1st YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA12	STATISTICAL METHODS AND ITS APPLICATIONS-1	Allied	2	1	1	0	3	4	25	75	100

Learning Objectives	
LO1	Scope and diagrammatic representation of data
LO2	To know about Measures of Location
LO3	To gain knowledge on Measures of Dispersion
LO4	To understand the concept of skewness
LO5	To understand the relationship between variables and forecasting the future values

Unit	Content	Hours
1	Introduction - Scope and Limitations of Statistical Methods – Classification of Data –Tabulation of Data- Diagrammatic and Graphical Representation of Data.	12
2	Measures of Location: Arithmetic Mean, Median, Mode, and their Properties.	12
3	Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation.	12
4	Measures of Skewness: Karl Pearson's, Bowley's, and Kelly's and Coefficient of Skewness .	12
5	Correlation: KarlPearson– Spearman's Rank Correlation	12

CO	Course Outcomes
CO1	Understand the statistical methods measures of location
CO2	Understand the statistical methods measures of dispersion
CO3	Apply the statistical methods of dispersion and location
CO4	Understand the concept of Skewness.
CO5	Understand the relationship between variables and fore casting the future values

Textbooks:	
1	Fundamental of Mathematical Statistics-S.C.Gupta&V.K.Kapoor-SultanChand
2	Fundamental of Applied Statistics- S.C.Gupta & V.K.Kapoor-Sultan Chand
3	Statistical Methods-Snedecor G.W.& CochranW.G.oxford &+DII
4	Elements of Statistics-Mode. E.B.-Prentice Hall
5	Statistical Methods-Dr. S.P. Gupta -Sultan Chand &Sons
Reference Books:	
1	GuptaS.P.(2001),StatisticalMethods,SultanChand&Sons,NewDelhi.
2	Gupta.S.C.and Kapoor.V.K. Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi
3	PillaiR.S. N.And Bagavathi.V.(2005),Statistics, S.Chand & Company Ltd.,New Delhi.
4	Sancheti D.C.And Kapoor. V.K(2005),Statistics(7thEdition),Sultan Chand & Sons, New Delhi.
5	Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi
Web resources:	
	https://nptel.ac.in/courses/111107105

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	3	2	2	3	3	2
CO2	3	3	3	3	3	2	3	3	3	3	3
CO3	3	3	2	3	2	3	2	3	2	3	2
CO4	2	3	3	3	3	3	3	3	3	3	3
CO5	2	2	3	3	3	3	2	2	3	3	2
Total	13	13	14	15	13	14	12	13	14	15	12
Average	2.6	2.6	2.8	3	2.6	2.8	2.4	2.6	2.8	3	2.4

3 – Strong, 2- Medium, 1- Low

1st YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA13	MATHEMATICS-I	Allied	2	1	1	0	3	4	25	75	100

Learning Objectives

LO1	To learn about Summation of series
LO2	To know about basics of Matrices
LO3	Basic concepts of Numerical Methods
LO4	To gain the knowledge of Trigonometry basics
LO5	To understand the concepts of Calculus

Unit	Content	Hours
1	**Summation of series:** Binomial series, Exponential series, Logarithmic series	**12**
2	**Matrices:** Symmetric–Skew-Symmetric–Hermitian–Skew–Hermitian–Orthogonal and Unitary matrices–Cayley Hamilton theorem (withoutproof)–Verification Computation of inverse of matrix using Cayley-Hamilton theorem.	**12**
3	**Numerical Methods:** Newton's method to find a root approximately. Finite Differences: Interpolation: Operators, Δ, ∇, E, E^{-1}difference tables. Interpolation formulae: Newton's forward and backward interpolation formulae for equal intervals, Lagrange's interpolation formula.	**12**
4	**Trigonometry:** Expansions of $sin^n\theta$ and $cos^n\theta$,series of power of sinθ and cosθ-Expansions of $sin(n\theta)$ in a series of $sines$ and cosines of multiples of "θ"–Expansions of $sin\theta$,$cos\theta$ and $tan\theta$ in a series of powers of "θ"-Hyperbolic functions	**12**
5	**Differential Calculus:** Successive differentiation,n^{th} derivatives, Leibnitztheorem (without proof) and applications, Jacobians, maxima and minima of functions of two variables–Simple problems	**12**

CO	Course Outcomes
CO1	Students will be able to Understand the concepts of Summation of Series
CO2	Students will be able to Understand the concepts of Cayley HamiltonTheorem.
CO3	Students will be able to Understand the concepts of finite differences
CO4	Students will be able to Understand the knowledge about expansions, hyperbolic functions
CO5	StudentswillbeabletoUnderstandtheconceptofLeibnitztheoremandfunctionsoftwovariables

Textbooks:	
1	AlliedMathematics,VolumeIbyP.DuraipandianandS.Udayabaskaran,S.ChandPublicationsforUnitI–IV
2	AlliedMathematics, VolumeIIbyP. DuraipandianandS. Udayabaskaran, S.ChandPublicationsforUnitV
3	AlliedMathematicsbyP.R.Vittal
4	Trignometry,S.Narayanan,T.K.ManicavachagomPillay,S.Viswanathan(Printers&Publishers) PVT.LTD.,2013
5	AncillaryMathematicsbyS.NarayananandT.K.ManickavachagomPillay,S.ViswanathanPinters,1986,Chennai
Reference Books:	
1	Allied Mathematics–IIK.Thilagavathi,S.ChandPublishing,2010
2	Allied Mathematics by A.Singaravelu
3	Calculus of Finite Differences and Numerical Analaysis P.Kandasamy, K.Thilagavathy S.Chand & amp; Company LTD,7361,RamNagar,NewDelhi-110 055
4	Calculus Volume –I, S. Narayan M.A,Retaired Professor Department ofMathematics(U.G.C),VivekanandaCollege,Madras,T.K.ManicavachagomPillay , M.A., L.T., Retired Professor, Department of Mathematics, A.G.CollegeofTechonologyGuindy,Madras, S.Viswanathan(Printers&Publishers)Chennai
5	J.Stewart,L.Redlin,andS.Watson,Algebraand Trigonometry,CengageLearning,2012.

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	3
CO3	3	2	2	2	2	3	2	2	3	2	3
CO4	2	2	3	3	2	3	2	3	3	3	3
CO5	2	2	3	3	2	2	3	3	3	3	3
Total	13	12	14	14	12	14	12	14	15	14	15
Average	2.6	2.4	2.8	2.8	2.4	2.8	2.4	2.8	3	2.8	3

3-Strong, 2-Medium, 1-Low

1st YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA14	NUMERICAL METHODS-I	Allied	2	1	1	0	3	4	25	75	100

Learning Objectives	
LO1	To know about the knowledge of Curve fitting
LO2	Introduction to Numerical Methods
LO3	To understand the Solution of simultaneous linear algebraic equations
LO4	To gain the knowledge of finite difference
LO5	To know about Central differences

Unit	Content	Hours
1	**Curve Fitting- Principle of Least square**: Basics Fitting of straight-line$y = ax + b$ -Parabola$y = ax^2 + bx + c$ -Exponential curves of forms $y = ax^b, y = ae^{bx}, y = ab^x$	**12**
2	**The solution of numerical algebraic and transcendental Equations**: Bisection method–Iteration Method– Regula Falsi Method–Newton–Raphson method	**12**
3	**Solution of simultaneous linear algebraic equations**: Gauss elimination method – Gauss Jordan method – Method of Triangularization – Gauss Jacobi method–Gauss Seidel method	**12**
4	**Finite differences:** Operators Δ,∇ and E-relation between them—factorial polynomials. **Interpolation with equal intervals**: Gregory-Newton forward and backward interpolation formulas.	**12**
5	**Central differences formulae** : Operators, and relation with the other operators. Gauss forward and backward formulae, Stirling's formula and Bessel'sformula	**12**

CO	Course Outcomes
CO1	Solve the problems of fitting of straight lines, parabolas and the different form of exponential curves.
CO2	Solve algebraic equations using various methods like Bisection method, Iteration method, Regula Falsi method and Newton–Raphson method.
CO3	Estimate the solution of simultaneous linear equations using different numerical methods.
CO4	Define basic concept of operators Δ, ∇ and E, Solving interpolation with equal intervals problems using Gregory Newton‟s forward formula and Newton‟s backwardformula
CO5	Estimate the solution of central difference formula using the methods Gauss's forward, backward formula, Stirling's formula and Bessel's formula .

Textbooks:	
1	Kandasamy.P, Thilagavathi.K and Gunavathi.K "Numericalmethods"–S.Chand and Company Ltd NewDelhi–Revised Edition 2007.
2	Numerical Methods, G.Balaji, HOD, Department of Maths, Thangevelu Engineering College Chennai, June 2009, G.Balaji Publisher, Chennai-33
3	Finite Difference and Numerical Analysis, H.C.Saxena, Former Senior Lectures, Department of Maths, Ramjas College, Delhi University, Delhi,2000, S.chand & amp; Company Ltd.,Newdelhi-110055
4	Numerical Methods in Science and Engineering, Dr.M.K.Venkataraman,M.A.,M.Tech.,Ph.D,Retires Proffessor of Mathematics, Alagappa Chettigar College of Engineering and Techonology, Karaikudi, 2007,TheNational Publishing Company, Chennai
5	Numerical Analysis, T.K. Manicavachagom Pillay and Prof.S. Narayanan, S. Viswanathan, Printer & amp; Publisher, PVT, LTD,1994
Reference Books:	
1	Venkataraman M.K.,"Numerical Methods inScience and Engineering "National Publishing company V Edition1999
2	Sankara Rao K.,"Numerical Methods for Scientists and Engineers" 2nd Edition Prentice Hall India 2004.
3	Numerical Methods for Scientific and Engineering Computation, Fifth Edition, M.K. Jain, S.R.K. Iyengar, R.K. Jain, Department of Mathematics, Indian Institution of Technology, Delhi, New age International limited, Publisher, New Delhi
4	Numerical Analysis, Dr.B.SW. Goel,Senior Deputy director, Institute of productivity and Management Ghaziabed, Dr.S.K.Mittal, Department of Maths, M.M. College, Modinagar (Meerut University) 1993, Chand off set Printer, Chennai
5	Calculus of Finite Differences and NumericalAnalaysisP.Kandasamy,K.ThilagavathyS.Chand&CompanyLTD,7361,RamNagar,NewDelhi.110055
Web resources:	
	https://nptel.ac.in/courses/111107105

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	2	2	3	3
CO2	3	3	2	3	3	3	2	2	2	3	3
CO3	3	2	2	3	2	3	3	3	2	2	2
CO4	3	3	3	2	2	3	2	2	3	3	3
CO5	3	2	3	2	3	2	3	3	3	2	2
Total	15	13	13	13	13	14	13	12	12	13	13
Average	3	2.6	2.6	2.6	2.6	2.8	2.6	2.4	2.4	2.6	2.6

3-Strong, 2- Medium, 1- Low

1st YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAE11	DISCRETE MATHEMATICS	Elective	2	1	2	0	3	5	25	75	100

Learning Objectives	
LO1	To know the concepts of relations
LO2	To know the concepts of functions
LO3	To know and solve matrices, rank of matrix
LO4	To gain knowledge on mathematical logics
LO5	To study the graphs and its types

Unit	Content	Hours
1	**Relations:** Relation Introduction- Cartesian Product of Two Sets- Relation Definition with Examples- Domain and Range of a Relation-Representation of Relation- Matrix of a Relation- Digraph of a Relation-Operations on Relations-Compositions of Relation- Equivalence Relations	**15**
2	**Functions:** Functions and Operators- Range of a Function- One to One &Onto Functions- Special Types of Functions- Many to One Mapping- The Identity Function- Invertible Functions- Composition of Functions	**15**
3	**Matrices:** Matrix Algebra- Equality of Matrix – Matrix Operations-Transpose of a Matrix- The Inverse of a Square Matrix- Elementary Operations and Rank of a Matrix	**15**
4	**Mathematicallogics:** Proposition- TF Statement- Connectives-Conjunction & Disjunction- Negation- Conditional & Bi conditional Statement-The Truth Table of a Formula- Tautalogy- Tautological Implications and Equivalence of Formulae	**15**
5	**Graph Theory:** Basic Concepts: Graph- Subgraph- Degree of a Vertex-Isomorphism of a graph	**15**

CO	Course Outcomes
CO1	To understand the concepts of relations distinguish among normal forms
CO2	To understand the concepts of functions distinguish among normal forms
CO3	To solve and know various types of matrices
CO4	To distinguish the various logic operators
CO5	To evaluate and solve various types of graphs

Textbooks:	
1	DiscreteMathematics–Dr.M.K.Venkataraman,Dr.N.Sridharan,N.Chandrasekaran-The National Publishing Company
2	N.Chandra sekaran and M.Umaparvathi, Discrete mathematics, PHI Learning Private Limited, NewDelhi, 2010.
3	Rudolf Lidl and Gunter Pilz, Applied Abstract Algebra, 2nd Indian Reprint,Springer Verlag, NewYork,2006.
4	Mathematical Foundation – U. Rizwan, Scitech Publications (India) Pvt. Ltd, Chennai
5	Invitation to Graph Thoery – S. Arumugam, S. Ramachandran, Scitech Publications (India) Pvt. Ltd, Chennai
Reference Books:	
1	Kimmo Eriksson & Hillevi Gavel, Discrete Mathematics & Discrete Models, Student literature AB, 2015.
2	Kenneth H. Rosen Discrete Mathematics and applications, McGrawHill,2012
3	A. Gill, Applied Algebra for Computer Science, Prentice Hall Inc., New Jersey.
4	J.L. Gersting, Mathematical Structures for Computer Science, 3rd Edn., Computer Science Press, NewYork.
5	S.Wiitala, Discrete Mathematics –A Unified Approach, McGraw Hill Book Co.
Web resources:	
1	https://nptel.ac.in/courses/106106094//
2	https://nptel.ac.in/courses/111107058//

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	3	3	3	3	3
CO2	3	3	3	2	2	3	2	2	3	3	2
CO3	3	2	3	3	3	3	3	3	3	2	2
CO4	2	2	3	2	2	3	2	2	3	3	3
CO5	2	3	2	3	3	2	3	3	3	2	3
Total	13	13	14	13	12	14	13	13	15	13	13
Average	2.6	2.6	2.8	2.6	2.4	2.8	2.6	2.6	3	2.6	2.6

3 – Strong, 2- Medium, 1- Low

1st YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA15	MATHEMATICAL FOUNDATION- I	Allied	2	1	1	0	3	4	25	75	100

Learning Objectives	
LO1	To understand the conceptsofsymbolic and logical operators
LO2	To understand the concepts of Set Theory Basis
LO3	To understand the concepts of SetTheory
LO4	To understand the concepts of Binary Operations
LO5	To understand the concepts Two-dimensional analytical geometry

Unit	Content	Hours
1	**Symbolic Logic**: Proposition,Logical operators, conjunction, disjunction, negation, conditional and bi-conditional operators, converse, Inverse, ContraPositive, logically equivalent, tautology and contradiction. Arguments and validity of arguments.	**12**
2	**Set Theory:** Sets, set operations, venn diagram, Properties of sets	**12**
3	**Set Theory Continuous:** Number of elements in a set, Cartesian product, Relations & functions	**12**
4	**Binary Operations:** Types of Binary Operations: Commutative, Associative, Distributive and identity, Boolean algebra: simple properties.	**12**
5	**Two Dimensional Analytical Geometry:** Straight Lines- Pair Straight Lines	**12**

CO	Course Outcomes
CO1	Student can able to understand about symbolic and logical operators
CO2	After completion of unit2 student can able to understand about Set Theory
CO3	After completion of unit3 student can able to understand about Binary Operations.
CO4	After completion of unit4 student can able to understand about Differentiation
CO5	After completion of unit5 student can able to understand about Two dimensional analytical geometry

Textbooks:	
1	P.R. Vittal, Mathematical Foundations –Maragham Publication, Chennai.
2	U. Rizwan, Mathematical Foundation-SciTech, Chennai
3	Elements of Discrete Mathematics-A computer Oriented Approach- CLLiu, DP Mohapatra. Third Edition, Tata Mc Graw Hill.2.
4	Discrete Mathematics for Computer Scientists & Mathematicians, J.L.Mott,A.Kandel,T.P. Baker, PHI.
5	Vatsa, B.S. and Vatsa, Suchi: Modern Algebra, New Age International (p) Ltd.,New Delhi110002.
Reference Books:	
1	V. Sundaram & Others, Dircrete Mathematical Foundation- A.P. Publication, sirkali.
2	P.Duraipandian & Others, Analytical Geometry 2 Dimension-Emerald publication 1992 Reprint.
3	Manicavachagom Pillay & Natarajan. Analytical Geometry partI- TwoDimension-S.Viswanathan (printers & publication) Pvt Ltd.,1991.
4	Lecture Notes Mathematical Foundations of Computer Science, Mr.V.S.S.V.D. Prakash
5	Allied Mathematics Prof.P. Duraipandian, Dr.S. Udayabaskaran- S.Chand Publication
Web resources:	
1	https://guides.lib.uni.edu/oer//

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	3	2	3	3	2
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	2	2	3	2	2	3	2	2	3	3	2
CO4	2	3	2	3	3	2	3	3	2	2	3
CO5	3	2	3	3	2	2	3	2	3	3	2
Total	13	13	14	14	12	12	14	12	14	14	12
Average	2.6	2.6	2.8	2.8	2.4	2.4	2.8	2.4	2.8	2.8	2.4

3– Strong, 2- Medium, 1- Low

1st YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCOE12	BUSINESS STATISTICS & OPERATION RESEARCH -I	Core	3	1	1	0	3	5	25	75	100

Learning Objectives	
LO1	To enhance the understanding of multiple correlation and multiple regression
LO2	To extend the knowledge of technique of probability.
LO3	To gain the deep knowledge on Sampling methods, proportions-large and small samples- Z test.
LO4	To outline the fundamentals of Operations Research
LO5	To use OR models for problem solving

Unit	Content	Hours
1	**Correlation & Regression Analysis** Partial correlation- Partial correlation coefficient-Partial correlation in case of three variables –Multiple correlation-Multiple regression.	**15**
2	**Probability Distribution** Theory of profit ability – Probability rules- Bayes Theorem (Proof only)- Probability Distribution - Characteristics and application of Binomial, Poisson and Normal Distribution.	**15**
3	**Sampling and Hypothesis Testing** Sampling- Sampling methods- Sampling error and standard error- Relationship between sample size and standard error. Testing hypothesis-testing of means and proportions- large and small samples- Z test.	**15**
4	**Introduction and Linear Programming Problem** Introduction to Operations Research– Uses and Limitations–Linear Programming Problem: Formulation, Solving LPP: Graphical method, Simplex method, theBig-M Method.	**15**
5	**Transportation and Assignment Problems** Transportation problem: Introduction – Assumptions – Formulation of Transportation models – Basic feasible solution (North-West Corner Method, Least Cost Method, and Vogel's Approximation Method)–Optimal solution. Assignment Problem: Introduction – Comparison with the Transportation problem– Formulation of assignment problems- The Hungarian method of solution.	**15**

CO	Course Outcomes
CO1	To manipulate Partial and Multiple Correlations
CO2	To know about Probability and Binomial Distribution.
CO3	To know the Issues Surrounding Sampling, Hypothesis, Z Test.
CO4	To Solve Linear Programming
CO5	To find the Optimal solution using AP and TP

Textbooks:	
1	Sharma J.K.,(2016)"Operations Research", 6thEdition, Lakshmi Publications, Chennai.
2	DC Samcheri and VK Kapoor, Business statistics, Sultan Chand and sons, NewDelhi
3	S P Gupta, Statistical methods, Sultan chand & Sons 2000, New Delhi
4	Nagarajan N.,(2017) "Text Book of Operations Research: A Self Learning Approach", New Age Publications, Chennai.
5	Ken Black – Business Statistics, 5thed., WileyIndia
Reference Books:	
1	Gupta P.K and Hira D.S.,(2022)"Operations Research",7thEdition, S.Chand, Noida(UP)
2	J.K. Sharma, Business Statistics- Pearson Education
3	Business statistics and operations research, Dr D Joseph Anbarasu, Lintech press Trichy
4	Nagarajan N.,(2017) "Text Book of Operations Research: A Self Learning Approach", New Age Publications, Chennai.
5	Sharma J.K., (2016) "OperationsResearch", 6thEdition, Lakshmi Publications, Chennai.
Web resources:	
1	https://www.bbau.ac.in/dept/UIET/EMER601%20Operation%20Research%20Queuing%20theory.pdf
2	https://mdu.ac.in/UpFiles/UpPdfFiles/2021/Jun/4_06-11-2021_16-06-34_OPERATIONS%20RESEARCH%20TECHNIQUES(20MAT22C5).pdf
3	https://repository.up.ac.za/bitstream/handle/2263/25427/02chapter3.pdf?sequence=3
4	https://hbr.org/1964/07/decision-trees-for-decision-making

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	2	3	2	3	3	2
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	2	2	3	2	2	3	2	2	3	3	2
CO4	2	3	2	3	3	2	3	3	2	2	3
CO5	3	2	3	3	2	2	3	2	3	3	2
Total	13	12	14	14	12	12	14	12	14	14	12
Average	2.6	2.4	2.8	2.8	2.4	2.4	2.8	2.4	2.8	2.8	2.4

3– Strong, 2- Medium, 1- Low

1st YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UAAC12	STATISTICS FOR ECONOMICS - I	Core	**2**	1	1	0	**3**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	To know about collection of Data
LO2	Basic concepts about Graphical Representation
LO3	To know about the concept of Averages and its applications
LO4	To gain knowledge on Dispersion
LO5	To estimate Correlation and Regression values

Unit	Content	Hours
1	**Introduction and Collection of Data** Introduction– Nature and Scope of Statistics– Uses and Limitations of Statistics –Data Collection–Primary and Secondary Data–Tools for collecting Primary Data.	**12**
2	**Classification and Presentation of Data** Classification and Tabulation of Data– Types - Frequency Distribution –Cumulative Frequency Distribution-Class Interval– Graphical Representation–Histogram–Frequency Polygon- O give Curve- Lorenz Curve.	**12**
3	**Measures of Central Tendency** Measures of Central Tendency- Requisites of a Good Average– Arithmetic Mean, Median, and Mode	**12**
4	**Measures of Dispersion** Absolute and Relative Measures of Dispersion–Range –Quartile Deviation–Mean Deviation–Standard Deviation	**12**
5	**Correlation and Regression** Correlation – Types of Correlation – Methods –Karl Pearson's Coefficient of Correlation –- Spearman's Rank Correlation –Regression Equations	**12**

CO	Course Outcomes
CO1	Understand the overview of statistics and basic knowledge of statistical tools.
CO2	Differentiate Types of Data and its Classification
CO3	Explain the concept of Averages and its application
CO4	Know the concept of Dispersion and its application
CO5	Calculate Correlation and estimate values using Regression

Textbooks:	
1	Gupta .S.P (2005) Statistical Methods, Sultan Chand and Sons, New Delhi
2	Sancheti.D.CandKapoorV.K (2005) Statistical Theory Method and Application, Sultan Chand and Sons, NewDelhi.
3	Dr.T.K.V.Iyengar,Dr.B.Krishna Gandhi S.Ranganantham, Dr.M.V.S.S.N Prasad, Probability and Statistics, S.Chand and Co, 2020
4	Prof S.G.Vekatachalapathy and Dr.H.Premraj (2018) Statistical Methods Margham Publications
5	Dominick Salvatore and Derrick Reagle, theory and problems of statistics and econometrics, Mc Graw Hill, (2002)
Reference Books:	
1	Saxena H.C,(2016) Elementary Statistics, S Chand and Company New Delhi.
2	Elhance D.N, (2004), Fundamentals of Statistics Kitab Mahal,New Delhi
3	Manoharan M(2010), "Statistical Methods", Palani Paramount Publications, Palani.
4	R.S.N.Pillai and V. Bagavathi(2010), Statistics, Sultan Chand and Sons, New Delhi
5	Dr.S.Sachdeva (2014) Statistics- Lakshmi Narain Agarwal.
Web resources:	
1	https://www.cuemath.com/data/statistics/
2	https://stattrek.com/statistics/resources
3	https://testbook.com/learn/maths-mean-median-mode/
4	https://www.statistics.com/
5	https://thisisstatistics.org/students/

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	3	3	3	3	2	2
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	2	2	3	2	2	2	2	2	3	2	2
CO4	2	3	2	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	2	3	2	3	2	2
Total	13	12	14	14	12	13	14	13	14	12	12
Average	2.6	2.4	2.8	2.8	2.4	2.6	2.8	2.6	2.8	2.4	2.4

3 – Strong, 2- Medium, 1- Low

1st YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA17	MATHEMATICS FOR STATISTICS	Allied	**3**	**1**	**2**	**0**	**3**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	To know about the knowledge of Rational and Partial Fractions
LO2	To gain the knowledge of Series
LO3	To understand the Solution of Theory of Equations
LO4	To know the methods of solving Algebraic and Transcendental Equations
LO5	To acquire knowledge about Successive Differentiation

Unit	Content	Hours
1	**Rational fractions:** Proper and improper rational fractions. Partial fractions: Forms of partial fractions.	**12**
2	**Series**: Summation and approximations related to Binomial, Exponential and Logarithmic series -Taylor‘s series.	**12**
3	**Theory of equations:** Polynomial equations with real coefficients imaginary and irrational roots-solving equations with related roots equation with given numbers as roots	**12**
4	**Differential calculus:** Functions – Different types – simple valued and many valued – Implicit and Explicit functions, Odd and even functions, periodic functions, algebraic and transcendental functions.	**12**
5	**Successive differentiation**: Leibnitz‘s theorem, nth derivatives ofstandard functions – simple problems. Partial differentiation: Successive partial differentiation.	**12**

CO	Course Outcomes
CO1	Distinguish between proper and improper fractions. Express an algebraic fraction as the sum of its partial fractions
CO2	Demonstrate the knowledge to determine the sums, expansion and approximation of series including binomial, exponential, logarithmic
CO3	Solve problems about polynomials with real coefficients, imaginary and irrational roots.
CO4	Calculate limits of a function
CO5	Obtain then the derivative in successive differentiation

Textbooks:	
1	Duraipandian, P. and Udaya Baskaran, S. (2014): Allied Mathematics, Vol. – I,S. Chand & Company Pvt. Ltd.
2	Duraipandian, P. and Udaya Baskaran, S. (2014): Allied Mathematics, Vol. – II,S. Chand & Company Pvt. Ltd
3	Vittal, P.R(2012). Allied Mathematics, Margham Publications
4	Narayanan, S Manickavachagam Pillai (1993): Ancillary Mathematics, Book II : (Containing Differential Calculus)
5	S. Narayanan and T.K. Manicavachagom pillay Calculus, Volume I, S.Viswananthan Printers and Publishers Pvt. Ltd. Chennai.
Reference Books:	
1	Narayanan, S. Manickavachagam Pillai (1993): Ancillary Mathematics (Vol. II, Part I) : (Containing Trignometry) S. Viswanathan Pvt. Ltd
2	Narayanan, S and Manickavachagam Pillai (1993): Ancillary Mathematics, Book I : (Containing Algebra). S. Viswanathan Pvt.Ltd .
3	S.J. Venkatesan (2019), Algebra, Sri Krishna Publications ,Chennai-77 , skhengg1999@gmail.com
4	T. Apostol, Calculus, Volumes I
5	T. Apostol, Calculus, Volumes II
Web resources:	
1	e-books, tutorials on MOOC/SWAYAM courses on the subject

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	2	2	2	2	2	2	2	3	2	2
CO4	2	3	3	3	3	3	3	3	2	3	3
CO5	3	2	2	3	2	2	3	2	3	2	2
Total	14	12	13	14	12	13	14	13	14	13	12
Average	2.8	2.4	2.6	2.8	2.4	2.6	2.8	2.6	2.8	2.6	2.4

3 – Strong, 2- Medium, 1- Low

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UECC22	**STATISTICS FOR ECONOMICS II**	Core	3	1	1	0	3	5	25	75	100

Learning Objectives

LO1	To understand the various methods of index numbers and its applications
LO2	To analyze the components and measurement of time series data
LO3	To know the theories of probability and its applications
LO4	To probe the research design and sampling methods
LO5	To acquire knowledge on the application of test of Hypothesis in Research

Unit	Content	Hours
1	**Index Numbers** Index Numbers – Methods – Unweighted and Weighted Index Numbers – Aggregate and Relative Index Numbers – Chain and Fixed based Index Numbers – Test of Adequacy of Index Numbers -Applications. **Chapter: 13, Page No. 321-331,334-344**	15
2	**Time Series Analysis** Definition– Components and Measurement– Graphic Method - Methods of Semi Average, Moving Averages and Method of Least Squares- Applications**.** **Chapter: 12, Page No 295-299,301-310**	15
3	**Theory of Probability** Introduction-Probability – Theorems of Probability: Addition and Multiplication Theorem, Bayes Theorem – Binomial, Poisson and Normal – Properties- Uses and Applications **Chapters: 14,15,16, 17, Page No 370-374 ,409- 455**	15
4	**Sampling** Sampling – Census and Sample Method – Theoretical Basis of Sampling – Methods of sampling – Random and Non –Random Sampling - Size of Sample – Merits and Limitations of Sampling-Applications **Chapter : 4 Page No : E-4.1 to E-4.23**	15
5	**Testing of Hypothesis** Hypothesis Testing – Meaning, Types, Sources and Functions of Hypothesis – Test: Null and Alternative Hypothesis – One-way and Two-way ANOVA **Chapter: 22 Page No : 22.1-22.29**	15

CO	Course Outcomes
CO1	Gain Knowledge on the Index Numbers
CO2	Analyze the importance of Time Series Data and its measurement
CO3	Understand the knowledge of Probability
CO4	Identify the various Sampling Methods
CO5	Acquire Knowledge on Hypothesis Testing
Textbooks:	
1	Dr.P.R.Vittal, Business Mathematics and Statistics, Margham Publications, Chennai, 2006. (Unit – 1,2,3 &5)
2	Dr.S.P Gupta, Statistical Methods, Sultan Chand & Sons, 1994. (Unit - 4)
Reference Books:	
1	R.S.N. Pillai & V. Bagavathi, Statistics: Theory and Practice, S.Chand & Company Ltd. New Delhi, 2012.
2	Anderson, Sweeney andWilliams, Statistics for Business and Economics, Cengage, 2012.
3	Prof S.G. Vekatachalapathy and Dr.H.Premraj, Statistical Methods, Margham Publications, 2018.
4	Morris H.De Groot Mark J. Schervish, Probability and Statistics, S. Chand and Co, 2020.
5	Sancheti and Kapoor, Statistics, Sultan & Sons New Delhi, 2015.
Web resources:	
1	https://stattrek.com/statistics/resources
2	https://www.cuemath.com/data/f-test/
3	https://www.statistics.com/
4	https://thisisstatistics.org/students/
5	https://oli.cmu.edu/courses/probability-statistics-open-free/

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO 1	3	3	3	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	3	3	3	3	3
CO 4	3	3	3	3	2	3	2	3	3	3	3
CO 5	3	2	2	2	3	2	3	3	3	3	3
Total	15	14	14	14	14	14	14	15	15	15	15
Average	3.00	2.8	2.8	2.8	2.8	2.8	2.8	3.00	3.00	3.00	3.00

3 – Strong, 2- Medium, 1- Low

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA23	**STATISTICAL METHODS AND ITS APPLICATIONS -II**	Allied	2	1	1	0	3	4	25	75	100

Learning Objectives	
LO1	Understand basic concepts of regression, regression lines and curve fitting
LO2	Knowledge related to Sample Space in probability
LO3	Knowledge of standard discrete distributions
LO4	Understand about Test of Significance
LO5	Acquire knowledge about Analysis of variance (ANOVA)

Unit	Content	Hours
1	Regression- Regression lines, Simple problems. Curve fitting by the methods of least squares $y = a + bx$, $y = a + bx + cx^2$, $y = a^{bx}$ **Chapter: 9 Pages 9.1-9.9** **Chapter: 10 pages 10.1-10.10**	12
2	Sample Space -Events- Probability-Addition and Multiplication Theorem- Conditional probability - Baye's Theorem – Applications **Chapter :18 pages 737-750**	12
3	Standard distributions: Binomial, Poisson and Normal distribution - Simple problems and fitting of Binomial and Poisson. **Chapter :19 pages 769 -790**	12
4	Test of Significance: Large sample test based on mean and standard deviation, small sample: 't'-test, Chi-square test **Chapter :20 pages 823 – 840, 847 - 854**	12
5	F-test, Analysis of Variance: One-way classification, Two-way classification and Applications. **Chapter: 26 pages 26.1-26.29**	12

CO	Course Outcomes
CO1	Learn the basics of curve fitting methods
CO2	Basic knowledge of Sample Space in probability
CO3	Be familiar with the concept of standard distribution and fitting of distributions
CO4	Acquire knowledge about important inferential aspects like test of significance
CO5	Solve problems in applications of ANOVA

Textbooks:	
1	Dr.P.R.Vittal, Mathematical Statistics, Margham Publications, Chennai. (Unit – 1 & 5),2002
2	R.S.N.Pillai & Bagavathi (2012) Statistics: Theory and Practice, S.Chand & Company Ltd. New Delhi. (Unit- 2,3& 4)
Reference Books:	
1	S.C.Gupta & V.K.Kapoor, Fundamental of Mathematical Statistics, Sultan Chand & Sons
2	Dr.S.P.Gupta, Statistical Methods, Sultan Chand & Sons.
3	V.K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, 1984.
4	Dr.T.K.V. Iyengar, Dr.B.Krishna Gandhi, S.Ranganantham and Dr.M.V.S.S.N. Prasad Probability and Statistics, S.Chand and Co, 2020.
5	Prof S.G.Vekatachalapathy and Dr.H.Premraj, Statistical Methods, Margham Publications, 2018.
Web resources:	
1	https://stattrek.com/statistics/resources
2	e-books, tutorials on MOOC/SWAYAM courses on the subject
3	www.khanacademy.org/math/statistics-probability/random-variables-statslibrary
4	https://thisisstatistics.org/students/
5	https://oli.cmu.edu/courses/probability-statistics-open-free/

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	3	2	3	3	3	3
CO2	3	3	2	2	3	2	3	3	3	2	2
CO3	3	3	2	3	2	3	2	3	3	2	3
CO4	3	2	3	2	3	2	3	3	2	3	2
CO5	3	2	2	2	3	2	3	2	2	2	3
Total	15	12	11	11	13	12	13	14	13	12	13
Average	3	2.4	2.2	2.2	2.6	2.4	2.6	2.8	2.6	2.4	2.6

S-Strong-3 M-Medium-2 L-Low-1

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA23P	**STATISTICAL METHODS AND ITS APPLICATIONS - I&II PRACTICALS**	Allied Practical	1	0	1	0	2	2	25	75	100

Learning Objectives	
LO1	To acquire the knowledge on Measures of location, dispersion and Skewness.
LO2	To understand the correlation between the variables and Regression analysis
LO3	To understand the method of curve fitting and fitting of distribution
LO4	To acquire the knowledge in test of significance of large sample, small sample and ANOVA.
LO5	To acquire the knowledge on Measures of location, dispersion and Skewness.
	List of Problems
	1. Diagrams and Graphs 2. Measures of Location 3. Measures of Dispersion 4. Skewness 5. Correlation 6. Regression 7. Curve Fitting: $y = a + bx$, $y = a + bx + cx^2$ 8. Fitting of distributions- Binomial, Poisson, Normal 9. Test of significance of small sample and large sample. 10. One-way, two-way classification using ANOVA

CO	**Course Outcomes**
CO1	Understand various type of Diagrams and Graphs.
CO2	Understand the concepts Measures of location, dispersion and Skewness
CO3	Understand correlation between the variables and Regression analysis
CO4	Understand the method of curve fitting and fitting of distribution
CO5	Test the significance of large sample, small sample and ANOVA
Textbooks:	
1	S.C. Gupta & V.K. Kapoor, Fundamental of Mathematical Statistics, Sultan Chand & Sons
2	R.S.N. Pillai & V. Bagavathi, Statistics: Theory and Practice, S. Chand & Company Ltd. New Delhi, 2012.

Reference Books:	
1	E.B. Mode, Elements of Statistics, Prentice Hall.
2	Dr.S.P. Gupta, Statistical Methods, Sultan Chand &Sons.
3	V.K. Rohatgi, An introduction to probability theory and mathematical statistics, 1984.
4	Dr.T.K.V. Iyengar, Dr.B. Krishna Gandhi, S.Ranganantham and Dr.M.V.S.S.N Prasad, Probability and Statistics, S.Chand and Co, 2020.
5	Prof S.G. Vekatachalapathy and Dr.H. Premraj, Statistical Methods, Margham Publications, 2018.
Web resources:	
1	https://stattrek.com/statistics/resources
2	www.khanacademy.org/math/statistics-probability/random-variables-statslibrary

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	2	3	3	3	3
CO2	3	3	2	3	3	3	2	3	2	3	3
CO3	3	2	2	3	2	2	2	3	2	2	2
CO4	2	3	3	3	2	3	2	3	3	3	3
CO5	3	2	2	3	3	2	2	3	2	2	2
Total	14	13	14	15	12	13	10	15	14	13	13
Average	2.8	2.6	2.8	3	2.4	2.6	2	3	2.8	2.6	2.6

3 – Strong, 2-Medium, 1- Low

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA24	MATHEMATICS –II	Allied	3	1	1	0	3	5	25	75	100

Learning Objectives

LO1	To discuss and analyze the concept of gradient, divergence, curl and its properties
LO2	To be familiar with Gauss, Green's, and Stoke's theorem in vector integrals
LO3	To find the solution of first order linear partial differential equations
LO4	To comprehend the concepts and properties of Laplace Transform
LO5	To demonstrate the applications of ordinary differential equations

Unit	Content	Hours
1	**Vector Analysis** Vector functions – Derivative of a Vector function – Scalar & Vector Point function – Gradient of Scalar point function – Gradient – Directional derivatives – Unit Vector normal to a surface – Angle between the surfaces – Divergence, Curl. **Chapter 8: Sections: 8.1 - 8.4 (Exclude Theorems)**	15
2	**Vector Analysis (Contd.)** Line integrals – Surface integrals – Volume integrals – Guass, Stoke's and Green's theorems (without proof) – Simple Problems based on theorems. **Chapter 8: Sections: 8.5 - 8.6**	15
3	**Partial Differential Equations** Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions – Solutions of standard types of first order equations: $f(p, q) = 0$, $f(x, p, q) = 0$, $f(y, p, q) = 0$, $f(z, p, q) = 0$, $f_1(x, p) = f_2(y, q)$. **Chapter 6: Sections: 6.1 – 6.3**	15
4	**Laplace Transforms** Definition– Laplace transforms of $e^{at}, e^{-at}, \cos at, \sin at, \cosh at, \sinh at, t^n, e^{at} f(t), e^{-at} f(t), t^n f(t), f'(t), f''(t)$ Simple Problems. **Chapter 7: Sections:7.1.1 - 7.1.4**	15
5	**Laplace Transforms (Contd..)** Inverse Laplace transforms – Applications to solutions of linear differential equations of order 1 and 2 – Simple Problems. **Chapter 7: Sections: 7.2 – 7.3**	15

CO	Course Outcomes
CO1	Discuss and analyze the concept of gradient, divergence, curl and its properties.
CO2	Recognize the importance of Green's, Gauss and Stoke's theorem in vector integrals.
CO3	Find solution of first order linear partial differential equations.
CO4	Know the knowledge of basics on Laplace Transform.
CO5	Find solution of second order differentiation by using inverse Laplace Transform.
Textbooks:	
1	Prof P. Duraipandian, Dr. S. Udayabaskaran, Allied Mathematics, Volume – II, Muhil publishers, Chennai, 2009.
Reference Books:	
1	P.R. Vittal, Allied Mathematics, Margham Publications, Chennai, 1999.
2	S.Narayanan, P. Kandhasamy, R. Hanumantha Rao and T.K. Manickavasagom Pillai, Ancillary Mathematics, Volume II, S. Viswanathan Printers, Chennai 2010.
3	P.Kandsamy and K.Thilagavathy , Allied Mathematics Volume – II ,S. Chand & Company ,New Delhi, 2024.
4	Shanti Narayan, P.K. Mittal, Differential Calculus, S. Chand & Co, New Delhi, 2005.
5	A.Singaravelu, Allied Mathematics, Meenakshi Agency, Chennai, 2001.
Web resources:	
1	e-books, tutorials on MOOC/SWAYAM courses on the subject

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	2	3	2	3	2	3	3	3	2	2	2
CO2	3	2	2	3	3	2	2	2	2	3	3
CO3	3	2	2	3	3	2	3	2	2	3	2
CO4	3	3	2	3	3	3	3	3	3	2	3
CO5	3	2	2	3	2	3	2	3	2	3	3
Total	14	12	10	15	13	13	13	13	11	13	13
Average	2.8	2.4	2	3	2.6	2.6	2.6	2.6	2.2	2.6	2.6

3 – Strong, 2 – Medium, 1 – Low

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA26	MATHEMATICAL FOUNDATIONS - II	Allied	2	1	1	0	4	4	25	75	100

Learning Objectives

LO1	To understand the concepts of Matrices
LO2	To acquire knowledge on Matrices and linear equations
LO3	To derive Integration methods
LO4	To understand the concepts of properties of definite integrals
LO5	To know about analytical geometry of three dimensions

Unit	Content	Hours
1	**Matrices** Multiplication of matrices – Singular and non-singular matrices – Adjoint of a matrix, Inverse of a matrix – Symmetric and skew symmetric matrices – Hermitian and skew-Hermitian matrices – Orthogonal and unitary matrices – Solution of simultaneous linear equations by Cramer's rule (Definitions, properties and problems only) **chapter 8: Page No: 8.1-8.62, 8.130-8.141**	**12**
2	**Matrices (Contd.)** Rank of a matrix, Test for Consistency and Inconsistency of linear equations, Cayley - Hamilton theorem, Characteristic equation of a Matrix, Similarity of matrices, Diagonalizable matrix. **Chapter 8: Page No: 8.72-8.129**	**12**
3	**Integration** Introduction- Integration by substitution I, II & III Integration of rational function of the type $\frac{lx+m}{ax^2+bx+c}$, Integration by partial fractions , Integration by parts. **Chapter: 17.1 – 17.24, 17.27 – 17.31, 17.38 – 17.45**	**12**
4	**Integration (Contd.)** Reduction formula - Definite integrals, Applications of integration-Area under plane curves. **Chapter: 18,19 and 21**	**12**
5	**Analytical Geometry of Three Dimension** Planes - Straight lines -Applications. **Chapter: 29 and 30**	**12**

CO	Course Outcomes
CO1	Insights into preliminary exploration of different types of Matrices
CO2	Know about linear equations
CO3	Comprehend the basic concept of Integration
CO4	Understand the basic properties of definite integrals
CO5	Solve problems in plane and straight lines
Textbooks:	
1	Dr.P.R.Vittal, Mathematical Foundations - Margham Publication, Chennai, 2010.
Reference Books:	
1	U. Rizwan, Mathematical Foundation - SciTech, Chennai
2	Manicavachagom Pillay & Natarajan, Analytical Geometry part II - three Dimension, S.Viswanathan (Printers & Publication) Pvt Ltd., 1991.
3	S. Narayanan, R. Hanumantha Rao and T.K. Manicavachagom Pillai, Ancillary Mathematics, Volume – I, S. Viswanathan printers, Chennai, 2011.
4	K.C Mathew, S.Veeraraghavan, T. Raghavan, A Text book on Coordinate Geometry of 2D and 3D, S. Chand & Company, New Delhi,1988.
5	A. Singaravelu, Allied Mathematics, Meenakshi Agency, Chennai, 2001
Web resources:	
1.	**http://www.mathfoundation.com/**

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	3	2	2	3	3	3
CO2	3	3	3	3	3	2	3	3	3	3	2
CO3	3	3	2	3	2	3	2	3	2	3	3
CO4	2	3	3	3	3	3	3	3	3	2	2
CO5	2	2	3	3	3	3	2	2	2	3	3
Total	13	13	14	15	13	14	12	13	14	14	13
Average	2.6	2.6	2.8	3	2.6	2.8	2.4	2.6	2.8	2.8	2.6

3 – Strong, 2- Medium, 1- Low

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCOE21	**BUSINESS STATISTICS AND OPERATIONS RESEARCH-II**	Core	2	0	1	1	3	4	25	75	100

Learning Objectives

LO1	To acquire knowledge on Chi square test.
LO2	To analyze F-Test and Analysis of variance
LO3	To examine the role of Sequencing
LO4	To design and apply network analysis
LO5	To apply modelling techniques

Unit	Content	Hours
1	**Chi- Square Distribution** Chi-square distribution- Characteristics and applications- Test of goodness of fit and Test of independence- Test of Homogeneity. **Chapter 11: Sections: 11.1-11.5**	**12**
2	**F- Test & Analysis of Variance (ANOVA)** F distribution- testing equality of population variances- Analysis of variance- One way and Two-way classification. **Chapter 10: Sections:10.11-10.11.2** **Chapter 12: Sections: 12.1-12.5**	**12**
3	**Sequencing** Introduction-Assumptions- Processing of 'n' jobs through one machine-Processing of 'n' jobs through two machines. **Chapter 5: Sections: 5.1-5.4**	**12**
4	**Replacement and Network Analysis** Replacement: Introduction – Individual replacement problems – Group replacement problems. Network Analysis: PERT and CPM. **Chapter 11: Sections: 11.1-11.4** **Chapter 14: Sections: 14.1-14.9**	**12**
5	**Queuing Theory** Queuing: Introduction – Applications of queuing models,Waiting time and idle time costs – Single channel Poisson arrivals with Exponential Service, Infinite population model- An Explanatory note on the Queuing formulae. **Chapter 10: Section: 10.1-10.9**	**12**

CO	Course Outcomes
CO1	Know about applications of Chi- Square Distribution
CO2	Know F-Test and ANOVA
CO3	Learn on sequencing
CO4	Apply network analysis to enhance effectiveness
CO5	Examine the models for Queuing Theory
Textbooks:	
1	J.K. Sharma, Business Statistics- Pearson Education, Second Edition (Unit – I & II)
2	Er. Prem Kumar Gupta and Dr. D.S. Hira (2010) "Operations Research", Third Edition, S. Chand & Company ltd. New Delhi (Unit -III, IV & V)
Reference Books:	
1	D.C. Samcheri and V. K. Kapoor, "Business statistics", Sultan Chand and sons, New Delhi
2	Richard I Levin and David S. Rubit., "Statistics for management", Seventh Edition, Pearson education, New Delhi, 2002
3	Dr. D. Joseph Anbarasu, Business statistics and operations research, Lintech press, Trichy
4	J.K. Sharma, "Operations Research", 6th Edition, Lakshmi Publications, Chennai, 2016
5	N. Nagarajan, "Text Book of Operations Research: A Self Learning Approach", New Age Publications, Chennai, 2017
Web resources:	
1	**https://hbr.org/1964/07/decision-trees-for-decision-making**
2	**https://www.bbau.ac.in/dept/UIET/EMER-**
3	**https://mdu.ac.in/UpFiles/UpPdfFiles/2021/Jun/4_06-11-2021_16-06-**

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	3	2	3	2	2
CO2	2	3	3	3	3	3	2	2	3	2	3
CO3	3	3	1	2	3	2	3	2	3	2	2
CO4	2	3	3	2	3	3	2	2	3	2	2
CO5	3	3	2	3	3	3	3	2	3	2	3
Total	13	15	12	12	15	14	13	10	15	10	12
Average	2.6	3	2.4	2.4	3	2.8	2.6	2	3	2	2.4

High – 3 Medium – 2 Low –1

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA25	**NUMERICAL METHODS–II**	Allied	2	1	1	0	3	4	25	75	100

Learning Objectives

LO1	To evaluate derivatives using Newton's forward and backward differences formulae.
LO2	To acquire the knowledge about evaluation of numerical integration.
LO3	To analyze applications on Newton's divided difference formula and Lagrange's interpolation Formula
LO4	To obtain numerical solutions to the first order ordinary differential equations.
LO5	To acquire the knowledge on Euler's and Runge-Kutta Method.

Unit	Content	Hours
1	**Interpolation with Unequal Intervals** Divided differences-Newton's divided differences formula for interpolation and Lagrange's formula for Interpolation-Inverse interpolation -Lagrange's Method and its applications **Chapter 6: Sections: 6.1-6.2, 6.5 ,6.7**	**12**
2	**Numerical Differentiation** Derivatives using Newton's Forward and Backward Difference Formulae-Derivatives using Stirling's Formula **Chapter 7: Sections: 7.1 - 7.4**	**12**
3	**Numerical Integration** Trapezoidal Rule-Simpson's One-Third Rule - Simpson's Three-Eighth Rule **Chapter 7: Sections: 7.9,7.13 -7.14**	**12**
4	**Numerical Solution of Ordinary Differential Equations (First order only)** Taylor's series method- Picard's method **Chapter 9: Sections: 9.5 - 9.6**	**12**
5	**Numerical Solution of Ordinary Differential Equations (First order only)** Euler'sMethod-Modified Euler'sMethod-Runge-KuttaMethod (Fourth order only) and its applications. **Chapter 9: Sections 9.7, 9.9 - 9.11**	**12**

CO	Course Outcomes
CO1	Understand numerical methods to approximate derivatives by applying Newton's forward and backward differences formulae.
CO2	Knowledge of advanced numerical integration techniques.
CO3	Perceive the knowledge of Newton' divided difference formula and Lagrange's interpolation Formula
CO4	Grasp numerical solutions to the ordinary differential equations.
CO5	Estimate approximate numerical solutions of ordinary differential equations by Runge-Kutta methods, Euler and Modified Euler's Method
Textbooks:	
	P.Kandasamy and K.Thilagavathy, Calculus of Finite differences & Numerical Analysis, S.Chand & Company Ltd., New Delhi, 2003.
Reference Books:	
1	H.C. Saxena, Finite differences and Numerical analysis S.Chand & Co., Delhi, 1991.
2	M.K. Venkataraman, Numerical methods for Science and Engineering National Publishing Company, Chennai, 1992.
3	T.K. Manicavachagom pillay and Narayanan, Numerical Analysis, Viswanathan (Printers /Publishers) Pvt. Ltd, 1994.
4	Dr. B.S.W. Goel, Numerical Analysis, Chand offset Printer, Chennai
5	B.D.Gupta ,Numerical Analysis, Konark Pub.Ltd, Delhi, 2001.
Web resources:	
1	https://ocw.mit.edu/courses/22-15-essential-numerical-methods-fall-2014/pages/syllabus/
2	https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2004/

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	3	2	3	2	2
CO2	2	3	3	3	3	3	2	2	3	2	3
CO3	3	3	1	2	3	2	3	2	3	2	2
CO4	2	3	3	2	3	3	2	2	3	2	2
CO5	3	3	2	3	3	3	3	2	3	2	3
Total	13	15	12	12	15	14	13	10	15	10	12
Average	2.6	3	2.4	2.4	3	2.8	2.6	2	3	2	2.4

High – 3 Medium – 2 Low –1

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA25P	**NUMERICAL METHODS - I & II PRACTICALS**	Allied practical	1	0	1	0	2	2	25	75	100

Learning Objectives	
LO1	To understand the concepts of Bisection method
LO2	To acquire the knowledge on Gauss -Elimination, Gauss-Jacobi method.
LO3	To comprehend the solution of Gauss forward and backward formulae.
LO4	To obtain numerical solutions to the Lagrange interpolation, Trapezoidal and Simpson one-third rule.
LO5	To acquire the knowledge on Euler's and Picard's Method -Runge- Kutta Method.
	List of Problems
	1. Bisection method. 2. Gauss-Elimination method. 3. Gauss-Jacobi method. 4. Newton's forward and backward Interpolation. 5. Gauss forward and backward formula. 6. Lagrange's Interpolation. 7. Trapezoidal and Simpson one-third rules. 8. Euler's method. 9. Picard's method. 10. Runge-Kutta method.

CO	**Course Outcomes**
CO1	Understand Bisection method.
CO2	Understand the concepts of Gauss -Elimination, Jacobi method
CO3	Solve problems in Gauss forward and backward method.
CO4	Know the concept Trapezoidal and Simpson one-third rule.
CO5	Comprehend numerical solutions of ordinary differential equations by Euler, Picard's and Runge-Kutta methods.

Textbooks:

1	P.Kandasamy and K.Thilagavathy, Calculus of Finite differences & Numerical Analysis, S. Chand & Company Ltd., New Delhi, 2003.

Reference Books:	
1	H.C.Saxena, Finite Difference and Numerical Analysis, S. Chand & Company Ltd. Delhi, 2000.
2	M.K.Venkataraman, Numerical Methods in Science and Engineering, National Publishing company V Edition, 1999.
3	T.K. Manicavachagam Pillay and Narayanan, Numerical Analysis, Viswanathan (Printers /Publishers) Pvt.Ltd,1994.
4	Dr.B.S.W.Goel, Numerical Analysis, Chand offset Printer, Chennai
5	B.D.Gupta ,Numerical Analysis, Konark Pub.Ltd, Delhi,2001.
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1	https://ocw.mit.edu/courses/22-15-essential-numerical-methods-fall-2014/pages/syllabus//
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Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	2	3	3	2	3
CO2	3	3	2	2	3	3	2	3	2	3	3
CO3	3	2	2	3	2	2	2	3	2	2	2
CO4	2	3	3	3	2	3	2	3	3	2	3
CO5	3	2	2	2	3	2	2	3	2	3	2
Total	14	13	14	13	12	13	10	15	14	12	13
Average	2.8	2.6	2.8	2.6	2.4	2.6	2	3	2.8	2.4	2.6

3 – Strong, 2-Medium, 1- Low