

Marudhar Kesari Jain College for(Autonomous) Women, Vaniyambadi
PG & Research Department of Mathematics
UG-Mathematics Curriculum frame work

Semester - I						
Code	Course Title	Hours Distribution				C
		L	T	P	S	
24UFTA11	Tamil - 1	4	1	0	0	3
24UFUR11	Urdu -1	4	1	0	0	3
24UFEN11	English - 1	4	1	0	0	3
24UMAC11	CC-1 Algebra and Trigonometry	2	1	2	0	4
24UMAC12	CC-2 Differential Calculus	2	1	2	0	4
24UMAA11/ 24UMAA12	EC-1 Numerical Methods I / Physics I	2	1	1	0	3
24UMAS11/ 24UMAS12	SEC – 1 NM-Basic Mathematics / Mathematics for Competitive Exam	1	0	1	0	2
24UMAS13	SEC-2 Mathematics for Competitive Examinations I	1	0	1	0	2
24UMAF11	FC-Bridge Mathematics	1	1	0	0	2
					30	23
Semester - III						
24UFTA31	Tamil - 3	4	1	0	0	3
24UFUR31	Urdu - 3	4	1	0	0	3
24UFEN31	English - 3	4	1	0	0	3
24UMAC31	CC-5 Differential Equations	3	1	1	0	4
24UMAC32	CC-6 Optimization Techniques	3	1	1	0	4
24UMAA31 / 24UCHA11	EC-4 Mathematical Statistics I /Allied Chemistry 1	3	1	0	0	3
24UMAA31P/ 24UCHS12P	EC -5 AL Mathematical Statistics I practical Using Excel /Chemistry Practical for Physical and Biological Sciences-I	1	0	1	0	2
24UMAS31	SEC -4 R Programming	1	0	1	0	2
24UAEC31	AEC –2 Human Value and Ethics	1	1	0	0	2
					30	23

Semester - V						
	CC-9 Abstract Algebra	3	1	1	0	4
	CC-10 Elements of Mathematical Analysis	3	1	1	0	4
	CC-11 Complex Analysis	3	1	1	0	4
	CC-12 Programming in C with Practical	3	0	2	0	4
	EC-8 Graph Theory and it's Applications	3	1	0	0	3
	EC-9 Mathematical Modeling	3	1	0	0	3
	AEC – 4Social Responsibilities and Upliftment	1	1	0	0	2
	Internship				2	2
					30	26

Semester - II						
Code	Course Title	Hours Distribution				C
		L	T	P	S	
24UFTA21	Tamil - 2	4	1	0	0	3
24UFUR21	Urdu - 2	4	1	0	0	3
24UFEN21	English - 2	4	1	0	0	3
24UMAC21	CC-3 Integral Calculus	3	1	1	0	4
24UMAC22	CC-4 Analytical Geometry	3	1	1	0	4
24UMAA21/ 24UMAA22	EC-2 Numerical MethodsII / Physics II	3	1	0	0	3
24UMAA21P/ 24UMAA22P	EC - 3 AL Numerical Methods I & II Practical Using Python/ Physics I & II Practical	0	0	2	0	2
24UMAS21	SEC-3 Mathematics for Competitive Examinations II	1	0	1	0	2
24UAEC21	AEC – 1 Life Skills Through Yoga	1	1	0	0	2
					30	23
Semester - IV						
	Tamil - 4	4	1	0	0	3
	Urdu - 4	4	1	0	0	3
	English - 4	4	1	0	0	3
	CC-7 Vector Calculus	3	1	1	0	4
	CC-8 Mechanics	3	1	1	0	4
	EC - 6 Mathematical Statistics II/Allied Chemistry II	3	1	0	0	3
	EC - 7 AL Mathematical Statistics II practical Using R Programming /Chemistry Practical for Physical and	0	0	2	0	2
	SEC-5 Python Programming	1	0	1	0	2
	AEC –3 Environmental Studies	1	1	0	0	2
					30	23

Semester - VI						
	CC-13 Linear Algebra	3	1	2	0	4
	CC-14 Real Analysis	3	1	2	0	4
	CC - 15 - Project	0	0	0	5	4
	EC-10 Discrete Mathematics	3	1	1	0	4
	EC-11 Number Theory	3	1	1	0	3
	PEC – 1 Programming in C++	1	1	1	0	2
	SLC – Mathematical Aptitude				3	2
					30	23
					141+2*	

Students must complete at least one online course (MOOC) from platforms like SWAYAM, NPTEL, or Nanmudalvan within the fifth semester. Additionally, engaging in a specified Self-learning Course is mandatory to qualify for the degree, and successful participation will be acknowledged with an extra credit of 2*.

II YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAC31	Differential Equations	Core Course-5	3	1	1	0	4	5	25	75	100
Learning Objectives											
LO1	To understand the methods for solving first-order differential equations, including exact equations.										
LO2	To apply appropriate techniques to determine particular integrals for algebraic, exponential, and trigonometric functions.										
LO3	To recall the fundamental concepts of simultaneous linear differential equations and second-order linear equations.										
LO4	To understand the process of forming PDEs by eliminating arbitrary constants and arbitrary functions										
LO5	To create solutions for complex PDEs by implementing Charpit’s methods.										
Unit	Content										Hours
1	Ordinary Differential Equations: Introduction, Equations of the first order and of the first degree: Variable Separable- Homogeneous Equations- Non-Homogeneous Equations of first degree in two variables- Linear Equation- Bernoulli’s Equation- Exact differential equations – Problems. Chapter I : Sections 1 - 3, Chapter II: Sections 1 - 6.3										15
2	Equation of first order but of higher degree: Equations solvable for dy/dx- Equations solvable for y - Equations solvable for x- Clairaut’s form-Problems. Linear Equations with constant coefficients: Definitions-Particular integrals of algebraic, exponential, trigonometric functions and their products. Chapter IV: Sections:1-3.1 Chapter V: Sections: 1- 4										15
3	Simultaneous linear differential equations- Linear Equations of the Second Order: Complete solution in terms of a known integral-Reduction to the normal form- Change of the independent variable- Variation of Parameters and its applications. Chapter VI : Section: 6 Chapter VIII: Sections: 1- 4										15
4	Partial differential equations of the first order: Introduction- Classification of Integrals-Derivation of PDE by eliminating arbitrary constants and arbitrary functions – Lagrange’s method of solving linear Equation –Simple Applications. Chapter XII: Sections: 1- 4										15
5	Partial differential equations of the first order(continuation): Special methods – Standard forms - Charpit’s Method –Applications. Chapter XII: Sections: 5 and 6										15
Total										75	
Theory-20% Problem-80%											

CO	Course Outcomes
	The student will be able to
CO1	Determine solutions of homogeneous equations, non-homogeneous equations of degree one in two variables.
CO2	Solve the solutions of equations of first order but not of higher degree and to Determine particular integrals of algebraic, exponential, trigonometric functions.
CO3	Find solutions of simultaneous linear differential equations.
CO4	Form a PDE by eliminating arbitrary constants and arbitrary functions.
CO5	Illustrate standard forms and Differential equations using Charpit's method
Textbooks:	
1	S.Narayanan and T.K. Manickavachagom Pillay, Differential Equations and its Applications, S. Viswanathan Printers and Publishers Pvt. Ltd, 2007.
Reference Books:	
1	T.K.Manicavachagom Pillay, T.Natarajan, K.S. Ganapathy, Calculus Volume-III, S. Viswanathan Printers and Publishers Pvt. Ltd, 2012.
2	Dr.P.R.Vittal, Differential Equations, Fourier and Laplace Transforms, Margham Publications, Chennai, 1998.
3	V. Sundrapandian, Ordinary and Partial Differential Equations, Tata McGraw Hill Education Pvt.Ltd. New Delhi, 2013
4	H.T. H.Piaggio, Elementary Treaties on Differential Equations and their applications, C.B.S Publisher & Distributors, Delhi, 1985.
5	Boyce, W.E. and R.C.DiPrima. Elementary Differential Equations and Boundary Value Problems. (7th Edn.) John Wiley and Sons, Inc., New York. 2001
Web resources:	
1	https://nptel.ac.in

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	2	2	1	3	2	2
CO2	3	2	3	2	1	2	3	1	3	2	2
CO3	3	1	3	2	1	1	2	2	3	3	2
CO4	3	3	3	2	2	2	2	2	3	3	2
CO5	3	3	3	2	2	2	1	2	3	3	2
Total	15	12	15	10	7	9	10	8	15	13	10
Average	3	2.4	3	2	1.4	1.8	2	1.6	3	2.6	2

3 – Strong, 2- Medium, 1- Low

II YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAC32	Optimization Techniques	Core Course-6	3	1	1	0	4	5	25	75	100
Learning Objectives											
LO1	To develop the skill on formulation of LPP.										
LO2	To solve Transportation and Assignment problems.										
LO3	To study optimization sequencing problems.										
LO4	To describe inventory control methods										
LO5	To acquire knowledge on construction of Network										
Unit	Content										Hours
1	Linear Programming Problem Introduction-Concept of Linear Programming Model-Development of LP Models-Graphical Method- Linear Programming Methods (Simplex Method only)-Duality Chapter 2: Sections 2.1 - 2.5(2.5.1only), 2.7(2.7.1,2.7.2)										15
2	Transportation Problem Introduction- Mathematical Model for Transportation Problem- Types of Transportation Problem-Methods to Solve Transportation Problem. Assignment Problem: Introduction-Types of Assignment Problem- Hungarian Method. Chapter 3: Sections: 3.1-3.4; Chapter 4: Sections: 4.1-4.4										15
3	Sequencing Problem Introduction-Problems with n jobs through 2 machines - Problems with n jobs through 3 machines- Problems with n jobs through k machines. Chapter: 12 (12.1-12.6)										15
4	Inventory Control Inventory Control: Introduction- Cost associated with inventories-Factors affecting Inventory Control- Deterministic Inventory Problems with and without shortages- Probabilistic Inventory Problems. Chapter 19: Sections: 19.1 to 19.7, 19.12.										15
5	Network Scheduling by PERT/CPM Introduction- Network and Basic Components-Logical Sequencing- Rules of Network Construction- Critical Path Method (CPM)- Programme Evaluation and Review Technique (PERT) Chapter: 21										15
	Total										75
Theory-20% Problem-80%											

CO	Course Outcomes
	The student will be able to
CO1	Understand and apply the concepts involved in solving linear programming problems
CO2	Work on mathematical techniques to optimize transportation and assignment problems.
CO3	Solve sequencing problems.
CO4	Work on inventory management and control models.
CO5	Utilize mathematical techniques for project scheduling, networking, and time-based probability analysis.
Textbooks:	
1	R. Panner selvam, Operations Research, Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2008. (Unit I and Unit II)
2	Kanti Swarup, P. K. Gupta, Man Mohan, Operations Research –Sultan Chand & Sons, New Delhi- Reprint 2006. (Unit III, Unit IV and Unit V)
Reference Books:	
1	J. K. Sharma, Operations Research Theory & Applications – Trinity Press, India, Sixth edition, 2016
2	Hamdy A. Taha, Operations Research – An Introduction, Pearson, Seventh edition, 2014.
3	P. K Gupta, Problems in Operations Research, 2-e, S. Chand & Sons, New Delhi, 1983
4	S. Kalavathy, Operations Research – Vikas Publishing House Pvt. Ltd., 4th Edition, Second Reprint 2018
5	P.R.Vittal, V.Malini, Operations Research, Margham Publications, Chennai, 2002

Mapping with Programme Outcomes and Programme Specific Outcomes

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

3 – Strong, 2- Medium, 1- Low

II YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA31	Mathematical Statistics I	Elective Course - 4	3	1	0	0	3	4	25	75	100
Learning Objectives											
LO1	To understand the basic concepts of random variables and its types.										
LO2	To apply expectation properties in statistical problems.										
LO3	To study on cumulants in probability theory.										
LO4	To acquire knowledge on discrete probability distributions.										
LO5	To describe the characteristics and applications of distribution function .										
Unit	Content										Hours
1	Random variables: Introduction -Distribution Function - Discrete random variable - Continuous random variable Chapter: V Sections: 5.1-5.4.2										12
2	Mathematical Expectation: Introduction - Expected value of function of a random variable – Properties of expectation -Properties of variance – Covariance Chapter: VI Sections: 6.1-6.6										12
3	Generating Functions: Moment generating function – Cumulants - Chebychev's inequality. Chapter: VII Sections: 7.1,7.2 and 7.5										12
4	Discrete probability distribution: Introduction (Bernoulli distribution)- Binomial distribution-Poisson distribution – Geometric distribution Chapter VIII Sections: 8.1, 8.4(8.4.1-8.4.9), 8.4.12, 8.5(8.5.1- 8.5.7, 8.5.10) and 8.7										12
5	Normal distribution: Introduction - Normal distribution - Gamma distribution - Exponential distribution. Chapter IX: Sections: 9.1, 9.2 (9.2.1-9.2.10, 9.2.14), 9.5, 9.8										12
	Total										60
Theory-60% Problem-40%											

CO	Course Outcomes
	The student will be able to
CO1	Identify, differentiate, and analyze discrete and continuous random variables.
CO2	Apply Mathematical expectation properties to solve statistical problems
CO3	Illustrate the cumulants in probability theory
CO4	Work on discrete distributions in statistical applications
CO5	Evaluate continuous distribution functions.
Textbooks:	
1	S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Co, New Delhi, Reprint 2019.
Reference Books:	
1	P.R. Vittal, Mathematical statistics, Margham Publications, 2004.
2	J.N. Kapur & H.C. Saxena, Mathematical statistics, S.Chand & Company Ltd, 2010.
3	R.V. Hogg, J.W. McKean & A.T. Craig, Introduction to mathematical statistics, Pearson Education, India.
4	Murray R. Spiegel, Statistics, 2-e, McGraw Hill Book Company, New Delhi, 1992.
5	Richard A. Janson, Miller, Freunds, Probability and statistics for engineers, 6-e Pearson Education Pvt. Ltd. Delhi, 2001
Web resources:	
1	https://nptel.ac.in

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	2	3	3	2	2
CO2	3	3	2	2	2	1	2	3	3	2	2
CO3	3	2	2	2	2	2	2	3	3	2	2
CO4	3	3	2	2	3	2	3	3	3	2	3
CO5	3	3	3	2	2	2	2	3	3	2	2
Total	15	14	11	10	11	7	11	15	15	10	11
Average	3	2.8	2.2	2	2.2	1.4	2.2	3	3	2	2.2

3–Strong, 2-Medium, 1-Low

II YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA31P	Mathematical Statistics -I Practical Using Excel	Elective-5	1	0	1	0	2	2	25	75	100
Learning Objectives											
LO1	To describe MS Excel in measures of central tendency for different types of data sets.										
LO2	To utilize Excel functions to calculate geometric mean and harmonic mean.										
LO3	To analyze measures of dispersion by computing range and standard deviation using Excel										
LO4	To apply Excel tools to construct histograms and subdivided bar diagrams.										
LO5	To develop skills in constructing pie charts and frequency polygons using Excel for data representation										
	Content										Hours
	1. Measures of Central Tendency for individual data (Mean, Median, Mode) 2. Measures of Central Tendency for discrete data (Mean, Median, Mode) 3. Measures of Central Tendency for Continuous data (Mean, Median, Mode) 4. Measures of Central Tendency for individual data (Geometric Mean, Harmonic Mean) 5. Measures of Central Tendency for discrete data (Geometric Mean, Harmonic Mean) 6. Measures of Central Tendency for continuous data (Geometric Mean, Harmonic Mean) 7. Measures of dispersion for Individual data 8. Measures of dispersion for discrete data 9. Measures of dispersion for Continuous data 10. Graphical Presentation of data (Histogram, Subdivided bar diagram) 11. Graphical Presentation of data (Pie chart) 12. Graphical Presentation of data (Frequency polygon)										6

CO	Course Outcomes
	The student will be able to
CO1	Explain the use of MS Excel in computing measures of central tendency for various types of data sets
CO2	Employ Excel functions in determining geometric mean and harmonic mean.
CO3	Compute and analyze measures of dispersion, including range and standard deviation, using Excel.
CO4	Interpret histograms and subdivided bar diagrams using Excel.
CO5	Design pie charts and frequency polygons in Excel for presenting the data.

Textbooks:	
1	Remenyi, D., Onofrei, G., & English, J. (2022). <i>An introduction to statistics using Microsoft Excel</i> . UJ Press.
2	Rayat, C. S., & Rayat, C. S. (2018). Applications of Microsoft Excel in statistical methods. <i>Statistical Methods in Medical Research</i> , 139-146.
3	Abbott, M. L. (2014). <i>Understanding educational statistics using Microsoft Excel and SPSS</i> . John Wiley & Sons
Website and e-learning source	
	https://real-statistics.com

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	1	3	3	2	2
CO2	3	3	2	2	2	1	1	3	3	2	2
CO3	3	2	2	2	2	2	1	3	3	2	2
CO4	3	3	2	2	3	2	1	3	3	2	2
CO5	3	3	3	2	2	2	1	3	3	2	3
Total	15	14	11	10	11	7	5	15	15	10	11
Average	3	2.8	2.2	2	2.2	1.4	1	3	3	2	2.2

3 – Strong, 2- Medium, 1- Low

II YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UCHA11	Allied Chemistry - I	Elective Course - 4	3	1	0	0	3	4	25	75	100
Learning Objectives											
LO1	To understand chemical bonding and nuclear chemistry.										
LO2	To know about the important materials used in industries.										
LO3	To understand the various fundamental concepts in organic chemistry										
LO4	To understand the various fundamental concepts in organic chemistry										
LO5	To understand separation and purification techniques.										
Unit	Content										Hours
1	Chemical Bonding and Nuclear Chemistry: Chemical Bonding: Molecular Orbital Theory-bonding, anti-bonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers.										12
2	Industrial Chemistry: Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses. Fertilizers: Urea, NPK fertilizer, superphosphate, triple superphosphate.										12
3	Fundamental Concepts in Organic Chemistry: Hybridization: Orbital overlap, hybridization and geometry of CH ₄ , C ₂ H ₄ and C ₆ H ₆ . Electronic effects: Inductive effect, electromeric effect, mesomeric effect, hyper conjugation and steric effects - examples. Reaction mechanisms: Types of reactions – aromaticity (Huckel's rule) – aromatic electrophilic substitution: nitration, halogenation, Friedel-Craft's alkylation and acylation										12
4	Thermodynamics and Phase Equilibria: Thermodynamics: Types of systems, reversible and irreversible processes, Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. Entropy and its significance. Relationship between Gibbs free energy and entropy, Gibb's-Helmholtz equation - derivation. Phase equilibria: Gibb's phase rule, terms involved, phase diagram of water system										12
5	Analytical Chemistry: Principles of volumetric analysis. Separation and purification techniques – extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography										12
Total										60	
Theory - 100											

CO	Course Outcomes
	The student will be able to
CO1	Gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications
CO2	Evaluate the efficiencies and uses of various fuels and fertilizers.
CO3	Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions
CO4	Apply various thermodynamic principles, systems and phase rule.
CO5	Explain various methods to identify an appropriate method for the separation of chemical components.
Textbooks:	
1	Arun Bahl S. and Bahl B. S, "Advanced Organic Chemistry", S. Chand and Company, New Delhi, 23rd ed., 2012.
2	Soni P. L. and Chawla H. M, "Textbook of Organic Chemistry", Sultan Chand & Sons, New Delhi, 29th ed., 2007.
3	Gopalan R, "Analytical Chemistry", Sultan Chand & Sons, 2017.
4	Puri B. R, Sharma L. R. and Madan S. Pathania, "Principles of Physical Chemistry", Vishal Publishing Co., 48th ed., 2024.
5	Veeraiyan V. and Vaithyanathan S, "Textbook of Ancillary Chemistry", Priya Publications, Karur, 2006.
Reference Books:	
1	Soni P. L. and Mohan Katyal, "Textbook of Inorganic Chemistry", Sultan Chand & Sons, New Delhi, 20th ed., 2006.
2	Sharma B. K, "Industrial Chemistry", GOEL publishing House, Meerut, 16th ed., 2014.
3	Puri B. R. and Sharma L. R, "Textbook of Physical Chemistry", 47th ed., 2020.
4	Puri, Sharma, Pathania and Kaur, "Textbook of Physical Chemistry", Vishal Publishing Co., New Delhi, 2018
5	Veeraiyan V, "Textbook of Ancillary Chemistry", Priya Publications, Karur, 1sted., 2009.
Web resources:	
1	https://www.khanacademy.org/science/hs_chemistry/x2613d8165d88df5e:nuclearchemistry-hs
2	https://pubs.acs.org/journal/enfuem
3	https://m.youtube.com/watch?v=8c4urO_h1Ds
4	https://www.energy.gov/nnsa/national-nuclear-security-administration
5	https://en.wikipedia.org/wiki/Molecular_orbital

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	3	3	3
CO2	2	3	3	3	2	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2	3	3	3
CO4	3	3	3	3	3	3	3	2	3	3	3
CO5	3	2	3	3	3	3	3	2	3	3	3
Total	14	14	15	14	14	15	15	10	15	15	15
Average	2.8	2.8	3.0	2.8	2.8	3.0	3.8	2.0	3.0	3.0	3.0

3–Strong, 2–Medium, 1–Low

II YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA31P	Chemistry Practical for Physical and Biological Sciences - I	Elective-5	0	0	2	0	2	2	25	75	100
Learning Objectives											
LO1	Demonstrate accurate use of volumetric glassware, including burettes, pipettes, and volumetric										
LO2	Differentiate between types of titrations (acid-base, redox, complexometric, and precipitation										
LO3	Prepare standard solutions and perform standardization procedures to determine the exact										
LO4	Calculate the concentration of analytes from titration data using appropriate formulas and stoichiometric relationships										
LO5	Select suitable indicators for various types of titrations based on their pH range and the expected equivalence point.										
	Content										Hours
	1. Estimation of sodium hydroxide using standard sodium carbonate 2. Estimation of sodium carbonate using standard sodium hydroxide 6 3. Estimation of hydrochloric acid using standard oxalic acid 4. Estimation of ferrous sulphate using standard Mohr's salt 5. Estimation of oxalic acid using standard ferrous sulphate 6. Estimation of potassium permanganate using standard sodium hydroxide 7. Estimation of Ca (II) using EDTA solution 8. Estimation of Mg (II) using EDTA solution 9. Estimation of total hardness of water 10. Estimation of ferrous ion using diphenyl amine as indicator										6

CO	Course Outcomes
	The student will be able to
CO1	Gain an understanding of the use of standard flask and volumetric pipettes, burette.
CO2	Design, carry out, record and interpret the results of volumetric titration
CO3	Apply their skill in the analysis of water/hardness.
CO4	Analyze the chemical constituents in allied chemical products
CO5	Describe the measurable skills, abilities, knowledge in qualitative analysis

Textbooks:	
1	Venkateswaran V, Veerasamy R and Kulandaivelu A. R, “Basic Principles of Practical Chemistry”, Sultan Chand & Sons, 2nd ed., 1997.
2	Vogel A. I, Tatchell A. R, Furnis B. S, Hannaford A. J and Smith P. W. G, “Vogel's Textbook of Practical Organic Chemistry”, Prentice Hall, 5th ed., 1989.
3	Donald L. Pavia, Gary M. Lampman, George S. Engel & Roger G. Gries, “Experimental Organic Chemistry”, Cengage Learning, 2005
4	Jerry Mohrig, Craig Hammond & Paul F. Snyder, “Techniques in Organic Chemistry”, Macmillan Learning, 4th ed., 2014.
5	Mann F. G and Saunders B. C, “Practical Organic Chemistry”, Pearson Education, 4th ed., 1975.
Reference Books:	
1	Ralph J. Fessenden and Joan S. Fessenden, “Organic Chemistry Laboratory Manual”, Brooks/Cole, 3rd ed., 1982.
2	Middleton H, “Organic Qualitative Analysis”, Longmans, Green and Co., 1st ed., 1951.
3	Bansal R. K, “Laboratory Manual of Organic Chemistry”, New Age International Publishers, 5th ed., 2010.
4	John Leonard, Barry Lygo and Garry Procter, “Advanced Practical Organic Chemistry”, CRC Press, 3rd ed., 2013.
5	Lisa Nichols, Organic Chemistry Laboratory Techniques”, LibreTexts, 1st ed., 2016
Web resources:	
1	https://webbook.nist.gov/chemistry/
2	https://www.organic-chemistry.org/
3	https://www.routledge.com/Advanced-Practical-Organic-Chemistry/Leonard-Lygo-Procter/p/book/978143986097
4	https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Organic_Chemistry_Lab_Techniques_(Nichols)
5	https://www.academia.edu/43215226/Advanced_Practical_Organic_Chemistry_Third_Edi

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	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	15	15	15	15	15	15	15	15	15	15	15
Average	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2- Medium, 1- Low

II YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAS31	R – Programming		1	0	1	0	2	2	25	75	100
Learning Objectives											
LO1	To learn the fundamental concepts of ‘R’ using RGui and R Studio										
LO2	To understand the special data structures of R language Character Vector, Array, Matrix and List										
LO3	To provide knowledge for various control structures										
LO4	To provide knowledge in Data types and packages										
LO5	To understand about graphical analysis pie and bar charts										
Unit	Content										Hours
1	Introduction: History of R- Benefits of Using R – Working with code Editor: RGui and R Studio - Starting your First R Session - Sourcing a script - Navigating the workspace- Vectors: Creating vectors- combining vectors repeating vector - Getting values in and out of vectors- working with logical vectors										6
2	Using character vector for text data - Manipulating text - Factoring in Factors - Naming matrix rows and columns - Calculating with matrices- Creating an array- Creating a list Creating a list - Extracting elements from lists - Changing elements in lists										6
3	Control Structures: Conditional control structures: if statement - if..else statement - switch statement - Loops: for, while and repeat loops - break and next statement. Functions: The Function Keyword - Arguments - Return Values-Computing basic statistics: mean, median, mode, correlation and covariance.										6
4	Getting data into and out of R: Working with other data types - Getting your data out of R - Working with Files and Folders. Packages: Finding packages, installing packages, loading packages, updating package and unloading packages.										6
5	Introduction to Graphical Analysis: Box-Whiskers plots - Scatter plots - Pairs plots - Line charts - Pie charts - Bar charts: single category bar chats and multiple category bar charts.										6
COURSE OUTCOMES											
	The student will be able to										
CO1	Understand the basics of R programming										
CO2	Work with vectors and matrices										
CO3	Acquire the knowledge of various control structures										
CO4	Parse data files using built-in functions										

CO5	Apply the various statistical functions and produce high quality graphics
Practice	
1	To Understand how to install and set up R and R Studio
2	To learn how to write and run R scripts.
3	To Write R code to assign values to variables
4	To Generate basic plots using base R.
5	Learner visualizes relationships between variables using plot() and pairs()
Textbooks:	
1	Andrie De Vries And Joris Meys , "R Programming For Dummies", Wiley Publications, Isbn:978-81-265-5201-6. (Unit 1 : chapter-2,3,4) (Unit 4: chapter 12,14) (Unit 2 chapter 5,6,7)
2	Tilman M .Davis “The Book of R”, No Starch Press, 2016 (Unit 3: chapter 10,11,3)
3	Paul Teetor, "R Cook Book", O'reilly Publications, First Edition, 2011, Isbn: 978-0-596-80915-7 (Unit 5: Chapter 10)
4	Alex Nordeen, Learn R Programming In 24 Hours: Complete Guide For Beginners, Guru99, 2020.
5	Dr.Mark Gardener, "Beginning R- The Statistical Programming Language", Wiley Publications, Isbn: 978-81-265-4120-1.
Reference Books:	
1	Joseph Adler, "R In Nutshell A Desktop Quick Reference", Isbn:978-0-596- 80170-0
2	Roger D. Peng, "R Programming For Data Science", Leanopub, 2015
3	Matloff, Norman, And Matloff, Norman S, The Art Of R Programming: A Tour Of Statistical Software Design, No Starch Press, 2011
4	Lovelace, Robin, And Gillespie, Colin. Efficient R Programming: A Practical Guide to Smarter Programming, O'reilly Media, 2016.
5	Jeeva Jose, Beginner's Guide For Data Analysis Using R Programming., Khanna Publishing House, 2019
Web resources:	
1	https://www.tutorialspoint.com/r/index.htm
2	https://www.youtube.com/watch?v= V8eKsto3Ug
3	https://www.youtube.com/watch?v=SYyUBtX1ng

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

3 – Strong, 2- Medium, 1- Low