venkataraman, M.K. Sridharan, N.& Chandrasekaran, N. (2000). *Discrete Mathematics*. The National Publishing Company. India.

Reference Books

- Sundaresan, V. Ganapathy Subramanian, K.S.& Ganesan, K. (1996). *Discrete Mathematics*. A.R. Publications.
- Tremblay, J.P. Manohar. R.(1999). *Discrete Mathematical Structures with Applications to Computer Science*. Tata Mc Graw Hills Publications Company Pvt. Ltd. New Delhi.

III & IV EVALUATION COMPONENTS OF CIA

Semester	Category	Course code	Course Title	Component III	Component IV
I	Major Core IV / DSC IV	PMAM105	Calculus of Variations and Integral Equations	Assignment	Term Paper
	Major Core V/ DSC V	PMAM106/ PMAM407	Fuzzy Analysis	Assignment	Seminar
	Major Core I / DSC (I)	PMAM108	Abstract Algebra	Assignment	Seminar
	Major Core II / DSC II	PMAM102	Real Analysis	Assignment	Term Paper
	Major Core III / DSC III	PMAM103	Ordinary Differential Equations	Assignment	Problem Solving
II	Major Core VI / DSC VI	PMAM210	Linear Algebra	Assignment	Seminar
	Major Core VII / DSC VII	PMAM202	Measure and Integration	Assignment	Seminar
	Major Core VIII / DSC VIII	PMAM206	Partial Differential Equations	Assignment	Problem Solving
	Major Core IX / DSC IX	PMAM204	Classical Mechanics	Assignment	Seminar
	Major Core X / DSC X	PMAM208	Operations Research	Assignment	Problem Solving

III & IV EVALUATION COMPONENTS OF CIA-NME

Semester	Category	Course code	Course Title	Component III	Component IV
I	Non Major Elective	PMAE101/ PMAE209	LaTeX and MATLAB	Assignment	Seminar
		PMAE102/ PMAE208	Operations Research	Assignment	Problem Solving
		PMAE103	Discrete Mathematics	Assignment	Problem Solving