Undergraduate Department of Mathematics

Learning Outcomes - Based Curriculum Framework (LOCF)

(w.e.f. 2024-2025)

Sem	Part	Course Code	Course Title	Hours/Wk.	Credits	Marks
1	I	24XXXNNNN	*Tamil / Hindi / French*	3	2	30
1	II	24XXXNNNN	*English*	3	2	30
1	III CC	24MAT/MAS1501	Algebra & Trigonometry	5	5	75
1	III CC	24MAT/MAS1403	Differential Calculus	4	4	60
1	III CC	24MAT/MAS1405	Probability and its Applications	4	4	60
1	III S	24MAT1407	Programming in C	5	4	60
		24PHSNNNN	*Offered by Physics*			
1	IV NME	24XXXNNNN	*Non Major Elective - I*	3	2	30
1	IV AEC	24MAT/MAS1200	Environmental Studies	3	2	30
1	V	24XXXNNNN	*NSS/NCC/PED/SLP/GMP/ GNS/LIB/ACH*	-	-	-
			Total	**30**	**25**	**375**
2	I	24XXXNNNN	*Tamil / Hindi / French*	3	2	30
2	II	24XXXNNNN	*English*	3	2	30
2	III CC	24MAT/MAS1502	Analytical Geometry 2D & 3D	5	5	75
2	III CC	24MAT/MAS1404	Integral Calculus	4	4	60
2	III CC	24MAT/MAS1406	Statistics and its Applications	4	4	60
2	III S	24MAT1408	Object Oriented Programming with C++	5	4	60
		24PHSNNNN	*Offered by Physics*			
2	IV NME	24XXXNNNN	*Non Major Elective -II*	3	2	30
2	IV AEC	24VAL/HVS/CHR 1200	Value Education / Human Values Development/ Christian Studies	3	2	30
2	V	24XXXNNNN	*NSS/NCC/PED/SLP/GMP/ GNS/LIB/ACH*	-	1	15
			Total	**30**	**25+1**	**375+15**
3	I	24XXXNNNN	*Tamil / Hindi / French*	3	2	30
3	II	24XXXNNNN	*English*	3	2	30
3	III CC	24MAT/MAS2601	Abstract Algebra	6	6	90
3	III CC	24MAT/MAS2603	Elements of Mathematical Analysis	6	6	90
3	III CC	24MAT/MAS2405	Graph Theory	4	4	60
3	III S	24PHYNNNN	*Offered by Physics*	5	4	60
		24COSNNNN	*Offered by Computer Science*			
3	IV SEC	24XXXNNNN	*Skill Enhancement Course - I*	3	2	30
3	V	24XXXNNNN	*NSS/NCC/PED/SLP/GMP/ GNS/LIB/ACH*	-	-	-
			Total	**30**	**26**	**390**
4	I	24XXXNNNN	*Tamil / Hindi / French*	3	2	30
4	II	24XXXNNNN	*English*	3	2	30
4	III CC	24MAT/MAS2602	Linear Algebra	6	6	90
4	III CC	24MAT/MAS2604	Real Analysis	6	6	90
4	III CC	24MAT/MAS2406	Vector Calculus and Applications	4	4	60
4	III S	24PHYNNNN	*Offered by Physics*	5	4	60
		24COSNNNN	*Offered by Computer Science*			
4	IV SEC	24XXXNNNN	*Skill Enhancement Course - II*	3	2	30
4	V	24XXXNNNN	*NSS/NCC/PED/SLP/GMP/ GNS/LIB/ACH*	-	1	15
			Total	**30**	**26+1**	**390+15**

Sem	Part	Course Code	Course Title	Hours/Wk.	Credits	Marks
5	III CC	24MAT/MAS3601	Mechanics	6	6	90
5	III CC	24MAT/MAS3603	Differential Equations and Applications	6	6	90
5	III CC	24MAT/MAS3605	Linear Programming	6	6	90
5	III DSE	24XXXNNNN	*Discipline Specific Elective - I*	5	4	60
5	III GE	24XXXNNNN	*Generic Elective - I*	4	3	45
5	IV IS	24MAT/MAS3255	Internship*	-	2	30
5	IV SEC	24XXXNNNN	Skill Enhancement Course - III	3	2	30
			Total	**30**	**29**	**435**
6	III CC	24MAT/MAS3602	Complex Analysis	6	6	90
6	III CC	24 MAT/MAS3504	Mathematical Modelling	5	5	75
6	III CC	24MAT/MAS3406	Operations Research	4	4	60
6	III CC	24MAT/MAS3322	Project	3	3	45
6	III DSE	24XXXNNNN	*Discipline Specific Elective – II*	5	4	60
6	III GE	24XXXNNNN	*Generic Elective - II*	4	3	45
6	IV SEC	24MAT/MAS3266	Professional Competency Skill	3	2	30
			Total	**30**	**27**	**405**
			Grand Total	**180**	**158+2**	**2370 +30**

* Internship - Second Year Vacation (30 Hrs.)

Part III

Discipline Specific Elective (DSE)

Sem	Part	Course Code	Course Title	Hours/Wk.	Credits	Marks
5	III	24MAT/MAS3421	Number Theory	5	4	60
5	III	24MAT/MAS3423	Introduction to Combinatorics	5	4	60
6	III	24MAT/MAS3422	Fuzzy Mathematics	5	4	60
6	III	24MAT/MAS3424	Numerical Methods with Applications	5	4	60

Supportive (offered to Physics, Chemistry, Economics, and Commerce)

Sem	Part	Course Code	Course Title	Hours /Wk.	Credits	Marks
1	III	24MAT/MAS1411	Mathematics for Physics - I	5	4	60
1	III	24MAT/MAS1413	Mathematics for Economics – I (ECO/ECE)	5	4	60
2	III	24MAT/MAS1412	Mathematics for Physics - II	5	4	60
2	III	24MAT/MAS1414	Fundamentals of Computer Applications (ECO/ECE)	5	4	60
3	III	24MAT2411	Mathematics for Chemistry - I	5	4	60
3	III	24MAT/ MAS2413	Business Mathematics (COM/CME)	5	4	60
4	III	24MAT2412	Mathematics for Chemistry - II	5	4	60
4	III	24MAT/MAS2414	Business Statistics (COM/CME)	5	4	60

Supportive (offered to other Major Students) (SF)

Sem	Part	Course Code	Course Title	Hours /Wk.	Credits	Marks
1	III	24MAS1415	Mathematics for Chemistry - I	5	4	60
1	III	24MAS1417	Business Statistics (CPA)	5	4	60
1	III	24MAS1419	Discrete Mathematics (CAI)	5	4	60
2	III	24MAS1416	Mathematics for Chemistry - II	5	4	60
2	III	24MAS1418	Business Mathematics (CPA)	5	4	60
2	III	24MAS1420	Statistics and Probability (CAI)	5	4	60
2	III	24MAS1422	Business Statistics (BBA)	5	4	60
2	III	24MAS1424	Discrete Mathematics (BIT)	5	4	60
2	III	24MAS1426	Statistics for Data Science (DSC)	5	4	60
2	III	24MAS1428	Mathematics for Logistics (BML)	5	4	60
2	III	24MAS1430	Discrete Mathematics (COS)	5	4	60
3	III	24MAS2415	Business Mathematics (CMC)	5	4	60
3	III	24MAS2417	Business Mathematics (CIT)	5	4	60
3	III	24MAS2421	Operations Research (CAI)	5	4	60
3	III	24MAS2423	Resource Management Techniques (BBA)	5	4	60
3	III	24MAS2425	Operations Research (BIT)	5	4	60
3	III	24MAS2427	Linear Algebra (DSC)	5	4	60
3	III	24MAS2429	Discrete Mathematics (BCA)	5	4	60
3	III	24MAS2431	Operations Research (COS)	5	4	60
3	III	24MAS2433	Statistics for Behavioural Science (PSY)	5	4	60
4	III	24MAS2416	Business Statistics (CMC)	5	4	60
4	III	24MAS2418	Business Statistics (CIT)	5	4	60
4	III	24MAS2420	Research Methodology for Biochemistry (BCH)	5	4	60
4	III	24MAS2422	Biostatistics (MIC)	5	4	60
4	III	24MAS2428	Resource Management Techniques (DSC)	5	4	60
4	III	24MAS2430	Operations Research (BCA)	5	4	60

Generic Elective (GE)

Sem	Part	Course Code	Course Title	Hours /Wk.	Credits	Marks
5	III	24MAT/MAS3341	Office Automation	4	3	45
5	III	24MAT/MAS3343	Biostatistics*	4	3	45
6	III	24MAT/MAS3342	Speed Arithmetic	4	3	45
6	III	24MAT/MAS3344	Wonders of the Sky	4	3	45

*Other than Microbiology Student

Part IV

Non-Major Electives (NME)

Sem	Part	Course Code	Course Title	Hours /Wk.	Credits	Marks
1	IV	24MAT/MAS1231	Arithmetic and Mathematical Logic	3	2	30
1	IV	24MAT/MAS1233	Mathematics for Life	3	2	30
2	IV	24MAT/MAS1232	Recreational Mathematics	3	2	30
2	IV	24MAT/MAS1234	Ancient Indian Mathematics	3	2	30

Skill Enhancement Courses (SEC)

Sem	Part	Course Code	Course Title	Hours/ Wk.	Credits	Marks
3	IV	24MAT2261	Introduction to Data Science using R	3	2	30
		24MAS2263	Mathematical Reasoning			
4	IV	24MAT2262	Latex	3	2	30
		24MAS2264	Mathematical Puzzles			
5	IV	24MAT/MAS3261	Mathematics for Competitive Exams	3	2	30

Undergraduate Department of Mathematics

Programme Specific Outcomes (PSOs)

On the successful completion of the Undergraduate programme, the students will be able to

PSO1 **Disciplinary Knowledge**	demonstrate deep understanding, skills, techniques, and a broad spectrum of mathematical understanding in interdisciplinary and multidisciplinary fields related to mathematics in undergraduate studies.
PSO2 **Communication Skills**	exhibit expert communication skills, including modelling and effectively sharing mathematical ideas and perspectives with mathematicians, other people, and machines.
PSO3 **Problem Solving**	validate their problem-solving abilities by examining real-world challenges, creating mathematical models of them, devising appropriate creative strategies, and applying them to attain effective solutions. Further ensuring continuous advancement.
PSO4 **Analytical Reasoning**	demonstrate analytical reasoning skills by utilizing mathematical logic and critical thinking to examine difficult situations and assess evidence in order to make sound decisions in the context of the academy, profession, and society.
PSO5 **Research Skills**	acquire research skills by identifying and articulating research questions through literature review, data analysis, and communication with scholars, and by applying moral principles and procedures to mathematical progress.
PSO6 **Digital Literacy**	demonstrate digital knowledge such as the capacity to use modern mathematics-related software, validate data available online, and apply software for research in novel ways that promote professional, individual, and social advancement.
PSO7 **Leadership and Teamwork**	demonstrate their abilities as team members by rendering assistance to one another, exchanging information, and participating in decision-making to complete tasks. Showcase leadership by motivating and steering the group toward growth and success as an organization in both the professional and social spheres.
PSO8 **Moral and Ethical Awareness/Reasoning**	validate moral and ethical awareness in their lifestyle, be able to balance ethical reasoning in challenging situations, and ensure a positive and smooth environment.
PSO9 **Multicultural Competence**	exhibit multicultural competency by acknowledging and respecting the opinions of others in decision-making and collaborating with people with different perspectives in sorting and deducing solutions in a societal context.
PSO10 **Self-directed & Lifelong Learning**	continue the lifelong learning process by accumulating knowledge through self-directed thinking and being able to adapt to currently evolving situations throughout their lives.

Mapping with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
MAT	3	3	3	3	2	2	2	2	2	2
MAS	3	3	3	3	2	2	2	2	2	2

Mapping of Courses with PSOs

Courses	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
24MAT/MAS1501	3	3	3	3	3	2	2	2	2	2
24MAT/MAS1403	3	3	3	3	2	2	2	1	2	1
24MAT/MAS1405	3	2	3	3	2	2	2	3	2	2
24MAT/MAS1200	3	2	2	3	2	2	3	2	2	2
24MAT/MAS1502	3	3	3	3	2	1	2	1	1	1
24MAT/MAS1404	3	3	3	3	3	2	2	2	2	1
24MAT/MAS1406	3	2	3	3	3	2	2	3	2	2
24MAT/MAS2601	3	2	3	2	3	3	2	2	1	2
24MAT/MAS2603	3	3	3	3	2	2	1	1	1	1
24MAT/MAS2405	3	2	3	3	3	2	2	2	2	2
24MAT/MAS2602	3	2	3	3	3	1	2	2	2	2
24MAT/MAS2604	3	3	3	3	2	2	1	1	1	1
24MAT/MAS2406	3	3	3	2	2	3	2	1	2	1
24MAT/MAS3601	3	3	3	3	2	3	2	1	2	2
24MAT/MAS3603	3	2	3	3	2	1	2	3	2	2
24MAT/MAS3605	3	3	3	3	3	2	2	1	2	2
24MAT/MAS3602	3	3	3	3	3	2	2	1	1	1
24MAT/MAS3504	3	3	3	3	2	1	2	1	1	1
24MAT/MAS3406	3	3	3	3	3	2	2	1	2	2
24MAT/MAS3322	3	3	3	3	3	3	3	3	3	2
24MAT/MAS3421/ 24MAT/MAS3423	3	3	3	2	2	3	2	2	1	2
24MAT/MAS3422/ 24MAT/MAS3424	3	3	3	3	2	2	2	2	1	3
24MAT/MAS3266	3	2	3	3	3	2	2	2	2	2
24MAT/MAS3255	3	3	3	3	2	2	2	2	2	2
24MAT1407	3	3	3	3	3	3	3	1	1	3
24MAT1408	3	3	3	2	1	3	2	1	2	2
Average (MAT)	3	2.7	3	2.9	2.4	2.1	2	1.7	1.7	1.8
Average (MAS)	3	2.7	3	2.9	2.5	2	2	1.8	1.7	1.7

Mapping of Courses with POs

Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
24MAT/MAS1411	3	3	3	3	1	2	1	1	1	1
24MAT/MAS1413	3	2	3	2	1	2	2	1	1	2
24MAT/MAS1412	3	3	3	3	2	2	2	1	1	1
24MAT/MAS1414	3	3	3	2	1	2	2	1	1	2
24MAT/MAS2413	3	3	3	3	2	1	2	1	1	1
24MAT/MAS2414	3	2	3	3	2	3	2	3	2	2
24MAT/MAS1231	3	3	3	2	2	1	2	1	2	2
24MAT/MAS1233	3	3	3	2	1	3	2	1	2	1
24MAT/MAS1232	3	2	3	2	2	1	2	1	2	2
24MAT/MAS1234	3	3	2	3	2	1	2	1	2	2
24MAT/MAS3341/ 24MAT/MAS3343	3	3	3	2	2	3	2	1	2	1
24MAT/MAS3342/ 24MAT/MAS3344	3	3	3	3	2	2	3	2	2	2
24MAT/MAS3261	3	3	3	3	2	1	2	2	2	2
24MAT2411	2	3	3	2	3	2	2	2	1	2
24MAT2412	2	3	3	2	3	2	2	2	2	2
24MAT2261	3	3	3	2	2	3	2	1	2	1
24MAT2262	3	3	3	3	3	1	2	1	1	2
24MAS1415	2	3	3	2	3	2	2	2	1	2
24MAS1417	3	3	3	2	2	3	2	1	2	1
24MAS1419	3	3	3	3	3	2	1	1	2	1
24MAS1416	2	3	3	2	3	2	2	2	2	2
24MAS1418	3	3	3	3	2	3	2	1	2	1
24MAS1420	3	3	3	3	3	2	1	1	2	1
24MAS1422	3	3	3	3	2	2	2	1	1	2
24MAS1424	3	3	3	3	2	2	2	1	1	2
24MAS1426	3	3	3	3	3	2	2	1	2	1
24MAS1428	3	3	3	3	3	2	1	1	2	1
24MAS1430	3	3	3	3	2	2	2	1	1	1
24MAS2415	3	3	3	3	2	1	2	1	1	1
24MAS2417	3	3	3	3	2	2	2	2	2	2
24MAS2421	3	3	3	3	3	2	1	1	2	1
24MAS2423	3	3	3	3	2	2	1	1	2	1
24MAS2425	3	3	3	3	3	2	1	1	2	1
24MAS2427	3	3	3	3	3	2	2	1	1	3
24MAS2429	3	3	2	3	2	1	2	1	2	2
24MAS2431	3	3	3	3	3	2	3	1	1	3
24MAS2433	3	2	3	3	3	2	2	1	2	2
24MAS2416	3	2	3	3	1	3	2	3	2	2
24MAS2418	3	3	3	2	2	3	2	1	2	1
24MAS2420	3	3	3	3	3	3	3	3	2	2

24MAS2422	3	3	3	2	2	3	2	1	2	1
24MAS2428	3	3	3	3	2	2	2	1	2	2
24MAS2430	3	3	3	3	2	2	2	2	2	2
24MAS2263	3	3	3	3	1	1	1	1	1	2
24MAS2264	3	3	3	2	2	3	2	1	2	1
Average (MAT)	2.9	2.8	2.9	2.5	1.9	1.9	2	1.4	1.6	1.6
Average (MAS)	3	2.9	3	2.7	2.1	2	1.9	1.3	1.7	1.6

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS1501	Algebra & Trigonometry	Core	5	5

This course aims to equip the students with the basic ideas on the Theory of Equations, Matrices, and Number Theory and to find expansions of Trigonometry Functions, solve theoretical and applied problems.

Course Outcomes:

At the end of the course, students will be able to

CO1: classify and solve reciprocal equations

CO2: find the sum of binomial, exponential and logarithmic series

CO3: solve eigen values, eigen vectors, verify Cayley – Hamilton theorem

CO4: expand the powers and multiples of trigonometric functions in terms of sine and cosine

CO5: determine relationship between circular and hyperbolic functions and the logarithm of complex quantities.

Unit I **(15 Hours)**

Reciprocal Equations – Standard form – Increasing or Decreasing the Roots of a given Equation- Removal of Terms – Approximate Solutions of Roots of Polynomials by Newton's Method of Divisors – Horner's Method – related problems.

Unit II **(15 Hours)**

Summation of Series: Binomial – Exponential – Logarithmic Series (Theorems without proof) – Approximations – related problems.

Unit III **(15 Hours)**

Characteristic equation – Eigen values and Eigen Vectors – Similar matrices – Cayley – Hamilton Theorem – related problems.

Unit IV **(15 Hours)**

Expansions of $sinn\theta, cosn\theta$ in Powers of $sin\theta, cos\theta$ – Expansion of $tann\theta$ in Terms of $tan\theta$, Expansions of $cos^n\theta$, $sin^n\theta$, $cos^m\theta sin^n\theta$ – Expansions of $sin\theta\ and\ cos\theta$ in terms of θ –related problems.

Unit V **(15 Hours)**

Hyperbolic Functions – Relation between Circular and Hyperbolic Functions, Inverse Hyperbolic Functions, Logarithm of Complex Quantities – related problems

Learning Resources:

Text Book(s)

1. T.K. Manicavachagom Pillay, T. Natarajan and K.S. Ganapathy, *Algebra Volume I and II,* S.Viswanathan(Printers & Publishers)Pvt. Ltd., 2008.

   Unit I : Chapter 6 (Sec 16 to 18, 19, 29.4, 30) (Volume I)

   Unit II : Chapter 3(Sec 10); Chapter 4(Sec 3, 9, 11)(Volume I)

   Unit III : Chapter 2 (Sec 16) (Volume II)

2. S.Narayanan and T.K.Manicavachagom Pillay, *Trigonometry,* Divya Subramanian for Ananda Book Depot, Reprint 2019.

   Unit IV : Chapter 3 (Sec 1, 2, 4, 5)

   Unit V : Chapter 4 (Sec 2 to 2.3); Chapter 5 (Sec 5)

References

1. W.S. Burnstine and A.W. Panton, *Theory of equations*, Wentworth press, 2016
2. C. V. Durell and A. Robson, *Advanced Trigonometry*, Courier Corporation, 2003.
3. R.L. Finney and G.B. Thomas, *Calculus*, 9th Edition, Pearson Education, Delhi, 2005.
4. R.L. Finney and G.B. Thomas, *Calculus and Analytical Geometry*, 9th Edition, Pearson Publication, 2010.
5. David C. Lay, *Linear Algebra and its Applications,* 3rd Edition, Pearson Education Asia, Indian Reprint, 2007.
6. L. Redlin, J. Stewart and S. Watson, *Algebra and Trigonometry*, Cengage Learning, 2012.

CO – PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	3	2	3	3	2	2	2	2	2
CO 2	3	3	2	3	3	2	1	2	1	2
CO 3	3	3	3	2	3	2	2	2	2	2
CO 4	3	3	3	2	3	1	2	2	2	2
CO 5	3	2	3	3	3	2	2	2	2	2
Average	3	2.8	2.6	2.6	3	1.8	1.8	2	1.8	2

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS1403	Differential Calculus	Core	4	4

The objective of the course is to enable the students to understand the basic skills of differentiation, successive differentiation, and their applications. Basic knowledge on the notions of curvature, evolutes, involutes and polar co- ordinates and in solving related problems.

Course Outcomes:

At the end of the course, students will be able to

CO1: apply Leibnitz's formula to determine the nth derivative of algebraic and trigonometric functions and construct equations involving derivatives.

CO2: analyze and apply partial differentiation, employ the function of a function rule, evaluate special cases and deal with special functions.

CO3: implement partial differentiation to determine the maxima and minima of functions of two variables.

CO4: describe the method of finding the envelope, explore alternative definitions of envelope and specifically dealing with envelopes of families of curves that are quadratic in the parameter.

CO5: determine curvatures, radius of curvature, involute and evolute of the curve.

Unit I **(12 Hours)**

Successive Differentiation: Introduction (Review of basic concepts) The n^{th} derivative Standard results – Fractional expressions – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula for the n^{th} derivative of a product.

Unit II **(12 Hours)**

Partial Differentiation: Partial derivatives – Successive partial derivatives – Function of a function rule – Total differential coefficient – A special case – Implicit Functions.

Unit III **(12 Hours)**

Partial Differentiation (Continued): Homogeneous functions – Partial derivatives of a function of two variables – Maxima and Minima of functions of two variables – Lagrange's method of undetermined multipliers.

Unit IV **(12 Hours)**

Envelope**:** Method of finding the envelope – Another definition of envelope – Envelope of family of curves which are quadratic in the parameter.

Unit V **(12 Hours)**

Curvature: Definition of Curvature – Circle, Radius and Centre of Curvature – Evolutes and Involutes – Radius of Curvature in Polar Co-ordinates.

Learning Resources:

Text Book(s)

1. S. Narayanan and T. K. Manickavachagom Pillay, *Calculus Vol I,* Viswanathan Pvt. Ltd., Reprint 2012.

   Unit I **:** Chapter 3 (Sec 1.1 to 1.6 & Sec 2.1, 2.2)

   Unit II **:** Chapter 8 (Sec 1.1 to 1.5)

   Unit III **:** Chapter 8 (Sec 1.6, 1.7, 4 & 5)

   Unit IV **:** Chapter 10 (Sec 1.1 to 1.4)

   Unit V **:** Chapter 10 (Sec 2.1 to 2.7)

References

1. G.B. Thomas and R.L. Finney, *Calculus*, Pearson Education, 2010.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, *Calculus*, 3rd Edition, Dorling Kindersley India P. Ltd. Pearson Education, Delhi, 2007.
3. R. Courant and F. John, *Introduction to Calculus and Analysis (Volumes I & II)*, Springer-Verlag, New York, Inc., 1989.
4. T. Apostol, *Calculus Volumes I and II*. Wiley India Pvt. Ltd. 2nd Edition, 1975.

Websites/ e-Learning Resources

https://www.youtube.com/watch?v=akF6NoIErus

https://www.youtube.com/watch?v=ZCJfq77sFE8

CO – PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	2	3	2	2	2	2	1	1	1
CO 2	3	3	3	3	2	2	2	1	1	1
CO 3	3	3	3	3	2	1	1	1	2	1
CO 4	3	2	3	3	2	2	2	1	2	1
CO 5	3	3	3	3	2	1	1	1	2	1
Average	3	2.6	3	2.8	2	1.6	1.6	1	1.6	1

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS1405	Probability and its Applications	Core	4	4

The aim of the course is to enable students to understand the fundamental elements of probability, explore the intricacies of random variables, and gain insights into discrete and continuous distributions. The final unit introduces essential probability distributions, such as the Normal, Chi-square, t-distribution, F-distribution, and logistics distribution, ensuring a holistic understanding of statistical concepts and their real-world applications.

Course Outcomes:

At the end of the course, students will be able to

CO1: show the role of probability density function in determining the nature of probability.

CO2: apply the moment generating function to determine moments and the relation to mean, standard deviation and variance. Measure the dispersion of the data of any distribution by Chebychev's inequality.

CO3: identify and apply various distributions to solve problems

CO4: evaluate the relation between different data.

CO5: fit the appropriate curve using the methods of least squares.

Unit I **(12 Hours)**

Sample space – Random Variable - Discrete and continuous Distribution function - Probability density function - joint probability function.

Unit II **(12 Hours)**

Mathematical expectation and generating functions – Moment generating function- Chebychev's inequality - Law of large numbers.

Unit III **(12 Hours)**

Theoretical Discrete and continuous distributions - Binomial, Poisson, Normal, Gamma, Exponential, Rectangular, Uniform distributions - Standard properties.

Unit IV **(12 Hours)**

Correlation and Regression.

Unit V **(12 Hours)**

Method of least squares – Curve fitting- linear, polynomial, exponential and logarithmic.

Learning Resources:

Text Book(s)

1. S. Arumugam and A. Thangapandian Isaac, *Statistics*, New Gamma Publications Private Limited, 2003.

   Unit I **:** Chapter 12 (Sec 12.1 to 12.3)

   Unit II **:** Chapter 12 (Sec 12.4 to 12.6)

   Unit III **:** Chapter 13

   Unit IV **:** Chapter 6 (Sec 6.1to 6.4)

   Unit V **:** Chapter 5

2. S.C. Gupta and V.K. Kapoor, *Elements of Mathematical Statistics*, Sultan Chand and Sons 2001.

   Unit I **:** Chapter 5 (Sec 5.5.1 to 5.5.4)

   Unit II **:** Chapter 6 (Sec 6.12, 6.13 & 6.13.1)

   Unit III : Chapter 8 (Sec 8.1, 8.3 & 8.6)

References

1. Manmohan and Gupta, *Statistics*, Sultan Chand and Sons, 2001.
2. Gupta S.C, Kapoor.V.K, *Fundamentals of Mathematical Statistics*, 10th Edition, 2000.
3. Gupta. S.P., *StatisticalMethods,* Sultan Chand & Sons,NewDelhi,2012

CO - PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	3	3	2	2	2	2	2	2
CO 2	3	3	3	3	2	1	2	2	2	2
CO 3	3	2	3	3	2	2	2	3	2	2
CO 4	3	2	3	3	2	2	2	3	2	2
CO 5	3	2	3	3	3	1	2	3	2	3
Average	3	2.4	3	3	2.2	1.6	2	2.6	2	2.2

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours /wk.	Credits
24MAT/MAS1200	Environmental Studies	AEC	3	2

The primary objective is to provide students with a comprehensive understanding of the intricate relationship between human activities and the natural environment. The course aims to equip students with the knowledge and skills necessary to analyze, evaluate, and address various environmental issues through scientific principles, ethical considerations, and mathematical modeling.

Courses outcomes:

At the end of the course, the students will be able to

CO1: explain different types of ecosystem, relation between food chain and ecological pyramids, determine geographical and conservation of bio- diversity.

CO2: create awareness on environmental pollution issues, its effects on ecosystem and measures to control and conserve the natural environment.

CO3: analyze energy resources and know the optimal utilization of energy resources.

CO4: describe environmental ethics, awareness on solid waste management and emphasize household environment and health.

CO5: create mathematical models for environmental issues using differential equation, linear programming and chaos theory and hence obtain solution for environmental issues.

Unit I **(9 Hours)**

Understanding eco system – Food chain – Ecological pyramids – Introduction to different eco-system – hot spots of biodiversity.

Unit II **(9 Hours)**

Introduction of Environmental Pollution – Causes and effects of air, water, noise and soil pollution- Measure of control and Management – Oil sleek and its effects on the marine eco system- Global warming and climate change – Acid rain – Ozone layer depletion.

Unit III **(9 Hours)**

Energy sources – Renewable- Non renewable energy sources – Nuclear energy – Bio fuels– Nonconventional energy sources –Pollution free energy.

Unit IV **(9 Hours)**

Social Issues – Urbanization and pollution – Hazard identification – Air quality standards – Major pollutants and their effects in an urban environment – Permissible limit sand methods of control–Environmental ethics–Environmental protection act (Air, water, wildlife protection, forest conservation acts)

Unit V **(9 Hours)**

Mathematical modeling for environmental issues – weather/ disaster predictions– mathematical models using differential equations, linear programming.

Learning Resources:

Text Book

1. Erach Bharucha, *Textbook of Environmental studies,* Universities Press, 2005.

   Unit I: Chapter 3 (Sec 3.1.1, 3.4, 3.6, 3.7); Chapter 4 (Sec 4.6)

   Unit II: Chapter 5 (Sec 5.1, 5.2); Chapter 6 (Sec 6.6)

   Unit III: Chapter 2 (Sec 2.2, 2.3)

   Unit IV: Chapter 6 (Sec 6.2, 6.5, 6.9 to 6.13)

   Unit V : http://math.unipa.it/~grim/Jferruccicarter.PDF

References

1. Rana, *Essentials of Ecology and Environmental science*, S.V.S.PHI, 2003.
2. N.S.Subramanian, Sambamoorthy -A.V.S.S *Ecology*, Narosa publishing house, 2000.
3. Raman Sivakumar, *Introduction to environmental science and energy*, 2005.
4. Raman Sivakumar, *Introduction to Environmental Science and Engineering*, 2005.
5. Ravikrishnan. A, *Environmental Science and Engineering*, Sri Krishna Hi tech Publishing Company Pvt. Ltd, 2010.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	2	2	3	1	2	3	2	2	2
CO 2	3	2	2	3	2	2	3	1	3	2
CO 3	3	2	3	3	2	2	3	2	2	2
CO 4	3	2	2	2	1	3	3	1	2	2
CO 5	3	1	3	3	3	3	3	2	3	3
Average	3	1.8	2.4	2.8	1.8	2.4	3	1.6	2.4	2.3

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS1502	Analytical Geometry 2D & 3D	Core	5	5

The objectives of the course are to obtain necessary skills to analyse characteristics and properties of two-and three-dimensional geometric shapes, to present mathematical arguments about geometric relationships and to solve world problems on geometry and its applications.

Course Outcomes:

At the end of the course, students will be able to

CO1: define the polar coordinates and find the polar equations of straight line, circle, conic.

CO2: recognize the fundamental ideas about coordinate geometry 3D

CO3: describe various forms of equation of a plane

CO4: illustrate the various forms of equation of a line and solve problems related to the shortest distance and length of the perpendicular.

CO5: compute the equation of sphere under various conditions and check for the orthogonality of spheres.

Unit I **(15 Hours)**

Polar coordinates: General polar equation of straight line – Polar equation of a circle given a diameter, Equation of a circle, conic – Equation of chord, tangent, normal.

Unit II **(15 Hours)**

Rectangular Cartesian co-ordinates – Direction ratios and Direction cosines.

Unit III **(15 Hours)**

System of Planes – Length of the perpendicular – Orthogonal projection.

Unit IV **(15 Hours)**

Representation of line – Angle between a line and a plane – co-planar lines – Shortest distance between two skew lines – Length of the perpendicular – Intersection of three planes.

Unit V **(15 Hours)**

Equation of a sphere general equation – Section of a sphere by a plane – Equation of the circle – Tangent plane – Angle of intersection of two spheres – Condition for the orthogonality – Radical plane.

Learning Resources:

Text Book(s)

1. P.R. Vittal, *Analytical Geometry 2D and 3D*, Pearson, Edition 2013.

   Unit I: Chapter 9 (Sec 9.1 to 9.4, 9.6 to 9.7.1, 9.7.4 to 9.7.6)

2. Shanthi Narayan, P.K. Mittal, *Analytical Solid Geometry*, S.Chand and company Limited, Edition 2021(Reprint: 2022).

   Unit II: Chapter 1 (Sec 1.1 to 1.9)

   Unit III: Chapter 2 (Sec 2.1 to 2.10)

   Unit IV: Chapter 3 (Sec 3.1 to 3.8)

   Unit V: Chapter 6 (Sec 6.1 to 6.6 (Excluding 6.6.1 to 6.6.4), 6.7, 6.8)

References

1. S. L. Loney, *The Elements of Co-ordinate Geometry*, Macmillan and Co., Limited, 1985.
2. T. K. Manicavachagom pillay, and T. Natarajan, *Analytical Geometry Part II 3D*, S. Viswanathan Pvt. Ltd.2006.
3. J. T. Robert Bell, *Co-ordinate Geometry of Three Dimensions*, Macmillan and Co., Limited, 1923.
4. C. Robert Yates, *Analytic Geometry with Calculus*, Prentice Hall, Inc., New York, 1961.
5. G.B. Thomas and R. L. Finny, *Calculus and Analytical Geometry*, Pearson Publication, 9th Edition, 2010.
6. William F. Osgood and William C. Graustein, *Plane and Solid Analytic Geometry*, Macmillan Company, New York, 2016.

CO – PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	3	2	1	1	1	1	1	1
CO 2	3	2	3	3	2	1	2	1	1	1
CO 3	3	3	3	3	2	2	2	1	1	1
CO 4	3	3	3	3	2	1	3	1	1	2
CO 5	3	3	3	3	3	1	2	1	1	2
Average	3	2.8	3	2.8	2	1.2	2	1	1	1.4

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS1404	Integral Calculus	Core	4	4

The objective of the course is to enable the students to understand integration and its geometrical applications, double, triple integrals and improper integrals. Equip students with knowledge of Beta and Gamma functions and their applications.

Course Outcomes:

At the end of the course, students will be able to

CO1: determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae.

CO2: evaluate double integrals and problems using change of order of integration.

CO3: solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution.

CO4: explain beta and gamma functions and to use them in solving problems of integration

CO5: describe Geometric and Physical applications of integral calculus

Unit I **(12 Hours)**

Reduction formulae – Types, integration of product of powers of algebraic and trigonometric functions, integration of product of powers of algebraic and logarithmic functions - Bernoulli's formula.

Unit II **(12 Hours)**

Multiple Integrals – Definition of double integral - Evaluation of double integral – Double integral in polar coordinates – Change of order of integration.

Unit III **(12 Hours)**

Triple integrals – Applications of multiple integrals – Volumes of solids of revolution – Areas of curved surfaces – Change of variables – Jacobian.

Unit IV **(12 Hours)**

Beta and Gamma functions – Infinite integral - Definitions–recurrence formula of Gamma functions – Properties of Beta and Gamma functions- Relation between Beta and Gamma functions - Applications.

Unit V **(12 Hours)**

Geometric and Physical Applications of Integral calculus.

Learning Resources:

Text Book(s)

1. S. Narayanan and T. K. Manickavachagom Pillay, *Calculus Vol II*, Viswanathan Pvt Ltd, Reprint 2012.

   Unit I **:** Chapter 1 (Sec 13, 13.1 to 13.10, 14, 15.1)

   Unit II **:** Chapter 5 (Sec 1, 2.1, 2.2, 3.1)

   Unit III **:** Chapter 5 (Sec 4, 5.1 to 5.3, 6.1 to 6.3, Sec 7); Chapter 6 (Sec 1.1, 1.2, 2.1 to 2.4)

   Unit IV **:** Chapter 7 (Sec 1.1 to 1.4, 2.1, 2.3, 3 to 6)

   Unit V **:** Chapter 2 (Sec 1.4, 4, 4.1, 4.2, 5); Chapter 3 (Sec 1.1 to 1.5)

References

1. H. Anton, I. Birens and S. Davis, *Calculus*, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, *Calculus*, Pearson Education, 2007.
3. Chatterjee, *Integral Calculus and Differential Equations*, Tata-McGraw Hill Publishing Company Ltd., 1999.
4. P. Dyke, *An Introduction to Laplace Transforms and Fourier Series,* Springer Undergraduate Mathematics Series, Second Edition, 2001.

Websites/ e-Learning Resources

https://www.youtube.com/watch?v=4rc3w1sGoNU

https://www.youtube.com/watch?v=xHE-WI6z3Uk

https://www.youtube.com/watch?v=w_KiHgultbM

CO – PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	2	3	2	2	2	2	2	2	1
CO 2	3	3	3	2	3	3	2	2	2	1
CO 3	3	3	3	3	3	3	3	2	2	1
CO 4	3	2	3	3	2	2	3	2	1	1
CO 5	3	3	3	3	3	2	2	2	3	1
Average	3	2.6	3	2.6	2.6	2.4	2.4	2	2	1

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS1406	Statistics and its Applications	Core	4	4

This is the second segment of a sequential course as a tool for solving problems in real life. The aim of this course is to enable the students to understand statistics. The course deals with analysis of variance- analysis of time series and statistical quality control.

Course Outcomes:

At the end of the course, students will be able to

CO1: outline basic principles in sampling also apply testing hypothesis on large samples at appropriate situations.

CO2: study the applications of various distributions.

CO3: analyze various index numbers and formulate the procedure to measure the change in the variable over the period of time.

CO4: predict the future values based on previously observed values using concept of the time series.

CO5: evaluate the interdependency of two or more variables.

Unit I **(12 Hours)**

Sampling and Large sample tests.

Unit II **(12 Hours)**

Distributions arising from the normal – chi-square distribution – t-distribution – F-distribution– logistics distribution.

Unit III **(12 Hours)**

Index numbers – fixed and chain base indices – cost of living index – consumer price index – ideal index number.

Unit IV **(12 Hours)**

Analysis of time series – components of time series – measurement of trend – seasonal variations.

Unit V **(12 Hours)**

Analysis of variance – one way & two way classification – Latin square design.

Learning Resources:

Text Book(s)

1. S. Arumugam and A. Thangapandian Isaac, *Statistics*, New Gamma Publications Private Limited, 2003.

   Unit I : Chapter 14

   Unit III : Chapter 9

   Unit IV : Chapter 10

   Unit V : Chapter 17

2. Sheldon M. Ross *"Introduction to Probability and Statistics for engineers and scientists",* fifth edition, Elsevier, 2014.

   Unit II : Chapter 5 (Sec 5.5, 5.8 & 5.9)

References

1. Manmohan and Gupta, *Statistics*, Sultan Chand and Sons, 2001.
2. Manmohan and Gupta, *Statistics*, Sultan Chand and Sons, 2001.
3. Gupta. S.P., *Statistical Methods*, Sultan Chand and Sons, NewDelhi, 2012.

CO - PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	2	3	3	3	2	2	2	2	2
CO 2	3	2	3	3	3	2	2	2	2	2
CO 3	3	2	3	3	3	2	2	3	2	2
CO 4	3	2	3	3	3	2	2	3	2	2
CO 5	3	2	3	3	3	2	2	3	2	3
Average	3	2	3	3	3	2	2	2.6	2	2.2

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT1407	Programming in C	Supportive	5 (3T+2L)	4

To introduce programming concepts and develop programming skills in C using mathematical and business - oriented problems. The course deals with the basic commands of C language, statements in C, structures. Students are given practical experience using computers.

Course Outcomes:

At the end of the course, students will be able to

CO1: describe the concept of structure-oriented programming and understand various C-tokens

CO2: illustrate with examples the idea of conditional statements

CO3: illustrate with examples the idea of looping statements

CO4: differentiate various 'function prototypes' and demonstrate nesting of functions

CO5: categorize one dimensional and two-dimensional arrays and distinguishes the idea of structures.

Unit I **(15 Hours)**

Introduction to C: Identifiers, Key words, Variables –Data types - Operators and expressions- Input and Output statements.

Unit II **(15 Hours)**

Branching statements: simple if, if-else, nested if-else, else if ladder, switch and goto statement.

Unit III **(15 Hours)**

Looping statements: while, do-while and for statements -Nesting of loops.

Unit IV **(15 Hours)**

Functions- Defining a Function - Accessing a Function- Function Prototypes- Passing Arguments to a Function- Recursion.

Unit V **(15 Hours)**

Arrays – One dimensional- Two dimensional arrays- Passing arrays to functions -

Introduction to Structures: Defining and processing a structure.

Learning Resources:

Text Book(s)

1. Byron Gottfried, *Schaum's Outline Programming with C*, Fourth Edition, Tata McGraw-Hill, 2018.

   Unit I: Chapter 1 (Sec 1.5, 1.6); Chapter 2 (Sec 2.1 to 2.7), Chapter 3 (Sec 3.1 to 3.5), Chapter 4 (Sec 4.2 to 4.5)

   Unit II: Chapter 6 (Sec 6.2, 6.7, 6.11)

   Unit III: Chapter 6 (Sec 6.3 to 6.6)

   Unit IV: Chapter 7 (Sec 7.1 to 7.6, 9.1 to 9.3)

   Unit V: Chapter 9 (Sec 9.1 to 9.3, 11.1 to 11.2)

References

1. E. Balagurusamy, *Programming in ANSI C*, Tata McGraw-Hill, Third Edition, 2013.
2. Y. Kanetkar, *Understanding Pointers in C*, 4th Edition, BPB publications, New Delhi.
3. P. Pandiyaraja, *Programming in C*, Vijay Nicole Imprint Private Limited, 2005.
4. Kernighan and Ritchie, *The C Programming Language*, Second Edition, Prentice Hall, 1998.
5. Les Han Cock, Morris Kringer, *C Primer*, Mc Graw Hill, 1997.
6. D. M. Ritchie, *The C programming language*, Prentice Hall of India, 1977.

CO-PSO Mapping Table

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	2	2	3	2	3	3	1	1	3
CO 2	3	3	3	3	3	3	3	1	1	3
CO 3	3	3	2	3	3	3	3	1	1	2
CO 4	3	3	3	3	2	3	3	1	1	3
CO 5	3	3	3	2	3	3	3	1	1	3
Average	3	2.8	2.6	2.8	2.6	3	3	1	1	2.8

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT1408	Object Oriented Programming with C++	Supportive	5	4

This course introduces the object oriented programming structure in C++ and deals with objects, inheritance, and polymorphism in C++. Students are given practical experience using computers.

Course Outcomes:

At the end of the course, students will be able to

CO1: explain oops principles and distinguish between Structured and Object- Oriented problem-solving approaches and apply them based on the problem given.

CO2: describe the functions, overloading functions, inline functions.

CO3: identify classes and objects from the given problem description and able to create classes and objects using C++ and describe static and friend functions.

CO4: create constructors and destructors using C++ and explain Polymorphism with operator overloading and improve secured data processing.

CO5: create code reusability and extensibility by means of Inheritance.

Unit I **(15 Hours)**

Introduction to Object Oriented Programming – Basics of OOP - Structure of a C++ Program – Data types and Declarations – Operators – Control Structures – User Defined Data types.

Unit II **(15 Hours)**

Functions – Function Overloading – Inline Function – String Handling Functions.

Unit III **(15 Hours)**

Classes and Objects – Specifying a Class – Defining Member Functions – Static Data Members and Static Functions – Objects as Function Arguments - Friend Function – Returning Objects.

Unit IV **(15 Hours)**

Constructor and Destructors – Operator Overloading: Overloading Function – Overloading Unary Operators using Member and Friend Functions – Overloading Binary Operators using Member and Friend Functions.

Unit V **(15 Hours)**

Inheritance: Levels of Inheritance – Multiple Inheritance – Multilevel Inheritance – Hierarchical Inheritance – Hybrid Inheritance – Virtual Base Classes.

Learning Resources:

Text Book(s)

1. Chandra Babu & T. Joshuva Devadass, *Programming with C++*, Narosha Publishing House Ltd. (2008).

    Unit I **:** Chapter 1 (Sec 1.2, 1.3, 1.6); Chapter 2

    Unit II **:** Chapter 3 (Sec 3.0 to 3.3, 3.5, 3.8)

    Unit III **:** Chapter 4 (Sec 4.0 to 4.5)

    Unit IV **:** Chapter 5; Chapter 6 (Sec 6.0 to 6.4)

    Unit V **:** Chapter 7 (Sec 7.0 to 7.4)

References

1. E. Balagurusamy, *Object oriented programming with C++*, Tata McGraw Hill, 2003.
2. Bjarne Strousstrup, *The C++ Programming Language*, Addison Wesley, 2000.
3. J. P. Cohoon and J. W. Davidson, *C++ Program Design – An Introduction to Programming and Object-Oriented Design*, Second Edition, McGraw Hill, 1999.
4. Grady Booch, *Object Oriented Analysis and Design*, Pearson Education, 2008.
5. Herbert Schildt, *C++ - The Complete Reference*, Third Edition, TMH, 1999.
6. C. J. Lippman, *C++Primer*, Third Edition, Addison Wesley, 2000.
7. P. Pandiyaraja, *Object Oriented Programming with C++*, S.Viswanathan Pvt., Ltd., 2008.
8. R. Rajaram, *Object Oriented Programming and C++*, New Age International Publications, New Delhi, 1997.

CO-PSO Mapping Table

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	3	3	3	1	2	1	1	2	2
CO 2	3	3	3	3	1	2	1	1	2	2
CO 3	3	3	3	2	1	3	2	1	2	2
CO 4	3	2	3	2	2	3	2	1	2	2
CO 5	3	2	3	2	2	3	2	1	2	2
Average	3	2.6	3	2.4	1.4	2.6	1.6	1	2	2

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS2601	Abstract Algebra	Core	6	6

This is a basic course for any student aspiring to complete B.Sc., degree in Mathematics. The students are exposed to the basic algebraic structure called group. Subsequently the properties of groups and imbedding a group in a bigger group called the group of symmetries are dealt with. The algebraic equivalence of any two groups is studied by means of isomorphism. This course also deals with basic ideas in Ring theory and Fields.

Course Outcomes:

At the end of the course, students will be able to

CO1: define a group and illustrate various types of groups including the most general type of group called group of permutation.

CO2: demonstrate with examples on cyclic subgroups and cosets.

CO3: analyze and infer the structural similarities between groups..

CO4: define rings and subrings and illustrate with examples and demonstrate with examples on ideals, integral domain, quotient rings

CO5: determine maximal and prime ideals.

Unit I **(18 Hours)**

Groups: Definition and Examples – Elementary Properties of a Group – Permutation Groups.

Unit II **(18 Hours)**

Subgroups – Cyclic Groups – Order of an Element – Cosets and Lagrange's Theorem.

Unit III **(18 Hours)**

Normal Subgroups and Quotient Groups – Isomorphism – Cayley's Theorem – Automorphism – Homomorphism.

Unit IV **(18 Hours)**

Rings: Definitions and Examples – Elementary Properties of Rings – Isomorphism – Types of Rings – Characteristic of a Ring – Subrings – Ideals – Quotient Rings.

Unit V **(18 Hours)**

Maximal and Prime Ideals – Homomorphism of Rings – Field of quotients of an Integral Domain.

Learning Resources:

Text Book(s)

1. S. Arumugam and A. Thangapandi Isaac, *Modern Algebra*, SCITECH Publications, Chennai, 2013.

   Unit I : Chapter 3 (Sec 3.1, 3.2, 3.4)

   Unit II : Chapter 3 (Sec 3.5 to 3.8)

   Unit III : Chapter 3 (Sec 3.9 to 3.11)

   Unit IV : Chapter 4 (Sec 4.1 to 4.8)

   Unit V : Chapter 4 (Sec 4.9 to 4.11)

References

1. M. Artin, *Abstract Algebra*, Second Edition, Pearson, 2011.
2. I.N. Herstein, *Topics in Algebra*, Second Edition, John Wiley & Sons, 1975.
3. John B. Fraleigh, *A First Course in Abstract Algebra*, Seventh Edition, Pearson, 2002.
4. Joseph A. Gallian, *Contemporary Abstract* Algebra, Eighth Edition, Brooks/Cole Cengage Learning, 2013.
5. Vijay K Khanna, S.K. Bhambri, *A Course in Abstract algebra*, Vikas Publishing House Private Limited, 2013.

Websites/ e-Learning Resources

https://nptel.ac.in

https://mathonline.wikidot.com

CO – PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	2	3	1	2	3	2	1	1	1
CO 2	3	2	3	2	3	3	2	1	1	2
CO 3	3	3	3	3	3	3	2	2	2	3
CO 4	3	2	3	2	2	3	2	2	2	3
CO 5	3	3	3	3	3	3	2	2	1	2
Average	3	2.4	3	2.2	2.6	3	2	1.6	1.4	2.2

Strong - 3 Medium-2 Low-1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS 2603	Elements of Mathematical Analysis	Core	6	6

This course helps to characterize the convergence and divergence of sequences, series understand about metric spaces with suitable examples.

Course Outcomes:

At the end of the course, students will be able to

CO1: demonstrate real valued functions, countability, LUB axiom, sequence of real numbers, limit of sequence, convergence, divergence.

CO2: characterize sequences and analyse limits of sequences.

CO3: analyse series using various tests.

CO4: characterize metric spaces and find limits in metric spaces.

CO5: analyse functions on metric space and generate functions on metric space.

Unit I **(18 Hours)**

Real valued functions- equivalence- countability- real numbers- least upper bounds - Sequences of Real Numbers: Definition of a sequence and subsequence-limit of a sequence – convergent sequences–divergent sequences.

Unit II **(18 Hours)**

bounded sequences-monotone sequences- Operations on convergent sequences – operations on divergent sequences – limit superior and limit inferior-Cauchy sequences.

Unit III **(18 Hours)**

Series of Real Numbers: Convergence and divergence – series with non–negative terms - alternating series-conditional convergence and absolute convergence- tests for absolute convergence.

Unit IV **(18 Hours)**

Limits and Metric Spaces: Limit of a function on a real line - Metric spaces - Limits in metric spaces.

Unit V **(18 Hours)**

Continuous Functions on Metric Spaces: Function continuous at a point on there a line-Function continuous on a metric space.

Learning Resources:

Text Book(s)

1. Richard R. Goldberg, *Methods of Real Analysis,* Oxford and IBH Publishing, (January 2020).

    Unit I: Chapter 1(1.4 to 1.7), Chapter 2 (2.1 to 2.4)

    Unit II: Chapter 2 (2.5 to 2.10)

    Unit III: Chapter 3 (3.1 to 3.6)

    Unit IV: Chapter 4 (4.1 to 4.3)

    Unit V: Chapter 5 (5.1 to 5.3)

References

1. Ethan D. Bloch, *The Real Numbers and Real Analysis*, Springer, 2011.
2. G.M. *The fundamentals of Mathematical Analysis*, vol I. Pergamon Press, New York, 1965.
3. T. M. Apostol, *Calculus (Vol. I)*, John Wiley and Sons (Asia) P. Ltd., 2002.
4. R.G. Bartle and D. R Sherbert, *Introduction to Real Analysis*, John Wiley and Sons (Asia) P. Ltd., 2000.
5. E. Fischer, *Intermediate Real Analysis*, Springer Verlag, 1983.
6. K.A. Ross, *Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics*, Springer Verlag, 2003.

CO – PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	3	3	3	1	2	1	1	1	1
CO 2	3	3	3	3	2	2	1	1	1	1
CO 3	3	3	3	3	2	2	1	1	1	1
CO 4	3	3	3	3	2	2	1	1	1	1
CO 5	3	3	3	3	2	2	1	1	1	1
Average	3	3	3	3	1.8	2	1	1	1	1

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS2405	Graph Theory	Core	4	4

A graph is a symbolic representation of a network and of its connectivity. It implies an abstraction of the reality so it can be simplified as a set of linked nodes. Graph theory is a branch of mathematics concerned about how networks can be encoded and their properties measured. It has been enriched in the last decades by growing influences from studies of social and complex networks. The origins of graph theory can be traced to Leonhard Euler who devised in 1735 a problem that came to be known as the "Seven Bridges of Konigsberg".

Course Outcomes:

At the end of the course, students will be able to

CO1: demonstrate graphs with examples and represent a graph by matrices.

CO2: identify and construct Eulerian and Hamiltonian graphs.

CO3: describe the properties of trees and able to examine minimal spanning tree for a given weighted graph.

CO4: discuss coloring concept of vertices and edges of a graph.

CO5: analyze planar graphs and its properties.

Unit I **(12 Hours)**

Graphs – Subgraphs – Isomorphism and degrees – Degree sequence – Walks and connected graphs – Cycles in graphs – Cut-vertices and cut-edges – Connectedness – Matrices associated with the graph – Operations on graphs.

Unit II **(12 Hours)**

Eulerian graphs – Hamiltonian graphs – Properties.

Unit III **(12 Hours)**

Bipartite graph – Trees.

Unit IV **(12 Hours)**

Independence number – Covering number – Planar graphs – Euler formula.

Unit V **(12 Hours)**

Colouring – Vertex colouring – Edge colouring – Five colour theorem and Four colour conjecture – Directed graphs.

Learning Resources:

Text Book(s)

1. Choudum. S.A, *A First Course in Graph Theory,* Trinity Press, 2015.

   Unit I **:** Chapter 1 (Sec 1.1 to 1.7);

   Unit II **:** Chapter 2 (Sec 2.1 to 2.4)

   Unit III **:** Chapter 3 (Sec 3.1 to 3.4)

   Unit IV **:** Chapter 5 (Sec 5.1 to 5.2)

   Unit V **:** Chapter 6 (Sec 6.1 to 6.2), Chapter 7(Sec 7.1 to 7.2)

2. Arumugam.S and Ramachandran. S, *Invitation to Graph Theory*, Scitech Publications Pvt Ltd., 2022.

   Unit I **:** Chapter 2 (Sec 2.8, 2.9), Chapter 3 (Sec 3.1 to 3.2)

   Unit IV **:** Chapter 2 (Sec 2.6)

References

1. John Clarke & Derek Allan Holton, A First Look at Graph Theory, World Scientific publishing Co. Ltd, 1995.
2. Murugan. M, Graph Theory and Algorithms, Muthali Publishing house, 2003.

CO – PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	2	3	3	3	2	2	2	2	3
CO 2	3	2	3	3	3	3	3	2	2	3
CO 3	3	3	3	2	3	2	3	2	2	2
CO 4	3	2	3	3	3	2	2	3	2	2
CO 5	3	3	3	3	3	3	2	2	3	2
Average	3	2.4	3	2.8	3	2.4	2.4	2.2	2.2	2.4

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS2602	Linear Algebra	Core	6	6

This is a basic course for any student aspiring to complete B.Sc., degree in Mathematics. The students are exposed to the basic concepts in vector space and inner product spaces. This course also deals with basic ideas in eigen values and eigen vectors of a matrix using cayley Hamilton theorem.

Course Outcomes:

At the end of the course, students will be able to

CO1: acquire a detailed knowledge about vector spaces and subspaces.

CO2: explain the concepts of Linear Dependence, Linear Independence, Bases and Dimension of basis.

CO3: explain the concept of Linear Transformations, their Matrix representation and the notion of dual spaces.

CO4: find the Eigen values and Eigen vectors, to apply the concepts for diagonalisation.

CO5: explain about Inner product and norms and to apply Gram Schmidt Orthogonalization Process to problems on inner product spaces.

Unit I **(18 Hours)**

Vector Spaces – Subspaces – Linear Combinations and Linear Span – Systems of Linear Equations – Homogenous Equations – Non-Homogenous Equations – Elementary Matrices – Row reduce -Echelon form.

Unit II **(18 Hours)**

Linear Dependence and Linear Independence – Bases – Dimensions – Maximal Linearly Independent Subsets.

Unit III **(18 Hours)**

Linear Transformations – null spaces and ranges – Matrix Representation of a Linear Transformation – Invertibility and Isomorphisms – Dual space.

Unit IV **(18 Hours)**

Eigen Values and Eigen Vectors – Diagonalizability – Invariant Subspaces – Cayley –

Hamilton Theorem.

Unit V **(18 Hours)**

Inner Products and Norms – Gram Schmidt Orthogonalization Process – Orthogonal Complements.

Learning Resources:
Text Book(s)

1. Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, *Linear Algebra*, Fifth edition, Pearson, 2019.

   Unit I **:** Chapter 1 (Sec 1.1 to 1.4)

   Unit II **:** Chapter 1 (Sec 1.5 to 1.7)

   Unit III **:** Chapter 2 (Sec 2.2, 2.4, 2.6)

   Unit IV **:** Chapter 5 (Sec 5.1(definition & problems), 5.2, 5.4)

   Unit V **:** Chapter 6 (Sec 6.1, 6.2)

References

1. David C. Lay, *Linear Algebra* and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
2. Gilbert Strang, *Linear Algebra and its Applications*, Thomson, 2007.
3. N.S.Gopalakrishnan, *University Algebra*, New Age International Publications, Wiley Eastern Ltd.
4. John B.Fraleigh, *First course in Algebra*, Addison Wesley.
5. S. Lang, *Introduction to Linear Algebra*, 2nd Ed., Springer, 2005.

CO – PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	2	3	3	2	1	2	2	2	2
CO 2	3	2	3	3	3	1	2	2	2	2
CO 3	3	2	3	3	2	1	2	2	2	2
CO 4	3	2	3	3	3	1	2	2	2	2
CO 5	3	2	3	3	3	1	3	3	2	2
Average	3	2	3	3	2.6	1	2.2	2.2	2	2

Strong - 3 Medium-2 Low-1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS 2604	Real Analysis	Core	6	6

This course helps to characterize Connectedness, Compactness, Completeness of Metric spaces, Riemann integration and convergence of sequences of functions**.**

Course Outcomes:

At the end of the course, students will be able to

CO1: understand the concept of Open sets, closed sets and demonstrate discontinuous function on R^1 and characterize Connectedness, Completeness and Compactness

CO2: analyse bounded sets, continuous functions on a compact metric space, uniform continuity

CO3: analyse Riemann integration

CO4: interpret Derivatives, Rolle's theorem, Law of mean, Fundamental theorems of calculus.

CO5: analyse Taylor's theorem, convergence of sequences of functions.

Unit I **(18 hours)**

Continuous Functions on Metric Spaces: Open sets– closed sets–Discontinuous function on R^1. Connectedness, Completeness and Compactness: More about open sets-Connected sets.

Unit II **(18 hours)**

Bounded sets and totally bounded sets: Complete metric spaces- compact metric spaces, continuous functions on a compact metric space, continuity of inverse functions, uniform continuity.

Unit III: **(18 hours)**

Calculus: Sets of measure zero, definition of the Riemann integral, existence of the Riemann integral-properties of Riemann integral.

Unit IV: **(18 hours)**

Derivatives-Rolle's theorem, Law of mean, Fundamental theorems of calculus.

Unit V: **(18 hours)**

Taylor's theorem-Point wise convergence of sequences of functions, uniform convergence of sequences of functions.

Learning Resources:

Text Books

1. Richard R. Goldberg, *Methods of Real Analysis*, Oxford and IBH Publishing, (January 2020).

   Unit I: Chapter 5 (Sec 5.4 to 5.6); Chapter 6 (Sec 6.1, 6.2)

   Unit II: Chapter 6 (Sec 6.3 to 6.8)

   Unit III: Chapter 7 (Sec 7.1 to 7.4)

   Unit IV: Chapter 7 (Sec 7.5 to 7.8)

   Unit V: Chapter 8 (Sec 8.5); Chapter 9 (Sec 9.1, 9.2)

References:

1. Ethan D. Bloch, The Real Numbers and Real Analysis, Springer, 2011.
2. G.M. The fundamentals of Mathematical Analysis, vol I. Pergamon Press, New York, 1965.
3. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
4. R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
5. E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983. K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003.

CO-PSO Mapping Table

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	3	3	3	1	2	1	1	1	1
CO 2	3	3	3	3	2	2	1	1	1	1
CO 3	3	3	3	3	2	2	1	1	1	1
CO 4	3	3	3	3	2	2	1	1	1	1
CO 5	3	3	3	3	2	2	1	1	1	1
Average	3	3	3	3	1.8	2	1	1	1	1

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS2406	Vector Calculus and Applications	Core	4	4

The primary objective of the course "Vector Calculus and Applications" is to provide students with a thorough understanding of the fundamental concepts and techniques of vector calculus, and to demonstrate their application in various scientific and engineering contexts.

Course Outcomes:

At the end of the course, students will be able to

CO1: describe the concept of derivative of vector and sum of vectors, product of scalar and vector point function and derivatives of scalar and vector products.

CO2: define the operator 'del' and classify solenoidal and irrotational vectors.

CO3: Solve simple line integrals and able to apply it in physical situations.

CO4: inculcate procedures to calculate surface integrals and volume integrals, and apply it in real time situations.

CO5: know about qualitative applications of Gauss, Stoke's and Green's Theorem.

Unit I **(12 Hours)**

Derivative of a vector function – derivative of a sum of vector function – Derivative of a scalar product of vector functions – derivative of vector product of vector functions – meaning of derivatives – physical applications: level surfaces - velocity and gradient.

Unit II **(12 Hours)**

The vector operator del - The gradient of a scalar point function - Divergence of a vector - Curl of a vector - solenoidal and irrotational vectors – simple applications**.**

Unit III **(12 Hours)**

Laplacian operator - Vector identities - Line integral – path independence - simple problems.

Unit IV **(12 Hours)**

Surface integral - Volume integral – Simple Applications.

Unit V **(12 Hours)**

Gauss divergence Theorem - Stoke's Theorem - Green's Theorem in two dimensions – Simple Applications.

Learning Resources:

Text Book(s)

1. Narayanan & Manichavasagam pillai, *Vector Algebra and Analysis,* Viswanathan Pvt Ltd, 1996.

    Unit I **:** Chapter 4 (Sec 1 to 8)

    Unit II **:** Chapter 4 (Sec 9 &10)

    Unit III **:** Chapter 4 (Sec 11 & 12), Chapter 6 (Sec 1 to 3)

    Unit IV **:** Chapter 6 (Sec 4 & 5)

    Unit V **:** Chapter 6 (Sec 6 to 10)

References

1. A. Gorguis, Vector Calculus for College Students, Xilbius Corporation, 2014.
2. J.C. Susan,Vector Calculus, (4th Edn.) Pearson Education, Boston, 2012.
3. J.E. Marsden and A. Tromba ,Vector Calculus, (5^{th} edn.) W.H. Freeman, New York, 1988

CO – PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	3	3	3	2	2	1	1	2	1
CO 2	3	3	3	3	2	2	1	1	2	1
CO 3	3	3	3	2	2	3	2	1	2	1
CO 4	3	2	3	2	2	3	2	1	2	1
CO 5	3	2	3	2	2	3	2	1	2	1
Average	3	2.6	3	2.4	2	2.6	1.6	1	2	1

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS3601	Mechanics	Core	6	6

The objective of this course mainly deals with two major areas of applied mathematics namely Statics and Dynamics. Statics is the branch of mechanics that is concerned with the analysis of loads acting on physical systems that do not experience an acceleration, but rather, are in static equilibrium with their environment. Whereas the dynamics is a branch of applied mathematics concerned with the study of forces and torques and their effect on motion. Brief introduction to central orbits to the learners becomes essential as we live in the era of satellites, missiles and space explorations.

Course Outcomes:

At the end of the course, students will be able to

CO1: be take on board of basic principle of forces.

CO2: classify the coplanar forces and frictional forces.

CO3: describe work, energy, power under varying forces and Simple Harmonic Motion and determine its Geometrical representation.

CO4: explain the Projectile and establish that the path of a projectile is a parabola.

CO5: elucidate the central orbits, and to realize conic section as centred orbits under law of inverse square.

Unit I **(18 Hours)**

Force: Newton's laws of motion – Resultant of two forces on a particle – Equilibrium of a Particle – Forces acting along a Triangle – Parallel Forces – Forces on a Rigid Body – Moment of a Force.

Unit II **(18 Hours)**

A specific reduction of Forces: Reduction of coplanar forces into a force and couple – Friction – Types of friction – Problems involving frictional forces – Limiting equilibrium of a particle on an inclined plane.

Unit III **(18 Hours)**

Work: Work function of a varying forces – Units of work – Tension in an elastic string – Work done – Power – Energy: Kinetic energy – Principle of work energy – Potential energy –

Principle of conservation of energy – Verification – Simple Harmonic Motion: Simple harmonic motion in a straight line – General solution – Geometric representation.

Unit IV **(18 Hours)**

Projectiles: Two fundamental principles – Path of a projectile – Characteristics of motion – Projectile from a certain height – Maximum horizontal range – Initial velocity of projection – Velocity of a projectile.

Unit V **(18 Hours)**

Central Orbits: Motion under action of central forces – Law of inverse square – Conic as a centred orbit (Theorem only).

Learning Resources:

Text Book(s)

1. Dr. M.K. Venkataraman, *Statics*, Agasthiar Publication, Eighteenth Edition, 2016.
   Unit I: Chapter 1, 2, 3
   Unit II: Chapter 6, 7 (Sec 1 to 12)
2. Dr. M.K. Venkataraman, *Dynamics*, Agasthiar Publication, Eighteenth Edition, 2017.
   Unit III : Chapter 4 (Sec 4.24 to 4.36); Chapter 10 (Sec 10.1 to 10.4)
   Unit IV : Chapter 6 (Sec 6.1 to 6.10)
   Unit V : Chapter 11 (Sec 11.1 to 11.9, 11.14)

References

1. A. Ruina and R. Pratap, *Introduction to Statics and Dynamics*, Oxford University Press, 2014.
2. S.L. Loney, *The Elements of Statics and Dynamics*, Cambridge University Press, 1904.
3. J.L. Meriam and L. G. Kraige, *Engineering Mechanics: Statics*, Seventh Edition, Wiley and sons Pvt ltd., New York, 2012.
4. J.L. Meriam, L. G. Kraige, and J.N. Bolton, *Engineering Mechanics: Dynamics*, Eighth Edition, Wiley and sons Pvt ltd., New York, 2015.
5. A. K. Dhiman, P. Dhinam and D. Kulshreshtha, *Engineering Mechanics (Statics and Dynamics)*, McGraw Hill Education (India) Private Limited, New Delhi, 2015.

CO - PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	3	3	3	2	2	1	1	2	2
CO 2	3	3	3	3	2	2	1	1	2	1
CO 3	3	3	3	2	2	3	2	1	2	1
CO 4	3	2	3	2	2	3	2	1	2	2
CO 5	3	2	3	3	2	3	2	1	2	2
Average	3	2.6	3	2.6	2	2.6	1.6	1	2	1.6

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS3603	Differential Equations and Applications	Core	6	6

This course is to impart knowledge about the methods of solving Ordinary and Partial differential equations and develops the understanding of how differential equations can be used as a powerful tool in solving problems in science.

Course Outcomes:

At the end of the course, students will be able to

CO1: determine solutions of homogeneous equations, non-homogeneous equations of degree one in two variables, solve Bernoulli's equations and exact differential equations.

CO2: find the solutions of equations of first order but not of higher degree and to determine particular integrals of algebraic, exponential, trigonometric functions and their products.

CO3: find solutions of simultaneous linear differential equations, linear equations of second order and to find solutions using the method of variations of parameters.

CO4: form a PDE by eliminating arbitrary constants, arbitrary functions, find complete, singular and general integrals to solve Lagrange's equations and solve differential equations using Charpit's methods.

CO5: study the various applications of differential equations.

Unit I **(18 Hours)**

Ordinary Differential Equations: Variable separable - Homogeneous Equation-Non-Homogeneous Equations of first degree in two variables -Linear Equation - Bernoulli's Equation-Exact differential equations.

Unit II **(18 Hours)**

Equation of first order but not of higher degree: Equation solvable for dy/dx- Equation solvable for y-Equation solvable for x- Clairauts' form - Linear Equations with constant coefficients-Particular integrals of algebraic, exponential, trigonometric functions and their products.

Unit III **(18 Hours)**

Simultaneous linear differential equations- Linear Equations of the Second Order -Complete solution in terms of a known integrals-Reduction to the Normal form-Change of the Independent Variable-Method of Variation of Parameters.

Unit IV **(18 Hours)**

Partial differential equation: Formation of PDE by Eliminating arbitrary constants and arbitrary functions – complete integral – singular integral-General integral-Lagrange's Linear Equations –Charpit's methods.

Unit V **(18 Hours)**

Applications of Second-Order linear differential equations with constant coefficients.

Learning Resources:

Text Book(s)

1. S.Narayanan and T.K.Manicavachagom Pillay, *Calculus Volume III*, S.Viswanathan Pvt., Ltd., 2011.

   Unit I : Chapter 1 (Sec 1 to 4)

   Unit II : Chapter 1 (Sec 5 and 6); Chapter 2 (Sec 1 to 4)

   Unit III : Chapter 3 (Sec 1 to 4); Chapter 2 (Sec 8 to 10)

   Unit IV : Chapter 4 (Sec 1 to 7)

2. Shepley L. Ross, *Differential Equations, 3rd Ed*., John Wiley and Sons, 1984.

   Unit V : Chapter 5

References

1. D.A. Murray, *Introductory course in Differential Equations*, Orient and Longman
2. H.T. H. Piaggio, *Elementary Treaties on Differential Equations and their applications,* C.B.S Publisher & Distributors, Delhi,1985.
3. Horst R. Beyer, *Calculus and Analysis*, Wiley, 2010.
4. Braun, M. *Differential Equations and their Applications. (3rd Edn.)*, Springer- Verlag, New York. 1983.
5. Tyn Myint-U and Lognath Debnath, *Linear Partial Differential Equations for Scientists and Engineers. (4th Edn.)* Birhauser, Berlin. 2007.
6. Boyce, W.E. and R.C.DiPrima, *Elementary Differential Equations and Boundary Value Problems. (7th Edn.)* John Wiley and Sons, Inc., New York. 2001.
7. Sundrapandian, V. *Ordinary and Partial Differential Equations*, Tata McGraw Hill Education Pvt.Ltd. New Delhi, 2013.

CO - PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	2	3	3	2	1	2	2	2	2
CO 2	3	2	3	3	2	1	2	2	2	2
CO 3	3	2	3	3	2	1	2	3	2	2
CO 4	3	2	3	3	2	1	2	3	2	2
CO 5	3	2	3	3	3	2	2	3	3	3
Average	3	2	3	3	2.2	1.2	2	2.6	2.2	2.2

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS3605	Linear Programming	Core	6	6

This course aims to develop students to use quantitative methods and techniques for effective decision making, mathematical model formulation and applications that are used in solving real life problems.

Course Outcomes:

At the end of the course, students will be able to

CO1: formulate Linear Programming Problem, find its solution by graphical method and identify the special cases of solution

CO2: predict solutions of different types of LPP using appropriate methods, namely, simplex, Big M and two-phase method.

CO3: interpret the concept of duality, dual simplex and revised simplex method to solve the LPP

CO4: solve transportation and assignment problems

CO5: obtain the optimum strategies in a game using different decision making tools.

Unit I **(18 Hours)**

Introduction – Formulation of L.P.P. – Graphical solution of L.P.P. and its special cases – Canonical form, Standard form and Basic solution – Basic feasible solution – Reduction of feasible solution to a basic feasible solution.

Unit II **(18 Hours)**

The Simplex method – Introduction – Simplex method – Big M method – Two phase Method.

Unit III **(18 Hours)**

Duality in Linear Programming – Concept of duality – Formulation of dual problem – Formulation of primal-dual pairs – Dual simplex method – Revised Simplex Method.

Unit IV **(18 Hours)**

The Transportation Problem -- Introduction -- Mathematical formulation – Loops in a transportation table – Finding IBFS – moving towards optimality – Degeneracy – Unbalanced

transportation problems – The Assignment problem – Introduction – Hungarian method – Variations of the Assignment problem – Multiple optimal solutions – Maximization case – Travelling salesman problem – Unbalanced assignment problem- Restrictions.

Unit V **(18 Hours)**

Introduction to theory of Games – Saddle Point – Without saddle point – Graphical solution for 2 x m, n x 2 – Dominance property – Solution of game by linear programming method.

Learning Resources:

Text Book(s)

1. Kanti Swarup, Gupta P.K. & Manmohan, *Operations Research*, Sultan Chand & Sons, Reprint 2020.

   Unit I: Chapters 2 & 3

   Unit II: Chapter 4 (Sec 4.1, 4.3, 4.4)

   Unit III: Chapter 5 (Sec 5.1 to 5.4, 5.7, 5.9); Chapter 9 (Sec 9.1)

   Unit IV: Chapter 10 (Sec 10.1-10.13 & 10.15); Chapter 11 (Sec 11.1 to 11.4, 11.7)

   Unit V: Chapter 17 (except Sec 17.8 & iterative method of approximate solution)

References

1. R. Bronson, *Operations Research* 2nd Edition, Schaum's Outline Series, 1997.
2. B.S. Goel & S.K. Mittal, *Operations Research*, Pragati Prakashan, Meerut, 2000.
3. G. Hadley *Linear Programming*, Narosa Book Distributors Private Ltd.,1963.
4. J.L. Sharma,*Operations Research Theory and applications*, Macmillan, New Delhi, 2003.

CO - PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	3	3	3	2	2	2	1	2	2
CO 2	3	3	2	3	3	2	2	1	1	2
CO 3	3	3	3	3	3	2	2	1	2	2
CO 4	3	3	2	3	2	2	2	1	2	2
CO 5	3	3	3	3	3	2	2	1	2	1
Average	3	3	2.6	3	2.6	2	2	1	1.8	1.8

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS3602	Complex Analysis	Core	6	6

This course covers analytic functions, differentiability, and the Cauchy-Riemann equations. It includes complex integration techniques, series in the complex plane, and the Residue Theorem. Applications involve evaluating complex integrals and solving real integrals using contour integration.

Course Outcomes:

At the end of the course, students will be able to

CO1: identify foundational concepts in complex analysis and verify the Harmonic functions using analyticity conditions.

CO2: explain the concept of conformal mappings and bilinear transformations.

CO3: evaluate contour integrals, differentiate between simply and multiply connected domains, utilize Liouville's theorem and the Maximum Modulus Principle to solve complex analysis problems.

CO4: analyze and determine the convergence of power series, derive Taylor's and Laurent's series

CO5: distinguish different types of singularities and poles, calculate residues**,** and apply the Cauchy Residue theorem to evaluate real improper integrals.

Unit I **(18 Hours)**

Functions of a Complex variable – Limits – Theorem on limits – Continuity – Derivatives – Differentiation formulas – Cauchy Riemann equation – Conditions for differentiability – Polar coordinates – Analytic functions – Harmonic functions.

Unit II **(18 Hours)**

Conformal Mapping – Elementary Transformation – Bilinear Transformations – Cross Ratio – Fixed points of Bilinear Transformation.

Unit III **(18 Hours)**

Complex Integration – Cauchy's Theorem – Cauchy's Integral formula – Maximum modulus Theorem – Higher derivatives – Liouville's theorem – Fundamental theorem of Algebra.

Unit IV **(18 Hours)**

Power Series – Taylor's series – Laurent's series – Zeros of an analytic function.

Unit V **(18 Hours)**

Singularities – Residues – Cauchy's Residue theorem – Evaluation of Definite Integrals (Type 1 and Type 2).

Learning Resources:

Text Book(s)

1. S. Arumugam, A. Thangapandi Issac and A. Somasundaram, *Complex Analysis*, SCITECH Publications private limited, 2007.

Unit I **:** Chapter 2 (Sec 2.0 to 2.8)

Unit II **:** Chapter 2 (Sec 2.9); Chapter 3 (Sec 3.0 to 3.4)

Unit III **:** Chapter 6 (Sec 6.0 to 6.4)

Unit IV **:** Chapter 4 (Sec 4.3); Chapter 7 (Sec 7.0 to 7.3)

Unit V **:** Chapter 7 (Sec 7.4); Chapter 8 (Sec 8.0 to 8.3)

References

1. James Ward Brown and Ruel V. Churchill, *Complex variables and application*, Mc-Graw Hill Book Co., International Edition, Seventh Edition, 2009.
2. Theodore W. Gamelan, *Complex Analysis*, Springer Verlag, 2008
3. Joseph Bak and Donald J. Newman, *Complex analysis*, 2nd Edition, Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.
4. Richard A. Silverman, Introductory *Complex Analysis*, Dover Publications, 1972.
5. S. Ponnusamy and H. Silverman, *Complex variables with applications*, Birkhauser, 2006.

Websites/ e-Learning Resources

https://archive.nptel.ac.in/courses/111/103/111103070/

https://archive.nptel.ac.in/courses/111/106/111106141/

CO - PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	3	3	3	2	3	2	1	1	1
CO 2	3	3	3	3	2	2	2	1	2	1
CO 3	3	3	3	2	3	3	2	1	1	1
CO 4	3	2	3	3	3	2	2	1	1	1
CO 5	3	3	3	2	3	2	2	1	2	1
Average	3	2.8	3	2.6	2.6	2.4	2	1	1.4	1

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS3504	Mathematical Modelling	Core	5	5

The course is aimed to construct and analyse mathematical models found in real life problems through differential and difference equations.

Course Outcomes:

At the end of the course, students will be able to

CO1: identify simple situations requiring mathematical modelling and to determine the characteristics of such models.

CO2: illustrate linear growth and decay models using differential equations

CO3: formulate a model using systems of ordinary differential equations of first order, to discuss about various models under the categories 'Epidemics' and 'Medicine'.

CO4: explain in detail about difference equations

CO5: construct a model using difference equations.

Unit I **(15 Hours)**

Mathematical Modelling: Simple situations requiring mathematical modelling - characteristics of mathematical models.

Unit II **(15 Hours)**

Mathematical Modelling through differential equations: Linear Growth and Decay Models- Non-Linear growth and decay models - Compartment models.

Unit III **(15 Hours)**

Mathematical Modelling through system of Ordinary differential equations of first order: Prey-predator models-Competition models-Model with removal and model with immigrations- Epidemics: simple epidemic model – Susceptible – infected - susceptible (SIS) model - SIS model with constant number of carriers - Medicine: Model for Diabetes Mellitus.

Unit IV **(15 Hours)**

Introduction to Difference Equations: The need for Mathematical Modelling through Difference Equations: Some Simple Models – The Linear Difference Equation – The Complementary Function – The Particular Solution – Solution of a System of Linear Homogeneous Difference Equations with Constant Coefficients.

Unit V **(15 Hours)**

Mathematical Modelling through difference equations: Harrod Model - Cob web model application to Actuarial Science

Learning Resources:

Text Book(s):

1. J N Kapur, *Mathematical Modeling*, New Age International publishers (2009)..

Unit I : Chapter 1 (Sec 1.1 to 1.4)

Unit II : Chapter 2 (Sec 2.1 to 2.2(2.2.1, 2.2.3 to 2.2.8), 2.3, 2.4)

Unit III : Chapter 3 (Sec 3.1(3.1.1, 3.1.2), 3.2(3.2.1 - 3.2.3, 3.2.6), 3.5(3.5.1))

Unit IV : Chapter 5 (Sec 5.1, 5.2)

Unit V : Chapter 5 (Sec 5.3(5.3.1, 5.3.2, 5.3.4))

References

1. Bimalk. Mishra and Dipak K.Satpathi , *Mathematical Modeling*, Ane Books Pvt. Ltd(1 Januuary 2009)
2. Edward A. Bender, *An introduction to mathematical Modeling*, CRC Press,2002
3. Jonas Hall & Thomas Ligefjard, *Mathematical Modeling applications with Geogebra* John Wiley & Sons, 2017
4. Mark M. Meerschaert, *Mathematical Modeling*, Elsevier Publ., 2007.
5. Sandip Banerjee, *Mathematical Modeling Models, Analysis and Applications*, CRC Press, Taylor & Francis group, 2014
6. Walter J. Meyer, *Concepts of Mathematical Modeling*, Dover Publ., 2000

Website and e-Learning Source

https://nptel.ac.in

CO - PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	3	3	3	1	1	2	1	1	1
CO 2	3	3	3	2	2	1	2	1	2	1
CO 3	3	3	3	3	2	1	2	1	1	1
CO 4	3	2	2	2	1	1	2	1	1	1
CO 5	3	2	3	3	2	1	2	1	1	1
Average	3	2.6	2.8	2.6	1.6	1	2	1	1.2	1

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/ MAS3406	Operations Research	Core	4	4

This course helps the student to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type and to design new simple models, like CPM to improve decision-making and develop critical thinking and objective analysis of decision problems.

Course Outcomes:

At the end of the course, students will be able to

CO1: determine optimum solution for the post-optimal problems.

CO2: compute to optimize an I.P.P using Gomary's method.

CO3: design new models imitating PERT/CPM, solve PERT/CPM, predict the probability of project completion time.

CO4: formulate different inventory models and identify formula to calculate different parameters.

CO5: identify the suitable queuing models and calculate the characteristics of the queuing system.

Unit I **(12 Hours)**

Introduction to Sensitivity Analysis – Changes in the cost vector, requirement vector – Coefficient Matrix –Addition of new constraints.

Unit II **(12 Hours)**

Introduction to Integer Programming – Construction of Gomary's constraints – Fractional cut method – all Integer and mixed Integer related problems.

Unit III **(12 Hours)**

Network Scheduling by PERT/CPM: Introduction – Network and Basic components – Rules of Network construction – Time calculations in networks – Critical Path Method (CPM)-PERT calculations – Advantages of Network (PERT/CPM).

Unit IV **(12 Hours)**

Introduction to Inventory Control – Types of inventories – The inventory decisions – Economic Order Quantity- Four EOQ models – Multi item deterministic problem.

Unit V **(12 Hours)**

Introduction to Queueing Theory – Queueing system – Characteristics of Queueing Systems - Classification of Queueing models – Solution of Queueing models {(M/M/1): (∞/FIFO)}, {(M/M/1): (N/FIFO)} and {(M/M/C): (∞/FIFO}.

Learning Resources:

Text Book(s)

1. Kanti Swarup, P.K. Gupta & Manmohan, *Operations Research*, Sultan Chand & Sons, Reprint 2020.

   Unit I : Chapter 6 (Sec 6.1 to 6.4, 6.5(i))

   Unit II : Chapter 7 (Sec 7.1 to 7.6)

   Unit III : Chapter 25 (Sec 25.1 to 25.7)

   Unit IV : Chapter 19 (Sec 19.1 to 19.10 & 19.13).

   Unit V : Chapter 21 (Sec 21.1 to 21.9 (Models I, III, V)).

References

1. R. Bronson, *Operations Research* 2nd Edition, Schaum's Outline Series, 1997.
2. B.S. Goel & S.K. Mittal, *Operations Research*, Pragati Prakashan, Meerut, 2000.
3. G. Hadley *Linear Programming*, Narosa Book Distributors Private Ltd.,1963.
4. J.L. Sharma,*Operations Research Theory and applications*, Macmillan, New Delhi, 2003.

CO - PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	2	3	3	2	2	1	2	2
CO 2	3	3	3	3	3	2	2	1	1	2
CO 3	3	3	3	3	3	2	2	1	2	2
CO 4	3	3	3	2	2	2	2	1	2	2
CO 5	3	3	2	2	2	2	2	1	2	1
Average	3	3	2.6	2.6	2.6	2	2	1	1.8	1.8

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS3322	Project	Core	3	3

This course aims to inspire and prepare students to apply the mathematical knowledge and abilities they have acquired over the last five semesters to appropriate real-world issues. Students are encouraged to use this as inspiration to come up with appropriate mathematical applications so that the outcome is appreciated by the society and the individual student.

Course Outcomes:

At the end of the course, students will be able to

CO1: compile the outcome based on their experiences as analysts.

CO2: utilize modern gadgets and explore digital literacy for accuracy and reliability.

CO3: students will be able to develop critical analysis ability and understand challenges pertaining with real times issues.

CO4: resolve issues in real time by using mathematical concepts.

CO5: influence them to care about the social issues as citizens.

Guidelines & Instructions:

- The project work for B.Sc. Mathematics Program is to be undertaken during VI semester.
- Students are divided into a group of at most three candidates to identify and take up a project work.
- Students maybe permitted to work on projects in an Industrial/Research Organization, on the recommendations of the Head of the Department. In such cases, the Project work shall be jointly supervised by a supervisor of the department and/or an expert, as a joint supervisor from the organization/institution.
- The student shall be instructed to meet the supervisor periodically and to attend the review committee meetings for evaluating the progress.
- The Project work shall be pursued for a minimum of 12 weeks during the final semester.
- The deadline for submission of final Project Report is the last working day of the semester.

- In case of candidates not completing of project work successfully, the candidates can undertake again in the June Repeat or the subsequent semester.

Evaluation:

The UG-Head of the Department and the supervisor shall constitute the review committee for each branch of study. The evaluation of Project Work for B.Sc. Mathematics shall be done independently in the respective semesters and marks shall be allotted as per the weightages given in the tabular column as mentioned below. There shall be two reviews (each 10 Marks) during the semester by the review committee. The student shall make presentation on the progress made by him / her before the committee. The total score for the two reviews is 20. The internal (Guide) will assess for 30 marks (Including the regular discussion, attendance and field work.) The project report shall carry a maximum 10 marks. The viva-voce examination shall carry 40 marks. (Marks are awarded to each student of the project group based on the individual performance in the viva –voce Examination).

Internal Assessment (50Marks)			**End Semester Examination (50 Marks)**		
Review -I	**Review -II**	**Internal (Guide)**	**Evaluation (10 Marks)**	**Viva – Voce (40 Marks)**	
			Internal (Guide)	**Examiner I**	**Examiner I**
10	10	30	10	40	

Review Committee members:

1. UG - Head of the Department
2. Supervisor/Guide.

CO - PSO Mapping

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO 10**
CO 1	3	3	3	3	3	3	3	3	3	2
CO 2	3	3	3	3	3	3	3	3	3	2
CO 3	3	3	3	3	3	3	3	3	3	2
CO 4	3	3	3	3	3	3	3	3	3	2
CO 5	3	3	3	3	3	3	3	3	3	2
Average	3	3	3	3	3	3	3	3	3	2

Strong - 3 Medium-2 Low-1

Course Code	Name of the Course	Category	Hours /Wk.	Credits
24MAT/MAS3255	Internship	IS	30*	2

This course aims to enable the students to have hands-on training in their subject specialization of choice, and to convert the theoretical knowledge into practical skills.

Course Outcomes:

As the end of the course, students will be able to

CO1: apply theoretical knowledge to solve practical challenges in the field.

CO2: demonstrate enhanced professional skills and ethical conduct in a real-world setting.

CO3: develop effective communication and teamwork abilities

CO4: exhibit reflective practice to assess personal learning, identify areas for improvement, and develop strategies for on-going professional growth.

CO5: establish connections with industry professionals, fostering networking opportunities and potential job prospects.

CO - PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	2	2	3	3	3	2	2	2	1
CO 2	3	3	3	3	3	3	2	2	2	1
CO 3	3	3	3	3	1	2	2	2	2	2
CO 4	2	2	3	3	1	2	3	2	2	2
CO 5	2	3	2	3	1	2	2	2	2	2
Average	2.6	2.6	2.6	3	1.8	2.4	2.2	2	2	1.6

Strong - 3 **Medium-2** **Low-1**

* Internship - Second Year Vacation (30 Hrs.)

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS3266	Professional Competency Skill	SEC	3	2

Professional competency skills encompass a broad range of abilities and attributes that enable the students to perform effectively in their professional roles. These skills are crucial for their success across various disciplines, higher education and job functions. Developing and refining the following professional competency skills can significantly enhance career prospects and contribute to professional growth and success in various organizational contexts.

Course Module & Outcome:

Brief recaps of all the core courses in the first five semesters were given in this course. Questions selected from these core courses which are of immense importance. In Semester VI, an Online Test will be conducted to test their competency skill and grades will be awarded accordingly.When it comes to testing mathematical knowledge as a professional competency skill, there are several key aspects to consider. The expected outcome of this test is as follows:

CO1: Problem-solving Ability: Assessing someone's capability to solve mathematical problems across various domains such as Algebra, Calculus, Statistics, etc. This involves not just computational skills but also the ability to understand the problem, formulate a solution approach, and executes it effectively.

CO2: Mathematical Reasoning: Evaluating how well an individual can apply logical reasoning to mathematical concepts and theories. This includes understanding mathematical principles, making connections between different concepts, and drawing conclusions based on mathematical evidence.

CO3: Quantitative Analysis: Testing proficiency in analysing numerical data, interpreting results, and making data-driven decisions. This skill is crucial in fields such as finance, economics, engineering, and scientific research.

CO4 Critical thinking in Mathematics: Evaluating the capacity to critically evaluate mathematical arguments, identify flaws in reasoning, and construct valid proofs or justifications.

CO5: Applied Mathematics: Testing proficiency in applying mathematical concepts to practical problems or situations, such as in engineering designs, statistical analysis, or optimization problems.

Unit I **(9 hours)**

Algebra & Trigonometry - Differential Calculus – Probability & its applications.

Unit II **(9 hours)**

Analytical Geometry (two & three Dimensions) – Integral Calculus – Statistics & its applications.

Unit III **(9 hours)**

Abstract Algebra – Elements of Mathematical Analysis – Graph Theory.

Unit IV **(9 hours)**

Linear Algebra – Real Analysis –Vector Calculus and Applications.

Unit V **(9 hours)**

Mechanics – Differential Equations and Applications – Operations Research.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	2	3	3	3	2	2	2	2	3
CO 2	3	2	3	3	3	3	3	2	2	3
CO 3	3	3	3	2	3	2	3	2	2	2
CO 4	3	2	3	3	3	2	2	3	2	2
CO 5	3	3	3	3	3	3	2	2	3	2
Average	3	2.4	3	2.8	3	2.4	2.4	2.2	2.2	2.4

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS3421	Number Theory	DSE	5	4

The study of number theory inevitably includes knowledge of the problems and techniques of elementary number theory; however the tools which have evolved to address such problems and their generalizations are both analytic and algebraic, and often intertwined in surprising ways. This course covers topics from classical number theory including discussions of prime numbers, division algorithms, congruences, and quadratic reciprocity.

Course Outcomes:

At the end of the course, students will be able to

CO1: recall the basic concepts of divisibility.

CO2: demonstrate properties in solving congruences.

CO3: solve system of linear congruences.

CO4: analyse various arithmetical functions.

CO5: discuss on quadratic congruence equations.

Unit I **(15 Hours)**

Divisibility theory: Division algorithm – GCD – Euclidean algorithm – LCM – Linear Diophantine Equation.

Unit II **(15 Hours)**

Primes – Fundamental theorem of arithmetic – Basic properties of congruences – Binary and Decimal Representations of Integers.

Unit III **(15 Hours)**

Linear congruences – Chinese Remainder theorem – Fermat's theorem – Wilson's theorem.

Unit IV **(15 Hours)**

Number-theoretic functions – Number of positive divisors – Sum of divisors – multiplicative functions – Mobius function – Mobius inversion formula – Greatest integer function – Euler's phi function – Euler's theorem.

Unit V **(15 Hours)**

Quadratic residues – Euler's criterion – Legendre symbol and its properties – Gauss lemma – Quadratic reciprocity law.

Learning Resources:

Text Book(s)

1. David M**.** Burton, *Elementary Number theory*, seventh edition, Tata Mcgraw Hill Education Private Limited, 2012.

    Unit I: Chapter 2 (Sec 2.2 to 2.5)

    Unit II: Chapter 3 (Sec 3.1); Chapter 4 (Sec 4.2 to 4.3)

    Unit III: Chapter 4 (Sec 4.4); Chapter 5 (Sec 5.2 to 5.3)

    Unit IV: Chapter 6 (Sec 6.1 to 6.3); Chapter 7 (Sec 7.2 to 7.3)

    Unit V: Chapter 9 (Sec 9.1 to 9.3)

References

1. G. E. Andrews, *Number theory*, Hindustan Publishing Corporation, 1994.
2. T. M. Apostol, *Introduction to analytic number theory*, Narosa publishing house, 1998.
3. K.C. Chowdhury, *A First Course Theory of Numbers,* Asian Books Private Limited, 2007.
4. G.A. Jones, & M.J. Jones, *Elementary Number Theory*, Springer Verlag, 2005.
5. S. Kumaravelu and Susheela Kumaravelu, *Elements of Number Theory*, Nagarcoil, January 2002.
6. S.B. Malik, *Basic Number Theory*, Vikas Publishing House Private Limited, 1998.
7. I. Niven and H.S. Zuckerman, *An introduction to the theory of numbers*, Wiley eastern, 2015.
8. J. William, *Fundamentals of Number Theory*, Leveque, Addison-Wesley, 1977.

Website and e-Learning Source

https://nptel.ac.in
https://mathonline.wikidot.com

CO - PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	3	2	1	1	2	2	1	1	2
CO 2	3	3	2	2	2	3	2	1	1	2
CO 3	3	3	3	2	2	3	3	1	1	3
CO 4	3	3	3	3	3	3	3	1	1	3
CO 5	3	3	3	3	3	3	1	1	1	2
Average	3	3	2.6	2.2	2.2	2.8	2.2	1	1	2.4

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS3423	Introduction to Combinatorics	DSE	5	4

Combinatorics is concerning the study of finite or countable discrete structures. Aspects of combinatorics include counting the structures of a given kind and size (enumerative combinatorics), deciding when certain criteria can be met, and constructing and analyzing objects meeting the criteria.

Course Outcomes:

At the end of the course, students will be able to

CO1: demonstrate effectively the addition and multiplication principles and use it for counting.

CO2: apply the concepts of special counting numbers such as Ramsay numbers, Stirling numbers, and Catalan numbers in appropriate environment.

CO3: design a new counting principle called inclusion and exclusion principle and use it for counting problems.

CO4: apply generating functions and the concept of partition to solve combinatorial problems.

CO5: model recurrence relations using different techniques for real time counting problems and find solutions.

Unit I **(15 Hours)**

The Sum Rule and the Product Rule – Permutations and Combinations – Derangements and other Constrained Arrangements – Related Problems.

Unit II **(15 Hours)**

Pigeon Hole Principle – Ramsey Numbers - Stirling Numbers – Catalan Numbers.

Unit III **(15 Hours)**

The Inclusion-Exclusion Principle – Related Problems.

Unit IV **(15 Hours)**

Generating Functions – Related Problems.

Unit V **(15 Hours)**

Recurrence Relations – Related Problems.

Learning Resources:

Text Book(s)

1. V.K. Balakrishnan, Schaum's outline series, *Combinatorics*, Tata McGraw-Hill Publishing Company Ltd., 2005.

Unit I : Chapter 1 (Sec 1.1 to 1.2; Problem Numbers 1.1 to 1.75)

Chapter 2 (Problem Number s 2.25 to 2.39)

Unit II : Chapter 1 (Sec 1.3; Problem Numbers 1.76 to 1.162)

Unit III : Chapter 2 (Sec 2.3; Problem Numbers 2.20 to 2.24)

Unit IV : Chapter 3 (Sec 3.1 to 3.2; Problem Numbers 3.1 to 3.53)

Unit V : Chapter 3 (Sec 3.3 to 3.5; Problem Numbers 3.54 to 3.80)

References

1. A.W. Tucker, *Applied Combinatorics*, Wiley, 2011.
2. D. Cohen , *Combinatorics*, Wiley, 1978.
3. M. Hall, *Combinatorial Mathematics*, McGraw Hill, 1968.
4. Krishnamurthy, *Combinatorics*, PHI, 1998.
5. C.L. Liu, *Introduction to Combinatorial Mathematics*, McGraw-Hill, New york, 1994.
6. H.J. Ryser, *Combinatorial Mathematics*, Carus Mathematical monograph, 1965.

Website and e-Learning Source

https://nptel.ac.in

https://mathonline.wikidot.com

CO - PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	2	3	3	2	3	2	3	2	2
CO 2	3	2	3	3	2	3	2	3	2	2
CO 3	3	2	3	3	2	3	2	3	2	2
CO 4	3	2	3	3	1	3	2	3	2	2
CO 5	3	2	2	3	2	3	2	3	2	1
Average	3	2	2.8	3	1.8	3	2	3	2	1.8

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS3422	Fuzzy Mathematics	DSE	5	4

Fuzzy mathematics forms a branch of mathematics related to fuzzy set theory and fuzzy logic. It started in 1965 after the publication of Lotfi Asker Zadeh's seminal work Fuzzy sets. The quest for imitating human brain (artificial intelligence) since the invention of computers has propelled this area of Mathematics to a large extend as the human brain does not see things in black and white but rather in rainbow colors.

Course Outcomes:

At the end of the course, students will be able to

CO1: distinguish between the crisp set and fuzzy set and draw a parallelism between crisp set operations and fuzzy set operations through the use of characteristic functions of crisp sets and membership functions of fuzzy sets, respectively.

CO2: discuss the properties of $\alpha - c\,u\,t\,s$ and various representation of fuzzy sets.

CO3: extend the binary operations union, intersection, complementation of crisp sets to fuzzy sets.

CO4: outline the concept of fuzzy numbers and arithmetic operations, and to solve fuzzy equations.

CO5: distinguish fuzzy relation from crisp relation and solve fuzzy relation equations.

Unit I **(15 Hours)**

Crisp sets and fuzzy sets – Basic concepts of fuzzy set – Convex fuzzy set.

Unit II **(15 Hours)**

α-cuts – Properties of α-cuts – Representations of fuzzy sets – Extension principle of fuzzy sets.

Unit III **(15 Hours)**

Operations on fuzzy sets – Fuzzy complements – Fuzzy intersection – Fuzzy union.

Unit IV **(15 Hours)**

Fuzzy numbers – Linguistic variables – Arithmetic operation on intervals – Arithmetic operation on fuzzy numbers – Fuzzy equations.

Unit V **(15 Hours)**

Crisp and fuzzy relations – Projections and cylindric extensions – Binary fuzzy relations – Binary relation on a single set – Equivalence and similarity relation – Fuzzy relation equation.

Learning Resources:

Text Book(s)

1. George J. Klir and BoYuan, *Fuzzy Sets, Fuzzy Logic, Theory and Applications,* Prentice Hall of India, 1997.

   Unit I **:** Chapter 1 (Sec 1.1 to 1.4)

   Unit II **:** Chapter 2 (Sec 2.1 to 2.3)

   Unit III **:** Chapter 3 **(**Sec 3.1 to 3.4 (exclude Theorems 3.7, 3.8, 3.11 & 3.16))

   Unit IV **:** Chapter 4 (Sec 4.1, 4.2, 4.3, 4.4, 4.6 (exclude Theorems 4.1 & 4.2))

   Unit V **:** Chapter 5 (Sect 5.1 to 5.5)

   Chapter 6 (Sec 6.1 to 6.3)

References

1. Esteban Indurain, Javier Fernandez and Humberto Bustince, *New Trends in fuzzy set theory and related items,* MDBI Publications, 2019.
2. Sudhir K.Pundir and Rimple Pundir, *Fuzzy sets and their applications,* Pragati Prakashan Publication, 2004.
3. Timothy J. Ross, *Fuzzy logic with engineering Applications*, McGraw Hill Inc. New Delhi, 2004.
4. H.J. Zimmermann, *Fuzzy Set Theory and Its Applications*, Kluwer Academic Publishers, 2001.

CO - PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	2	3	2	1	1	1	1	1	1
CO 2	3	3	3	3	2	1	2	1	1	1
CO 3	3	3	3	3	2	1	2	1	1	2
CO 4	3	3	3	3	3	1	2	1	1	2
CO 5	3	3	3	3	3	1	2	1	1	2
Average	3	2.8	3	2.8	2.2	1	1.8	1	1	1.6

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT /MAS3424	Numerical Methods with Applications	DSE	5	4

The aim of this course is to enable the students to acquire basic tools in numerical methods for solving algebraic, transcendental equations, Interpolation, Numerical differentiation and Integration and Numerical solution of ODE.

Course Outcomes:

At the end of the course, students will be able to

CO1: solve algebraic, transcendental equations and system of simultaneous equations.

CO2: apply interpolation techniques in various intervals in real life situations.

CO3: obtain the solution of numerical differentiation and integration.

CO4: find the methods for solving ordinary differential equations.

CO5: compute the methods of Predictor-Corrector methods and Cubic spline method.

Unit I **(15 Hours)**

Solution of algebraic and transcendental equations – Bisection method – Iteration method – Method of false position – Newton Raphson method.

Unit II **(15 Hours)**

Interpolation – Finite differences – Forward difference – Backward differences – Central differences – Central difference interpolation formulae – Gauss central difference formulae Stirling's formula – Bessel's formula.

Unit III **(15 Hours)**

Numerical differentiation – Numerical integration – Trapezoidal rule – Simpson's 1/3 rule – Simpson's 3/8 rule – Romberg Integration.

Unit IV **(15 Hours)**

Numerical Solutions of ordinary differential equations – Solution by Taylor's series – Picard's method of Successive approximation – Euler's method-Runge-Kutta methods.

Unit V **(15 Hours)**

Predictor-Corrector methods – Adams-Moulton method – Milne's method – Cubic spline method.

Learning Resources:

Text Book(s)

1. S.S. Sastry, *Introductory Methods of Numerical Analysis*, Prentice hall of India. 2000.

   Unit I : Chapter 2 (Sec 2.2 to 2.5)

   Unit II: Chapter 3 (Sec 3.3, 3.3.1 to 3.3.3, 3.7.1 to 3.7.3)

   Unit III: Chapter 6 (Sec 6.2, 6.4, 6.4.1 to 6.4.3, 6.4.6)

   Unit IV: Chapter 8 (Sec 8.2 to 8.5)

   Unit V: Chapter 8 (Sec 8.6,8.6.1,8.6.2, 8.7).

References

1. S. Arumugam, A. ThangaPandian Isaac and S. Somasundaram,*Numerical Methods*, Scitech publications, 2009.
2. B.S Grewal, and J.S Grewal, *Numerical Methods in Engineering and Science*, Khanna Publishers, New Delhi, 1999.
3. M. K Jain, S. R. K. lyenga and *Numerical methods for Scientific and Engineering computation*, New age international, 2007.
4. P. Kandasamy, K .Thilakavathy,. and K.Gunavathy, *Numerical Methods,* S. Chand & Co., New Delhi, 1998.
5. M. K. Venkataraman, *Numerical Methods in Science and Engineering*,The national publishing company,1999.

Websites/e-Learning Resources

https://archive.nptel.ac.in/courses/111/107/111107105/

CO - PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
CO 1	3	3	3	2	2	3	1	2	1	3
CO 2	3	2	3	2	1	3	2	1	1	2
CO 3	3	2	3	3	3	3	3	2	2	3
CO 4	3	2	3	3	2	3	2	2	1	2
CO 5	3	3	3	3	3	3	3	1	1	3
Average	3	2.4	3	2.6	2.2	3	2.2	1.6	1.2	2.6

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS 1411	Mathematics for Physics- I	Supportive	5	4

This course develops among the students the mathematical skills required to study physics. This course deals with vectors, solutions of linear equations, Eigen value, Eigen vectors, complex numbers, and complex differentiation.

Course Outcomes:

At the end of the course, students will be able to

CO1: find the curl and the divergence of vector fields.

CO2: evaluate line integrals, surface integrals & volume integral and use Stoke's theorem, Green's theorem, divergence theorem to illustrate the relation between any two of the above three.

CO3: find the inverse and rank of a matrix using elementary transformations.

CO4: compute Eigenvalues and solve the system of linear equations using elementary transformation.

CO5: apply Cauchy Riemann equations to identify analytic functions.

Unit I **(15 Hours)**

Vector Definition – Dot Product – Cross Product – Unit Normal Vector – Vector Differentiation – Formulae of Differentiation – Vector Differential Operator Definition – Gradient - Directional Derivatives – Divergent and Curl – Solenoidal and Irrotational – Scalar Potential Function – Related simple problems.

Unit II **(15 Hours)**

Line Integral – Surface Integral – Volume Integral – Green's theorem for a Plane – Stokes theorem, Gauss theorem of Divergence(Statement & Simple problems only) – Orthogonal Curvilinear Coordinates – Polar Coordinates – Right Circular Cylindrical Coordinates – Spherical Coordinates – Transformation of Cylindrical Polar Coordinates.

Unit III **(15 Hours)**

Matrix Definition – Types of Matrices – Adjoint of a Matrix – Inverse of a Matrix – Elementary Transformations – Inverse of a Matrix using Elementary Transformations – Rank of a Matrix – Triangular Form.

Unit IV **(15 Hours)**

Solution of a System of Linear Equations – Homogeneous and Non-Homogeneous problems using Rank Method – Eigen Values – Eigen Vector – Properties of Eigenvalues & Vectors - Related problems.

Unit V **(15 Hours)**

Introduction to Complex Variables -- Complex Differentiation- Cauchy Riemann equations - Analytic functions - Harmonic equation - related problems.

Learning Resources:

Text Book(s)

1. H. K. Dass, Dr. Rama Verma, *Mathematical Physics* (S. Chand Publishing), 8th revised edition 2014.

   Unit I: Chapter 1 (Sec 1.1, 1.2, 1.5, 1.8, 1.11 1.12);
   Chapter 2 (Sec 2.1 to 2.5, 2.7 (ex. 7, 9, 10, 21, 24, 25), 2.8, 2.10 to 2.11 (ex. 26, 27, 28, 31, 33 to 43, 45, 46)

   Unit II: Chapter 3 (Sec 3.1(ex. 1 to 5), 3.2(ex. 11 to 14), 3.3, 3.4 (ex. 16, 17, 19, 20), 3.6(ex. 23 to 25, 35, 37), 3.8 (40, 41, 56, 58); Chapter 4 (Sec 4.1, 4.8 to 4.10)

   Unit III: Chapter 38 (Sec 38.1, 38.2, 38.10, 38.13, 38.14, 38.17);
   Chapter 39 (Sec 39.1, 39.3)

   Unit IV: Chapter 40 (Sec 40.1, 40.3(ex. 5-7, 13, 14) & 40.4);
   Chapter 41 (Sec 41.2(ex. 1 to 3), 41.5 & 41.6 (ex. 24 to 27))

   Unit V: Chapter 22(22.1 to 22.3, 22.5, 22.6, 22.8, 22.9, 22.10(Statement only), 22.11(Statement only) (ex. 11-13, 15, 20), 22.15 (ex. 22 to 24)).

References

1. G. B. Arfken, H. J. Weber, F. E. Harris, *Mathematical Methods for Physicists*, Elsevier, 7th Edition, 2013.
2. M. Dass, P.K. Jena and B. K. Dash, *Mathematical Physics and Special Relativity*, A.K. Mishra Publication, 3rd Edition.
3. Erwin Kreyszig, *Advanced Engineering Mathematics*, Wiley Publication,10th Edition, 2011.
4. B. D.Gupta, *Mathematical Physics*, Vikas Publication, 4th edition, 2010.
5. C. Harper, *Mathematical Physics*, Prentice Hall India, 2003.

6. Weber and Arfken, *Essential Mathematical Methods for Physicists*, Academic Press, 2003.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	3	3	1	2	1	1	1	1
CO 2	3	2	3	2	2	2	2	1	1	1
CO 3	3	3	3	2	2	2	1	1	1	1
CO 4	3	3	3	3	2	2	2	1	1	1
CO 5	3	2	3	3	1	2	2	1	1	1
Average	3	2.6	3	2.6	1.6	2	1.6	1	1	1

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS1413	Mathematics for Economics –I (ECO/ECE)	Supportive	5	4

The course deals with sets, quadratic equation, matrices, differentiation and integration. This course introduces to the learner the quantitative techniques which can be applied in dealing with the study of economics.

Course Outcomes:

At the end of the course, students will be able to

CO1: illustrate the concepts of sets and functions.

CO2: identify and solve linear and quadratic equations, examine the nature of roots and the relations between roots and coefficients.

CO3: apply matrix operations to solve simultaneous equations.

CO4: discuss the concept of derivatives of a function and apply this to find maxima and minima.

CO5: illustrate the concepts of integration and find area between curves.

Unit I **(15 Hours)**

Set Theory- Forms of sets –set operations –Venn diagrams- Theory of Indices- Laws of Indices - Variable- Functions and their Graphical representation (upto polynomial function).

Unit II **(15 Hours)**

Equations - linear, quadratic equations – Simultaneous Linear equations-nature of roots – relations between roots and coefficients.

Unit III **(15 Hours)**

Matrices – types of matrices – Hessian Matrix- addition and subtraction of matrices – Matrix multiplication –Trace- Transpose -determinants – inverse of matrix – solving system of equations using Crammer's rule.

Unit IV **(15 Hours)**

Differentiation – rules of differentiation (I – VII) - Partial differentiation - maxima & minima of a function.

Unit V **(15 Hours)**

Integration- rules of integration (I - VI) - definite integral –Area between two Curves- Cost functions- Revenue functions.

Learning Resources:

Text Book(s)

1. H Bose. D, *An introduction to Mathematical Economics,* Himalaya Publishing House, Reprint 2017.

   Unit I **:** Chapter 8 (Pg.No. 297 to 313); Chapter 2 (Pg.No. 7 to 9, 13 to 21)

   Unit II **:** Chapter 2 (Pg.No.46 to 65)

   Unit III **:** Chapter 9 (Pg.No. 321 to 363, 376 to 383)

   Unit IV **:** Chapter 3 (Pg.No. 75 to 87, 98 to 102, 110 to 116)

   Unit V **:** Chapter 7 (Pg.No. 260 to 267, 273 to 282)

References

1. Knut Sydseter, Peter Hammord, Arne Strom & Andres Carvajal, *Essential Mathematics for Economic Analysis,* Pearson Educational limited, 2016.
2. Mehta. B.C. and Madnani. G.M.K., *Mathematics for Economists* , Sulthan Chand & Sons, New Delhi, 2012.
3. Alpha C.Chiang, Kevin Wainwright, *Fundamental Methods of Mathematical Economic*, McGraw Hill Trwin, 2005.
4. Mike Rosser, *Basic Mathematics for economists,* Second edition, Routledy Taylor & Francis group, 2003.
5. Khanna. M.L., *Matrices*, Jai Prakash Nath & Co.Meerut, 2001.
6. Madha and Madnani, *Mathematical applications in Economics*, Himalaya, 2000.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	2	3	2	1	2	2	1	1	2
CO 2	3	2	3	2	1	2	2	1	1	2
CO 3	3	2	3	2	1	2	2	1	1	2
CO 4	3	2	3	2	1	3	2	1	1	2
CO 5	3	2	3	2	1	2	2	1	1	2
Average	3	2	3	2	1	2.2	2	1	1	2

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk	Credits
24MAT/MAS1412	Mathematics for Physics - II	Supportive	5	4

This course develops among the students, the mathematical skills required to study physics.

Course Outcomes:

At the end of the course, students will be able to

CO1: explain the relationship between Fourier series and linear time-invariant system

CO2: distinguish between linear, nonlinear, partial and ordinary differential equations and solve homogeneous, non-homogeneous, linear and exact differential equations

CO3: solve second order differential equation with constant, variable coefficients

CO4: classify and solve the partial differential equations of standard types and explore the relation between beta and gamma functions

CO5: formulate recurrence relations for Legendre and Hermite differential equations.

Unit I **(15 Hours)**

Periodic functions – Fourier series – Dirichlet's Condition for a Fourier series- Euler's Formulae–Fourier series for discontinuous functions- Odd and even functions- Half – range series: cosine and sine series.

Unit II **(15 Hours)**

Differential equations - Definition- Order and degree – Formation of Differential Equations- Solution of Differential Equation- Differential Equation of first order and first degree: Variable separable- Homogeneous equations- Equations reducible to homogeneous form - linear differential equation– Bernoulli's equation and exact differential equations.

Unit III **(15 Hours)**

Linear differential equations of Second order with constant coefficients-Methods for finding the complementary function - Rules to find particular integral- Second order differential equations with variable coefficients.

Unit IV **(15 Hours)**

Partial differential equations –Eliminating arbitrary constants, functions– Lagrange's method – Partial differential equations non-linear in p and q: Type I, II, III.

Gamma function – Beta function –Properties of beta functions – Relation between beta and gamma functions.

Unit V **(15 Hours)**

Legendre differential equation (without proof of the solution) - Legendre's polynomial – Rodrigue's Forumula (Statement only) - A generating function of Legendre's polynomial- Orthogonality of Legendre polynomial- Recurrence formula –Hermite differential equation (without proof of the solution) – Generating function– Orthogonal property – Recurrence relation.

Learning Resources:

Text Book(s)

1. H. K. Dass, Rama Verma, *Mathematical Physics*, S. Chand & Company Pvt. Ltd., Eighth revised edition 2018.

    Unit I **:** Chapter 11 (Sec 11.1 to 11.3, 11.6 to 11.11)

    Unit II **:** Chapter 12 (Sec12.1 to12.4, 12.6 to12.11 (upto ex 19 only), 12.12)

    Unit III **:** Chapter 13 (Sec13.1to13.3, 13.14 to13.19)(only second order D.E.); Chapter 14 (Sec 14.1(ex 1,2,4,6 only);

    Unit IV **:** Chapter 42 (Sec42.1 to 42.3, 42.5 to 42.8)(ex 6 to 10, 18 to 26); Chapter 9 (Sec 9.1 (ex.1 to 5),9.4, 9.5(statement only) ,9.6, 9.8(ex 11to 13))

    Unit V **:** Chapter 28 (Sec 28.1(defn. only) to 28.2, 28.5(ex 1), 28.6, 28.7(without proof) (ex 6, 7 &9), 28.8(except examples), 28.9 (upto formula IV only)); Chapter 30 (Sec 30.2(defn. only) to 30.5(upto formula IV only))

References

1. G. B. Arfken, H. J. Weber, F. E. Harris, *Mathematical Methods for Physicists*, Elsevier, 7th Edition, 2013.
2. M. Dass, P.K. Jena and B. K. Dash, *Mathematical Physics and Special Relativity*, A.K. Mishra Publication, 3rd Edition.
3. Erwin Kreyszig, *Advanced Engineering Mathematics*, Wiley Publication, 10th Edition, 2011.
4. B. D.Gupta, *Mathematical Physics*, Vikas Publication, 4th edition, 2010.
5. C. Harper, *Mathematical Physics*, Prentice Hall India, 2003.
6. Weber and Arfken, *Essential Mathematical Methods for Physicists*, Academic Press, 2003.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	3	3	1	2	1	1	1	1
CO 2	3	2	3	2	2	2	2	1	1	1
CO 3	3	3	3	2	2	2	1	1	1	1
CO 4	3	3	3	3	2	2	2	1	1	1
CO 5	3	2	3	3	1	2	2	1	1	1
Average	3	2.6	3	2.6	1.6	2	1.6	1	1	1

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS1414	Fundamentals of Computer Applications (ECO/ECE)	Supportive	5	4

To create awareness on the efficiency and accuracy in using computer techniques in dealing with problems with special emphasis on study of economic, to introduce the basic tools in computer software.

Course Outcomes:

At the end of the course, students will be able to

CO1: identify the physical components of computer.

CO2: create, edit and format documents, print the letters in Microsoft Word.

CO3: construct formulas, including the use of built in functions, create charts using Microsoft Excel.

CO4: design a presentation using Microsoft Powerpoint.

CO5: use internet applications and explain various features of multimedia.

Unit I **(15 Hours)**

Introduction – Physical components of computer - Generation of computer– hardware and software - input – output devices — operating system – Applications of computers.

Unit II **(15 Hours)**

Word – Basic Operations Performed in MS Word: Creating, Saving, Editing, Formatting and Printing a document – finding and replacing text – spelling checking – column and tables – graphics.

Unit III **(15 Hours)**

MS Excel – Accessing MS Excel - Basic Operations: Creating , Saving , Modifying , Renaming, Deleting, Moving and Editing a worksheet – creating a chart – Formulae – naming ranges and using statistical data.

Unit IV **(15 Hours)**

Power-point – Accessing MS PowerPoint - Basic Operations: Creating, Designing, Saving, Adding slides and Printing the presentation -Running a slide show.

Unit V **(15 Hours)**

The Internet and World Wide Web: Introduction - History of Internet - Internet Applications - Understanding the World Wide Web - Web Browsers - Browsing the internet - Using a Search Engine - Email Service.

Learning Resources:

Text Book(s)

1. E Balagurusamy, *Fundamentals of Computers,* Tata McGraw Hill Education Private Limited, New Delhi, 2009

   Unit I: Chapter 1 (Sec 1.1, 1.3, 1.6 & 1.7); Chapters 4 & 5,
   Chapter 11 (Sec 11.1, 11.2)

   Unit II: Chapter 12 (Sec 12.3)

   Unit III: Chapter 12 (Sec 12.4)

   Unit IV: Chapter 12 (Sec 12.5)

   Unit V: Chapter 15 (Sec 15.1 to 15.8)

2. R. K. Taxali, *PC Software for windows–Made simple,* Tata McGraw-Hill,1998

   Unit II: Chapter 13, 16 & 17

   Unit III: Chapters 26 & 28

References

1. Alan R. Neibaner, *Microsoft word for windows*, Made easy, The basics and beyond, Tata McGraw Hill,New Delhi,1999.
2. Fundamentals of Computer Studies, Expert Solution Consults, 2010.
3. Torben Lage Frandsen, *Microsoft office word* 2007, e –publication,2010
4. Torben Lage Frandsen,Annexure B , *Microsoft office power point* 2007, e-publication,2010
5. Michael Miller, *Absolute Beginner's Guide to Computer Basics*, Fourth Edition, Que Publishing,2009.
6. Anita Goel, *Computer Fundamentals*, Pearson Education, 2010.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	2	2	2	1	1	2	2	1	1	2
CO 2	3	3	3	2	1	2	2	1	1	2
CO 3	3	3	3	3	1	2	2	1	1	2
CO 4	3	2	3	2	1	3	2	1	1	2
CO 5	2	3	2	1	1	2	2	1	1	2
Average	2.8	2.6	2.6	1.8	1	2.2	2	1	1	2

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT2411	Mathematics for Chemistry - I	Supportive	5	4

Mathematics will allow the students to develop a sophisticated understanding of mathematical structures and principles while gaining a wide range of skills that are attractive to employers. This course deals with matrices, Eigen values, Eigen vectors, sets, functions, groups, sampling, and numerical methods.

Course Outcomes:

At the end of the course, students will be able to

CO 1: identify the different types of matrices and perform associated operations.

CO 2: solve the system of equations and apply cayley hamilton theorem to find inverse of a matrix.

CO 3: illustrate the concepts of sets, relations, functions and groups.

CO 4: identify and apply large and small sample tests.

CO 5: apply numerical techniques to find roots of algebraic equations.

Unit I **(15 Hours)**

Theory of Matrices – Introduction – Algebra of matrices – types of Matrices – Elementary Transformations – Rank of a Matrix.

Unit II **(15 Hours)**

Simultaneous Linear Equations - Characteristic Equation – Verification of Cayley Hamilton Theorem – Eigen Values and Eigen Vectors – Properties of Eigen Values.

Unit III **(15 Hours)**

Theory of Sets – Introduction – The Concept of a Set – Set Inclusion – Union of Sets – Intersection of Sets – Difference of Two Sets – Complement of a Set – Symmetric Difference of Sets – Cartesian Product of Sets – Relations – Functions – Types of Functions – Groups – Definition and Examples.

Unit IV **(15 Hours)**

Test of Significance – Introduction – Sampling – Sampling Distribution – Testing of Hypothesis – Procedure for Testing of Hypothesis – Test of Significance of Large Samples for Mean – Small Samples – t-test – F-test, Chi-Square test.

Unit V **(15 Hours)**

Numerical Methods – Solution of Algebraic Equations – Iteration Method – Bisection Method – Regula-Falsi Method – Newton-Raphson Method – Interpolation – Newton's Interpolation Formula – Lagrange's Interpolation Formula.

Learning Resources:

Text Book(s)

1. S.Arumugam & A. Thangapandian Issac, *Modern Algebra*, SCITECH Publications, 2013.

   Unit I : Chapter 7 (Sec 7.1, 7.2, 7.4 & 7.5) (problems only)

   Unit II : Chapter 7 (Sec 7.6 to 7.8) (problems only)

   Unit III : Chapter 1 (Sec 1.1 to 1.8); Chapter 2 (Sec 2.1, 2.2, 2.4); Chapter 3 (Sec 3.1) (problems only)

2. S. Arumugam & A. Thangapandian Issac, *Statistics*, New gamma publishing house, 2011.

   Unit IV : Chapter 14 (Sec 14.1 to 14.5 II A); Chapter 15 (Sec 15.1), Chapter 16 (Sec 16.1)

3. S. Arumugam, A. Thangapandi Isaac & A. Somasundaram, *Numerical Methods*, Second edition, SCITECH Publications, 2005.

   Unit V : Chapter 3 (Sec 3.0 to 3.4); Chapter 7 (Sec 7.0, 7.1, 7.3)

References

1. S.C. Gupta &. V.K. Kapoor, *Elements of Mathematical Statistics*, S.Chand, 1995.
2. M. L. Khanna M.L., *Matrices*, Jai Prakash Nath & Co. Meerut, 2001.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	2	3	3	3	3	2	3	2	2	2
CO 2	3	3	3	3	3	2	3	2	2	2
CO 3	3	3	2	2	3	2	2	2	1	2
CO 4	2	3	3	2	3	2	1	2	1	2
CO 5	2	3	3	2	1	1	1	2	1	2
Average	2.4	3	2.8	2.4	2.6	1.8	2	2	1.4	2

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS2413	Business Mathematics (COM/CME)	Supportive	5	4

Business Mathematics is a specialized field of mathematics that deals with the application of mathematical concepts and techniques in business settings. This Course is designed to equip students with the necessary skills and knowledge to handle complex business situations using mathematical concepts.

Course Outcomes:

At the end of the course, students will be able to

CO1: solve problems in objective arithmetic.

CO2: solve practical problem involving the concepts of interest, simple interest, annuity.

CO3: recognize and apply matrix operations to solve simultaneous equations.

CO4: compute the optimum solution of both balanced and unbalanced transportation problems.

CO5: estimate the optimum solution of the Assignment problems.

Unit I **(15 Hours)**

Indices – Laws of indices – Surds – Order of a surd – Square root of a binomial surd $a + \sqrt{b}$.

Unit II **(15 Hours)**

Annuities – Immediate annuity – Deferred annuity – Simple interest – Compound interest.

Unit III **(15 Hours)**

Matrices – Types of matrix – Matrix operation – Inverse of a matrix – Simultaneous linear equations – Method of reduction.

Unit IV **(15 Hours)**

Transportation problems – Methods of finding IBFS – MODI Method – Degeneracy – Unbalanced problems.

Unit V **(15 Hours)**

Assignment problems – Hungarian Method – Unbalanced Assignment Problems – Maximization – Travelling Salesman Problem.

Learning Resources:

Text Book(s)

1**.** P.R Vittal , *Business Mathematics,* Margham Publications, third edition 2005.

Unit I : Chapters 4 & 5

Unit II : Chapters 11, 17 & 18

Unit III: Chapter 14

2. V. Sundaresan, K.S Ganapathy subramanian & K. Ganesan *Resource Management Techniques*, nineteenth edition, ARS Publications, 2019.

Unit IV: Chapter 7 (Sec 7.1 to 7.4)

Unit V : Chapter 8 (Sec 8.1 to 8.7 & 8.9)

References

1. S.C. Gupta, Business *Mathematics*, Sultan Chand & Sons, New Delhi, 2010.
2. P.K Gupta, and Man Mohan, *Problems in Operations Research*, Sultan chand &Sons, 2007.
3. C.K. Ranganath, C.S Sampagiram and Y.Rajaram, *Business Mathematics*, Himalaya Publishing House, Mumbai, 2011.
4. D.C. Sancheti, V.K. Kapoor, *Business Mathematics*, Sultan Chand & Sons, New Delhi,2005.
5. V. Sundaresan and S.D Jeyaseelan, *An introduction to Business Mathematics*, S. Chand & co., 2003.

CO – PSO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO 1	3	2	3	2	1	1	2	1	1	1
CO 2	3	2	3	3	2	1	2	1	1	1
CO 3	3	3	3	3	2	1	1	1	1	1
CO 4	3	3	3	3	2	1	2	1	1	2
CO 5	3	3	3	3	3	1	1	1	1	2
Average	3	2.6	3	2.8	2	1	1.6	1	1	1.4

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT2412	Mathematics for Chemistry-II	Supportive	5	4

Mathematics will allow the students to develop a sophisticated understanding of mathematical structures and principles while gaining a wide range of skills that are attractive to employers. To reinforce and enhance the mathematical tools introduced earlier. Differential equation as a mathematical model for solving problems in chemistry is the central theme of the course. This course deals with differentiation, integration, differential equations and Laplace transform.

Course Outcomes:

At the end of the course, students will be able to

CO 1: apply the concept of differentiation of functions

CO 2: identify and apply partial differentiation to determine the maxima and minima of functions of two variables.

CO 3: evaluate definite and indefinite integrals.

CO 4: formulate and solve the first and second order differential equations.

CO 5: use Laplace transforms technique to solve differential equations.

Unit I **(15 Hours)**

Introduction – Derivatives of Standard functions – Higher Derivatives – n^{th} Derivative of Some Standard Functions – Leibnitz Theorem.

Unit II **(15 Hours)**

Partial differentiation – Homogeneous function and Euler's theorem – maxima and minima of functions of two variables – Errors and approximation.

Unit III **(15 Hours)**

Evaluation of Integrals – Some Simple Integrals – Method of Substitution – Integration of Rational Functions – Integration of Irrational Functions – Evaluation of Definite Integral – Integration by Parts.

Unit IV **(15 Hours)**

Formation of Differential Equations – Solving First and Second order Differential Equations – Growth, Decay and Chemical Reactions.

Unit V **(15 Hours)**

Laplace Transforms – Inverse Transforms – Solving Linear Differential Equations.

Learning Resources:

Text Book(s)

1. S. Arumugam & A. Thangapandian Issac, *Calculus*, New Gamma Publishing house, 2005.

   Unit I : Part I: Chapter 2 (Sec 2.3 to 2.13) (problems only)

   Unit II : Part I: Chapter 2 (Sec 2.14, 2.15); Chapter 3 (Sec 3.7, 3.8) (problems only)

   Unit III : Part II: Chapter 2 (Sec 2.0 to 2.4, 2.6 to 2.7) (problems only)

2. S. Narayanan & T.K Manickavachagom Pillay, *Differential Equations and its Applications*, S.Viswanathan private limited, 2008.

   Unit IV : Chapter I (Sec 1, 3); Chapter II (Sec 1, 2, 4); Chapter III (Sec 1); Chapter V (Sec 1 to 4).

   Unit V : Chapter IX (Sec 1, 2, 4 to 8)

References

1. D.N. Hirst, *Mathematics for Chemistry*, Macmillan Press Ltd, 1993.
2. S. Narayanan & T.K. Manickavachagom Pillay, *Calculus Vol.I*, S. Viswanathan private limited, 2013.
3. S. Narayanan & T.K. Manickavachagom Pillay, *Calculus Vol.II*, S. Viswanathan private limited, 2013.
4. Sankaranarayanan & J.A Mangaladoss, *Differential Equations and its Applications*, Suja Publishing House, Palayamkottai, 1980.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	2	3	3	3	3	2	3	2	2	2
CO 2	2	3	3	3	3	2	3	2	2	2
CO 3	2	3	3	2	3	2	2	2	1	2
CO 4	3	3	3	2	3	2	2	2	1	2
CO 5	2	3	3	2	1	2	2	2	1	2
Average	2.2	3	3	2.4	2.6	2	2.4	2	1.6	2

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/ MAS 2414	Business Statistics (COM/CME)	Supportive	5	4

The objective of this course is to impart basic knowledge about application of statistics to various business situations.

Course Outcomes:

At the end of the course, students will be able to

CO1: demonstrate theoretical, graphical and diagrammatic representation of statistical data.

CO2: analyze statistical data using measures of central tendency and measures of dispersion.

CO3: interpret and calculate the correlation and regression between two variables.

CO4: analyze various index numbers and formulate the procedure to measure the change in the variable over the period of time.

CO5: demonstrate the basic concepts of probability and identify the problems on sampling distribution of small samples.

Unit I **(15 Hours)**

Statistics: Introduction – Definition – Nature and Scope –Objectives – Importance and Limitations of Statistics-Statistical Survey: Execution of Survey – Collection of Data – Sampling Design - Classification and Tabulation – Diagrammatic & Graphic Presentation.

Unit II **(15 Hours)**

Measures of Central Tendency – Arithmetic Mean –Simple and Weighted Arithmetic Mean – Combined Arithmetic Mean – Geometric Mean – Harmonic Mean – Median– Quartiles, Deciles and Percentiles – Mode – Measures of Dispersion – Range – Quartile Deviation-Standard Deviation–Combined Standard Deviation - Coefficient of Variation.

Unit III **(15 Hours)**

Correlation: Definition-Types of Correlation- Karl Pearsons's Coefficient of Correlation-Spearman's Rank Correlation-Regression.

Unit IV **(15 Hours)**

Index Numbers – Definition – Uses – Construction of Index Number – Methods– Laspeyre, Paasche, Bowley and Fisher's Ideal Index Number – Tests of Index number – Cost of living Index Number.

Unit V **(15 Hours)**

Probability – Addition, Multiplication Theorem – Conditional probability (Simple Problems Only) Sampling theory and Test of significance: Introduction – Estimation – Hypothesis – Standard Error –Tests of Significance for Small Samples – Students' t - Distribution - F test - Chi square test of goodness of fit.

Learning Resources:

Text Book(s)

1. R.S.N.Pillai & Bagavathi, *Statistics Theory & Practice*, S Chand & company limited, 2020.

    Unit I : Chapter1 to 8

    Unit II : Chapter 9, 10 (Problems related to the content)

    Unit III : Chapter 12 (Page no. 396 to 404 & 417 to 420),
    Chapter 13 (Page no. 471 to 480 & 531 to 540)
    (Problems related to the content)

    Unit IV : Chapter 14 (Problems related to the content)

    Unit V : Chapters 18, 20 and 21(Problems related to the content)

References

1. S.C.Gupta, V.K.Kapoor, *Fundamentals of Mathematical Statistics*, 10th Edition, 2000.
2. S, Arumugam & Isaac, *Statistics*, New gamma Publishers, 2008.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	2	3	3	2	3	2	3	2	2
CO 2	3	2	3	3	2	3	2	3	2	2
CO 3	3	2	3	3	2	3	2	3	2	2
CO 4	3	2	3	3	2	3	1	3	2	2
CO 5	3	2	3	2	2	2	2	3	2	2
Average	3	2	3	2.8	2	2.8	1.8	3	2	2

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS1415	Mathematics for Chemistry-I	Supportive	5	4

Mathematics will allow the students to develop a sophisticated understanding of mathematical structures and principles while gaining a wide range of skills that are attractive to employers. This course deals with matrices, Eigen values, Eigen vectors, sets, functions, groups, sampling, and numerical methods.

Course Outcomes:

At the end of the course, students will be able to

CO 1: identify the different types of matrices and perform associated operations.

CO 2: solve the system of equations and apply cayley hamilton theorem to find inverse of a matrix.

CO 3: illustrate the concepts of sets, relations, functions and groups.

CO 4: identify and apply large and small sample tests.

CO 5: apply numerical techniques to find roots of algebraic equations.

Unit I **(15 Hours)**

Theory of Matrices – Introduction – Algebra of matrices – types of Matrices – Elementary Transformations – Rank of a Matrix.

Unit II **(15 Hours)**

Simultaneous Linear Equations - Characteristic Equation – Verification of Cayley Hamilton Theorem – Eigen Values and Eigen Vectors – Properties of Eigen Values.

Unit III **(15 Hours)**

Theory of Sets – Introduction – The Concept of a Set – Set Inclusion – Union of Sets – Intersection of Sets – Difference of Two Sets – Complement of a Set – Symmetric Difference of Sets – Cartesian Product of Sets – Relations – Functions – Types of Functions – Groups – Definition and Examples.

Unit IV **(15 Hours)**

Test of Significance – Introduction – Sampling – Sampling Distribution – Testing of Hypothesis – Procedure for Testing of Hypothesis – Test of Significance of Large Samples for Mean – Small Samples – t-test – F-test, Chi-Square test.

Unit V **(15 Hours)**

Numerical Methods – Solution of Algebraic Equations – Iteration Method – Bisection Method – Regula-Falsi Method – Newton-Raphson Method – Interpolation – Newton's Interpolation Formula – Lagrange's Interpolation Formula.

Learning Resources:

Text Book(s)

1. S.Arumugam & A. Thangapandian Issac, *Modern Algebra*, SCITECH Publications, 2013.

Unit I : Chapter 7 (Sec 7.1, 7.2, 7.4, 7.5) (problems only)

Unit II : Chapter 7 (Sec 7.6 to 7.8) (problems only)

Unit III : Chapter 1 (Sec 1.1 to 1.8); Chapter 2 (Sec 2.1, 2.2, 2.4); Chapter 3 (Sec 3.1) (problems only)

2. S. Arumugam & A. Thangapandian Issac, *Statistics*, New gamma publishing house, 2011.

Unit IV : Chapter 14 (Sec 14.1 to 14.5 II A); Chapter 15 (Sec 15.1), Chapter 16 (Sec 16.1)

3. S. Arumugam, A. Thangapandi Isaac & A. Somasundaram, *Numerical Methods*, Second edition, SCITECH Publications, 2005.

Unit V : Chapter 3 (Sec 3.0 to 3.4); Chapter 7 (Sec 7.0, 7.1, 7.3)

References

1. S.C. Gupta &. V.K. Kapoor, *Elements of Mathematical Statistics*, S.Chand, 1995.

2. M. L. Khanna M.L., *Matrices*, Jai Prakash Nath & Co. Meerut, 2001.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	2	3	3	3	3	2	3	2	2	2
CO 2	3	3	3	3	3	2	3	2	2	2
CO 3	3	3	2	2	3	2	2	2	1	2
CO 4	2	3	3	2	3	2	1	2	1	2
CO 5	2	3	3	2	1	1	1	2	1	2
Average	2.4	3	2.8	2.4	2.6	1.8	2	2	1.4	2

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS1417	Business Statistics (CPA)	Supportive	5	4

The objective of this course is to impart basic knowledge about application of statistics to various business situations.

Course Outcomes:

At the end of the course, students will be able to

CO1: demonstrate theoretical, graphical and diagrammatic representation of statistical data.

CO2: analyze statistical data using measures of central tendency and measures of dispersion.

CO3: interpret and calculate the correlation and regression between two variables.

CO4: analyze various index numbers and formulate the procedure to measure the change in the variable over the period of time.

CO5: measure the trend or variation existing in a time series data and demonstrate the basic concepts of probability.

Unit I **(15 Hours)**

Introduction –Methods of Collecting Primary and Secondary Data- Sampling Methods - Classification and Tabulation – Formation of Discrete and Continuous Frequency Distribution – Graphical representation of Frequency Distribution – Diagrammatic presentation of Data.

Unit II **(15 Hours)**

Measures of Central Tendency – Arithmetic Mean – Simple and Weighted Arithmetic Mean – Combined Arithmetic Mean – Geometric Mean – Harmonic Mean – Median – Quartiles, Deciles and Percentiles – Mode – Measures of Dispersion – Range – Quartile Deviation - Standard Deviation – Combined Standard Deviation - Coefficient of Variation.

Unit III **(15 Hours)**

Correlation - Meaning – Significance – Types – Graphic method– Mathematical method- Karl Persons Co-efficient of Correlation - Rank Correlation- Concurrent Deviation- Lag and Lead in correlation- Regression- Meaning – Uses – Simple Regression Lines.

Unit IV **(15 Hours)**

Index Numbers - Definition – Uses – Construction of Index Number – Methods– Laspeyre,

Paasche, Bowley and Fisher's Ideal Index Number – Tests of Index number – Cost of living Index Number.

Unit V **(15 Hours)**

Analysis of Time Series - Meaning – Utilities – Components – Measurements of Trend – Method of Moving Averages – Method of Least Square – Measurement of Seasonal Variation- Probability – Addition, Multiplication Theorem – Conditional probability – Bayes' Theorem- Mathematical Expectations (Simple Problems Only).

Learning Resources:

Text Book(s)

1. R.S.N. Pillai and Bagavathi, *Statistics theory and practice*, S. Chand & sons, New Delhi,2017.

Unit I : Chapters 1, 4, 5, 6, 7, 8

Unit II: Chapters 9, 10

Unit III: Chapters 12, 13

Unit IV: Chapter 14

Unit V : Chapters 15, 18

References

1. Sanchetti & Kapoor, *Statistics*, Sulthan Chand, New Delhi, 2013.
2. S.P. Gupta, *Statistical Methods* , Sultan Chand & Sons, New Delhi, 2012.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	3	3	2	2	1	1	2	1
CO 2	3	3	3	3	2	2	1	1	2	1
CO 3	3	3	3	2	2	3	2	1	2	1
CO 4	3	2	3	2	2	3	2	1	2	1
CO 5	3	2	3	2	2	3	2	1	2	2
Average	3	2.6	3	2.4	2	2.6	1.6	1	2	1.2

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS 1419	Discrete Mathematics (CAI)	Supportive	5	4

The objective of this course is to introduce fundamental topics in mathematics and computer science, including logic, set theory, combinatorics, matrices, and coding theory. It provides a strong foundation of mathematics for the field of computer science and artificial intelligence.

Course Outcomes:

At the end of the course, students will be able to

CO1: demonstrate the basic principles of sets, relations with examples.

CO2: write an argument using logical notation and determine if the argument is valid or not

CO3: outline the basic tools in counting principles in combinatorial structures.

CO4: apply the knowledge of algebraic structures and Lagrange's theorem to solve problems.

CO5: analyze the binary codes and block coding techniques.

Unit I **(15 Hours)**

Sets – Subsets - Operations of Sets – Properties of Set Operations – Cartesian Products – Relations – Equivalence Relation.

Unit II **(15 Hours)**

Logic – Connectives – Truth Table of a Formula – Tautology – Tautology Implications and Equivalence Formula – Principle Normal Forms – Theory of Inferences.

Unit III **(15 Hours)**

Combinatorics – Addition and Multiplication Principle – Permutations – Combinations – Recurrence Relations. (Problems only).

Unit IV **(15 Hours)**

Algebraic Structure: Groups – Semigroups – Monoids – Elementary Properties of Group – Subgroups – Cosets & Lagrange's Theorem. (Definition and simple problems only).

Unit V **(15 Hours)**

Coding theory – Introduction – Bit strings and Binary operations – Hamming distance – Binary Codes – Error correcting codes in general – Concept of Binary linear codes – Block coding – Effect of Coding.

Learning Resources:

Text Book(s)

1. Dr. M.K.Venkataraman, Dr. N. Sridharan, N.Chandrasekaran, *Discrete Mathematics*, The National Publication Company, 2003.

   Unit I : Chapter 1 (Sec 1 to 4, 6, 7, 8, 9(problems only)); Chapter 2 (Sec 1 to 5)

   Unit II: Chapter 9 (Sec 1 to 4, 6, 7, 8, 11, 12, 13)

2. A. Tucker, *Applied Combinatorics*, John Wiley and sons, 6th Edition 2005.

   Unit III: Chapter 5(sec 5.1, 5.2); Chapter 7 (sec 7.1);

3. S. Arumugam & A. Thangapandian Isaac, *Modern Algebra*, SCITECH Publications, 2006.

   Unit IV : Chapter 3(Sec 3.1, 3.2, 3.5, 3. 8) (Simple Problems only)

4. Jurgen Bierbrauer, *Introduction to Coding Theory*, Second Edition 2017

   Unit V: Chapter 1(1.1-1.4), chapter 2(2.1,2.2)

References

1. J.E. Hopcroft, J.D.Ullman, Introduction to automata theory, Language and computations, Narosa publishing House, 1999.
2. Schaums outline Series, Set Theory and Logic, Tata McGraw Hill, 1999.
3. Schaums outline Series, Discrete Mathematics, Tata McGraw Hill, 1999.
4. Schaums outline Series, Combinatorics, Tata McGraw Hill, 1999

Websites/ e-Learning Resources

https://www.youtube.com/playlist?list=PLyqSpQzTE6M-hUn1ILCzWE2gc592_DgK4

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	2	3	1	2	2	1
CO 2	3	3	3	2	2	2	1	2	2	1
CO 3	3	3	3	3	3	2	2	1	2	1
CO 4	3	2	3	2	3	2	1	1	2	1
CO 5	3	2	3	3	3	3	2	1	2	1
Average	3	2.6	3	2.6	2.6	2.4	1.4	1.4	2	1

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS1416	Mathematics for Chemistry-II	Supportive	5	4

Mathematics will allow the students to develop a sophisticated understanding of mathematical structures and principles while gaining a wide range of skills that are attractive to employers. To reinforce and enhance the mathematical tools introduced earlier. Differential equation as a mathematical model for solving problems in chemistry is the central theme of the course. This course deals with differentiation, integration, differential equations and Laplace transform.

Course Outcomes:

At the end of the course, students will be able to

CO 1: apply the concept of differentiation of functions

CO 2: identify and apply partial differentiation to determine the maxima and minima of functions of two variables.

CO 3: evaluate definite and indefinite integrals.

CO 4: formulate and solve the first and second order differential equations.

CO 5: use Laplace transforms technique to solve differential equations.

Unit I **(15 Hours)**

Introduction – Derivatives of Standard functions – Higher Derivatives – n^{th} Derivative of Some Standard Functions – Leibnitz Theorem.

Unit II **(15 Hours)**

Partial differentiation – Homogeneous function and Euler's theorem – maxima and minima of functions of two variables – Errors and approximation.

Unit III **(15 Hours)**

Evaluation of Integrals – Some Simple Integrals – Method of Substitution – Integration of Rational Functions – Integration of Irrational Functions – Evaluation of Definite Integral – Integration by Parts.

Unit IV **(15 Hours)**

Formation of Differential Equations – Solving First and Second order Differential Equations – Growth, Decay and Chemical Reactions.

Unit V **(15 Hours)**

Laplace Transforms – Inverse Transforms – Solving Linear Differential Equations.

Learning Resources:

Text Book(s)

1. S. Arumugam & A. Thangapandian Issac, *Calculus*, New Gamma Publishing house, 2005.

Unit I : Part I: Chapter 2 (Sec 2.3 to 2.13) (problems only)

Unit II : Part I: Chapter 2 (Sec 2.14, 2.15); Chapter 3 (Sec 3.7, 3.8) (problems only)

Unit III : Part II: Chapter 2 (Sec 2.0 to 2.4, 2.6 to 2.7) (problems only)

2. S. Narayanan & T.K Manickavachagom Pillay, *Differential Equations and its Applications*, S.Viswanathan private limited, 2008.

Unit IV : Chapter I (Sec 1, 3); Chapter II (Sec 1, 2, 4); Chapter III (Sec 1); Chapter V (Sec 1 to 4).

Unit V : Chapter IX (Sec 1, 2, 4 to 8)

References

1. D.N. Hirst, *Mathematics for Chemistry*, Macmillan Press Ltd, 1993.
2. S. Narayanan & T.K. Manickavachagom Pillay, *Calculus Vol.I*, S. Viswanathan private limited, 2013.
3. S. Narayanan & T.K. Manickavachagom Pillay, *Calculus Vol.II*, S. Viswanathan private limited, 2013.
4. Sankaranarayanan & J.A Mangaladoss, *Differential Equations and its Applications*, Suja Publishing House, Palayamkottai,1980.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	2	3	3	3	3	2	3	2	2	2
CO 2	2	3	3	3	3	2	3	2	2	2
CO 3	2	3	3	2	3	2	2	2	1	2
CO 4	3	3	3	2	3	2	2	2	1	2
CO 5	2	3	3	2	1	2	2	2	1	2
Average	2.2	3	3	2.4	2.6	2	2.4	2	1.6	2

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS1418	Business Mathematics (CPA)	Supportive	5	4

The objective of this course is to impart basic knowledge and application of business mathematics to commercial situations.

Course Outcomes:

At the end of the course, students will be able to

CO1: solve problems in objective arithmetic.

CO2: compile different rules governing counting principles and solve problems in permutation and combination.

CO3: solve linear equations involving two variables and also quadratic equation.

CO4: compute the sum to n terms of an arithmetic/geometric progression and its relevance in the field of accounting.

CO5: utilize the methods and principles in differential calculus to solve problems in business world.

Unit I **(15 Hours)**

Ratios and Proportions - Simple and Compound Interest Including Application of Annuity – Variation, Indices – Laws of indices - Fractional index - Operations with power functions - Surds-Operations on surds - Rationalizing factor.

Unit II **(15 Hours)**

Set – Types of sets - Venn Diagrams - Operation on sets - Number of elements in a finite set - Related problems - Permutation – Fundamental rule of counting – Permutation of n different things - Circular permutations - Permutation of things not all different - Restricted permutations – Combinations - Restricted combinations- Combination of things not all different.

Unit III **(15 Hours)**

Linear Simultaneous Equations - Quadratic Equations - Solution to quadratic Equations - Nature of the roots - Inequalities.

Unit IV **(15 Hours)**

Sequence and Series- Summation of series - Arithmetic progression - Sum of series in A.P-

Geometric Progressions – Sum of series in G.P- Arithmetic mean – Geometric mean.

Unit V **(15 Hours)**

Calculus – Function - Types of functions – Limit of a function - Continuity of a Function – Differentiation - Derivative function of one variable, Power function, Constant with any function, sum, product, quotient of two function - Function of a function - Logarithmic functions - Maxima and Minima – Partial differentiation.

Learning Resources:

Text Book(s)

1. R.S Aggarwal, *Objective Arithmetic*, S.Chand publishing, New Delhi,2013.

   Unit I: Chapter 12, 21 & 22

2. D.C. Sancheti, V. K. Kapoor, *Business Mathematics*, Sultan Chand & Sons, New Delhi, 2005.

   Unit I: Chapter 6

   Unit II: Chapter 2, Chapter 9

   Unit III: Chapter 8 (Sec 8.3, 8.7 to 8.11)

   Unit IV: Chapters 11 & 12

   Unit V: Chapter 16 (Sec 16.1, 16.4, 16.5, 16.8),
   Chapter 17 (Sec 17.0 17.8, 17.10, 17.19 &17.20)

References

1. C.K Ranganath, C.S Sampagiram and Y. Rajaram, *Business Mathematics,* Himalaya Publishing House, Mumbai, 2011.
2. S.C.Gupta, *Business Mathematics* , Sultan Chand & sons, New Delhi, 2010.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	2	2	1	1	2	1
CO 2	3	3	3	3	2	2	1	1	2	1
CO 3	3	3	3	2	2	3	2	1	2	1
CO 4	3	2	3	2	2	3	2	1	2	1
CO 5	3	2	3	3	2	3	2	1	1	2
Average	3	2.6	3	2.6	2	2.6	1.6	1	1.8	1.2

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS 1420	Statistics and Probability (CAI)	Supportive	5	4

This course provides a deeper understanding on various statistical concepts such as measures of central tendencies and dispersion, hypothesis testing, regression, and correlation analysis; it also enables the students to understand the elementary concepts in probability as a measure of uncertainty which are essential in the field of Artificial Intelligence such as data analysis, research, and decision-making.

Course Outcomes:

At the end of the course, students will be able to

CO1: calculate central tendencies for different types of data

CO2: find dispersion parameters of the given data

CO3: compare the two different data using the concept of correlation and regression

CO4: interpret the real life situations using addition, multiplication theorems of probability & Bayes theorem

CO5: identify the significance of the parameters of small samples.

Unit I **(15 Hours)**

Measures of Central Tendency – Arithmetic Mean, Median, Mode (Individual, Discrete, Continuous and Cumulative Series) – Quartiles, Deciles, Percentiles, Geometric Mean, Harmonic Mean (Discrete, Continuous and Cumulative Series).

Unit II **(15 Hours)**

Dispersion – Methods of Measuring Dispersion – Range – Interquartile Range – Mean Deviation – Standard Deviation.

Unit III **(15 Hours)**

Correlation (using direct method, deviation taken from arithmetic mean, deviation taken from assumed mean) – Rank Correlation – Regression**.**

Unit IV **(15 Hours)**

Probability – Event – Sample Spaces – Classical Approach (Priori Probability) – Axiomatic approach to Probability – Theorems of Probability(Addition, Multiplication) – Bayes

theorem.

Unit V **(15 Hours)**

Test of Significance of small samples – chi square test of goodness of fit – chi square as a test of independence.

Learning Resources:

Text Book(s)

1. R.S.N Pillai & Bagavathi, *Statistics theory and practice*, S.Chand Publications, reprint 2022.

   Unit I: Chapter 9

   Unit II: Chapter 10

   Unit III: Chapter 12, 13

   Unit IV: Chapter 18(pg. no. 737 to 760)

   Unit V: Chapter 20, 21(pg. no. 847 to 854)

References

1. S.C.Gupta & V.K. Kapoor, *Elements Of Mathematical Statistics,* Sultan Chand Publications Edition, 2014.
2. P.Kandasamy, K.Thilagavathy, Gunavathy K, *Numerical Methods*, S CHAND & Co, 2015.
3. Ken Black- *Applied Business Statistics* –Wiley 2012.
4. Murray Spiegel, John Schiller, R.Alu Srinivasan, Debasree Goswami, *Probability and Statistics* , Tata McGrawhill, 2017.
5. Ron Larson & Betsy Farber, *Elementary Statistics*, Pearson 7th edition, 2018.
6. Dr.P.R.Vittal, *Allied Mathematics,* Margham Publications, 2012.

Websites/e-Learning Resources

https://www.youtube.com/playlist?list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	3	3	1	1	2	1
CO 2	3	3	3	3	3	2	1	1	2	1
CO 3	3	3	3	2	2	2	2	1	2	1
CO 4	3	2	3	3	2	2	2	1	2	1
CO 5	3	2	3	2	3	2	1	1	2	1
Average	3	2.6	3	2.6	2.6	2.2	1.4	1	2	1

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS1422	Business Statistics (BBA)	Supportive	5	4

This course is designed to acquire the skills needed for decision making under uncertainties using statistical data.

Course Outcomes:

At the end of the course, students will able to

CO1: observe the basic concepts of statistics and statistical survey theoretically.

CO2: study the statistical data using measures of central tendency.

CO3: analyze statistical data using measures of dispersion.

CO4: calculate the correlation and regression between two variables.

CO5: learn various index numbers and reversal tests.

Unit I **(15 Hours)**

Statistics: Introduction - Definition - Nature and Scope – Objectives - Importance and Limitations of Statistics-Statistical Survey: Execution ofSurvey –Collection of Data – Sampling Design -Classification and Tabulation –Diagrammatic & Graphic Presentation.

Unit II **(15 Hours)**

Central Tendencies: Arithmetic Mean - Combined Mean –Weighted Mean – Median – Quartiles - Percentile-Mode - Geometric Mean –Harmonic Mean.

Unit III **(15 Hours)**

Measures of Dispersion: Range-Quartile Deviation-Mean Deviation -Standard Deviation-Variance- Coefficient of Variation **.**

Unit IV **(15 Hours)**

Correlation: Definition-Types of Correlation- Karl Pearsons's Coefficient of Correlation-Spearman's Rank Correlation-Regression.

Unit V **(15 Hours)**

Index Numbers: Unweighted index number–Aggregate method-Average of price relative method-Weighted index number – Weighted aggregative method – Laspeyre’s index number – Paasches’ index number – Marshall -Edgeworth’s index number – Bowley’s index number

– Fisher's index number – Kelley's index number – Weighted average of price relative Method –Ideal index number –The time reversal test- The factor reversal Test – The commodity reversal test.

Learning Resources:

Text Book(s)

1. R.S.N.Pillai & Bagavathi, *Statistics Theory & Practice*, S Chand & company limited, (2020).

Unit I : Chapter 1 to 8

Unit II : Chapter 9 (Problems related to the content)

Unit III : Chapter 10 (Problems related to the content)

Unit IV : Chapter 12 (Page no. 396 to 404 & 417 to 420)
Chapter 13 (Page no. 471 to 480 & 531 to 540)
(Problems related to the content)

Unit V : Chapter 14 (Problems related to the content)

References

1. Gupta S.C, Kapoor.V.K, *Fundamentals of Mathematical Statistics*, 10th-Edition, 2000.
2. Arumugam & Isaac, *Statistics*, New gamma Publishers, 2008.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO 10
CO 1	3	3	3	3	2	2	2	1	1	2
CO 2	3	3	3	3	2	2	2	1	1	2
CO 3	3	3	3	3	2	2	2	1	1	2
CO 4	3	3	3	3	2	2	2	1	1	2
CO 5	3	3	3	3	2	2	2	1	1	2
Average	3	3	3	3	2	2	2	1	1	2

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS1424	Discrete Mathematics (BIT)	Supportive	5	4

The objective of this course is to train the students with fundamental concepts of mathematics and to equip the students with logical thinking and analytical skills. This course deals with sets, logic, combinatorics, graphs and automata.

Course Outcomes:

At the end of the course, students will be able to

CO1: elucidate the basic principles of sets, relations with examples.

CO2: write an argument using logical notation and determine if the argument is valid or not

CO3: outline the basic tools in counting principles in combinatorial structures.

CO4: demonstrate different types of graphs and their properties which may be explored through algorithms.

CO5: classify the concepts and techniques in automata and their link to computations

Unit I **(15 Hours)**

Set theory: Sets – Subsets – Operation on Sets – Properties of Set Operations – Cartesian Products – Relations – Equivalence Relation.

Unit II **(15 Hours)**

Logic: Connectives – Truth table of a formula – Tautology – Tautology implications and Equivalence formula – Principle Normal forms – Theory of Inferences.

Unit III **(15 Hours)**

Combinatorics: Addition and multiplication principle –Permutations–Combinations– Recurrence relations (Problems only)**.**

Unit IV **(15 Hours)**

Graph – Sub graph – Graph isomorphism – Some special classes of Graphs – Tree – Spanning Tree – Kruskal's and Prim's Algorithms – Eulerian Graph – Fleury's Algorithm.

Unit V **(15 Hours)**

Automata: Alphabets – Strings – Languages – Grammar – Type0, Type1, Type2 and Type3 Grammars – Finite automata – Regular expressions – Non-Deterministic Finite Automata.

Learning Resources:

Text Book(s)

1. M.K Venkataraman, Sridharan. N.Chandrasekaran, *Discrete Mathematics,* The National Publication Company, 2003.

   Unit I : Chapter 1 (Sec 1 to 4, 6, 7, 9)

   Chapter 2 (Sec 1 to 5)

   Unit II : Chapter 9 (Sec 3 to 8, 11 to 13)

   Unit IV: Chapter 11 (Sec 1 (except Digraph), 3, 4, 8)

   Unit V: Chapter 12 (Sec 3 to 7 and 17)

2. A. Tucker, *Applied Combinatorics*, Sixth Edition, John Wiley and sons, 2005.

   Unit III: Chapter 5 (Sec 5.1, 5.2); Chapter 7 (Sec7.1).

References

1. V.K.Balakrishnan, *Theory and Problems of Combinatorics,* Schaums outline Series, Tata McGraw Hill,1999
2. J.E.Hopcroft, J.D.Ullman*, Introduction to automata theory*, Language and computations, Narosa publishing House, 1999.
3. Seymour Lipschutz, *Set Theory and Logic*, Schaums outline Series, Tata McGraw Hill, Second Edition, 1999.
4. Seymour Lipschutz and Marc Lipson, *Discrete Mathematics*, Schaums outline Series, Tata McGraw Hill, Third Edition,1999.
5. Elliott Mendelson, *Boolean Algebra and switching circuits*, Schaums outline Series, Tata McGraw Hill, 1999.

Websites/e-Learning Resources

https://archive.nptel.ac.in/courses/111/106/111106086

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	2	2	3	1	1	2
CO 2	3	3	3	2	2	2	3	1	1	2
CO 3	3	3	3	3	2	2	2	1	1	2
CO 4	3	2	3	3	3	2	2	2	2	2
CO 5	3	3	3	3	2	2	1	1	1	2
Average	3	2.8	3	2.8	2.2	1.8	2.2	1.2	1.2	2

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS1426	Statistics for Data Science (DSC)	Supportive	5	4

This course provides a deeper understanding on various statistical concepts such as measures of central tendencies and dispersion, sampling, estimation, hypothesis testing, regression, and correlation analysis & it also enable the students to understand the elementary concepts in probability as a measure of uncertainty and apply wherever there is a need in the field of data science. It also intends to introduce to the learner the concept of random variables and its ramifications in data science.

Course Outcomes:

At the end of the course, students will be able to

CO1:analyze statistical data using measures of dispersion

CO2:calculate the correlation and regression between two variables.

CO3:differentiate p.d.f of one dimensional discrete and continuous random variables

CO4: identify and solve the problems on sampling distribution of large samples

CO5: analyze the problems on sampling distribution of small samples

Unit I **(15 Hours)**

Measures of Dispersion – Range – Interquartile Range – Quartile Deviation – Mean Deviation – Standard Deviation – Combined Standard Deviation – Coefficient of Variation.

Unit II **(15 Hours)**

Correlation – Meaning – Significance – Types – Graphic Method – Mathematical Method – Karl Pearson's Coefficient of Correlation – Spearman’s Rank Coefficient of Correlation – Regression – Methods of Studying Regression – Graphic Method – Algebraic Method.

Unit III **(15 Hours)**

Introduction – Conditional Probability – Bayes Theorem – Distribution Function – One Dimensional Random Variable – Discrete and Continuous Distribution Function**.**

Unit IV **(15 Hours)**

Introduction – Estimation – Hypothesis – Standard Error – Tests of Significance for Attributes – Tests of Significance for Large Samples.

Unit V **(15 Hours)**

Tests of Significance for Small Samples – Students' t-Distribution- F test – Chi Squared Test of Goodness of Fit – Chi Squared Test of Homogeneity.

Learning Resources:

Text Book(s)

1. R.S.N. Pillai Bagavathi, *Statistics Theory and Practice,* Eighth Edition, Sultan Chand and Company Ltd., New Delhi, reprint 2022.

   Unit I: Chapters 10

   Unit II: Chapters 12, 13

   Unit IV: Chapter 20

   Unit V: Chapter 20, 21

2. S.C. Gupta and V.K. Kapoor, *Mathematical Statistics,* Sultan Chand and Sons, 2001.

   Unit III: Chapter 3(Sec 3.1, 3.10); Chapter 4 (sec 4.2); Chapter 5 (sec 5.1 – 5.4)

References

1. S. Arumugam and A. Thangapandian Isaac, *Statistics*, New Gamma Publications Pvt. Ltd., 2000
2. V.K. Rohatgi and E. Saleh, *An Introduction to Probability and Statistics,* Third Edition, John Wiley and Sons Inc., New Jersey, 2015

Websites/e-Learning Resources

https://www.youtube.com/playlist?list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE

CO – PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	2	3	2	2	1	2	1
CO 2	3	3	3	2	3	3	2	1	2	1
CO 3	3	3	3	3	2	3	3	1	2	1
CO 4	3	2	2	3	3	2	3	1	2	1
CO 5	3	2	2	3	3	2	2	1	2	1
Average	3	2.6	2.6	2.6	2.8	2.4	2.4	1	2	1

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS1428	Mathematics for Logistics (BML)	Supportive	5	4

This course aims to provide students with a comprehensive understanding of various statistical and mathematical techniques used in data analysis, decision-making and optimization problems in different domains.

Course Outcomes:

At the end of the course, students will be able to

CO1: calculate central tendencies for different types of data.

CO2: find dispersion parameters of the given data.

CO3: correlation analysis and regression analysis techniques to assess the strength and direction of relationships between variables.

CO4: identify real-world problems that can be modeled using linear programming and solve by graphical method.

CO5: understand the mathematical formulation of transportation problems and assignment problem and solve.

Unit I **(15 Hours)**

Measures of Central Tendency – Arithmetic Mean, Median, Mode (Individual, Discrete, Continuous and Cumulative Series) – Quartiles, Deciles, Percentiles, Geometric Mean, Harmonic Mean (Discrete, Continuous and Cumulative Series).

Unit II **(15 Hours)**

Dispersion – Methods of Measuring Dispersion – Range – Interquartile Range – Mean Deviation – Standard Deviation.

Unit III **(15 Hours)**

Correlation (using direct method, deviation taken from arithmetic mean, deviation taken from assumed mean) – Rank Correlation – Regression.

Unit IV **(15 Hours)**

Linear Programming Problem – Mathematical Formulation – Graphical method of the solution of a LPP.

Unit V **(15 Hours)**

Transportation Problem - Mathematical formulation – Initial basic feasible solution – Northwest Corner Rule - Least Cost Method - Vogel's Approximation Method – Assignment Problem – Hungarian algorithm.

Learning Resources:

Text Book(s)

1. R. S. N. Pillai Bagavathi, *Statistics Theory and Practice,* Eighth Edition, Sultan Chand and Company Ltd., New Delhi, reprint 2022.

   Unit I: Chapter 9

   Unit II: Chapter 10

   Unit III: Chapter 12, 13

2. V. Sundaresan, K. S. Ganapathy Subramanian and K. Ganesan, *Resource Management Techniques,* A. R. Publications, Edition 2012.

   Unit IV: Chapter 2 (Sec 2.1 to 2.6)

   Unit V: Chapter 7 (Sec 7.1); 8(Sec 8.1 to 8.6)

References

1. S. C. Gupta and V. K. Kapoor, *Fundamental of Mathematical Statistics*, Tenth Revised Edition, Sultan Chand & Sons, Reprint 2002.
2. S. Arumugam and A.Thangapandian Isaac, *Statistics*, New Gamma Publications Private Limited, 2018.
3. P. K. Gupta and Man Mohan, *Problems in Operation Research*, Sultan Chand and Sons, 2010.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	2	2	1	2	2	1
CO 2	3	3	3	3	2	2	1	2	2	1
CO 3	3	3	3	2	3	2	2	1	2	1
CO 4	3	2	2	2	3	2	1	1	2	1
CO 5	3	2	2	3	3	3	2	1	2	1
Average	3	2.6	2.6	2.6	2.6	2.2	1.2	1.2	2	1

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS1430	Discrete Mathematics (COS)	Supportive	5	4

The objective of this course is to train the students with fundamental concepts of mathematics and to equip the students with logical thinking and analytical skills. This course deals with sets, logic, combinatorics, algebraic structures and automata.

Course Outcomes:

At the end of the course, students will be able to

CO1: demonstrate the basic principles of sets, relations with examples.

CO2: write an argument using logical notation and determine if the argument is valid or not

CO3: outline the basic tools in counting principles in combinatorial structures.

CO4: apply the knowledge of algebraic structures and Lagrange's theorem to solve problems.

CO5: demonstrate theories, concepts and techniques in automata and their link to computations

Unit I **(15 Hours)**

Set theory: Sets – Subsets – Operations of Sets – Properties of Set Operations – Cartesian Products – Relations – Equivalence Relation.

Unit II **(15 Hours)**

Logic: Connectives – Truth Table of a Formula – Tautology – Tautology Implications and Equivalence Formula – Principle Normal Forms – Theory of Inferences.

Unit III **(15 Hours)**

Combinatorics - Addition and Multiplication Principle – Permutations –Combinations – Recurrence Relations. (Problems only).

Unit IV **(15 Hours)**

Algebraic Structure: Groups – Semi Groups – Monoids – Elementary Properties of Group – Subgroups – Cosets & Lagrange's Theorem. (Definition and simple problems only).

Unit V **(15 Hours)**

Automata: Alphabets – Strings – Languages – Grammar – Type0, Type1, Type2 and Type3 Grammars – Finite Automata – Regular Expressions – Non-Deterministic Finite Automata.

Learning Resources:

Text Book(s)

1. M.K.Venkataraman, N. Sridharan, N. Chandrasekaran, *Discrete Mathematics*, The National Publication Company, 2003.

   Unit I : Chapter 1 (Sec 1 to 4, 6, 7, 8, 9(problems only))
   Chapter 2 (Sec 1 to 5)

   Unit II : Chapter 9 (Sec 1 to 4, 6, 7, 8, 11, 12, 13)

   Unit V : Chapter 12(Sec 3 to 7 and 17)

2. A. Tucker, *Applied Combinatorics*, John Wiley and sons, Sixth Edition 2005.

   Unit III : Chapter 5 (Sec 5.1, 5.2) , Chapter 7 (sec 7.1).

3. S. Arumugam and A. Thangapandian Isaac, *Modern Algebra*, SCITECH publications, 2006.

   Unit IV : Chapter 3(sec 3.1, 3.2, 3.5, 3. 8) (Simple Problems only)

References

1. J.E. Hopcroft, J.D.Ullman, Introduction to automata theory, Language and computations, Narosa publishing House, 1999.
2. Schaums outline Series, Set Theory and Logic, Tata McGraw Hill, 1999.
3. Schaums outline Series, Discrete Mathematics, Tata McGraw Hill, 1999.
4. Schaums outline Series, Combinatorics, Tata McGraw Hill, 1999.

Websites/e-Learning Resources

https://www.youtube.com/playlist?list=PLyqSpQzTE6M-hUn1ILCzWE2gc592_DgK4

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	2	2	3	1	1	2
CO 2	3	3	3	2	2	2	3	1	1	2
CO 3	3	3	3	3	2	2	2	1	1	2
CO 4	3	3	3	3	3	1	2	1	1	2
CO 5	3	3	3	3	2	2	1	1	1	2
Average	3	3	3	2.8	2.2	1.8	2.2	1	1	2

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS2415	Business Mathematics (CMC)	Supportive	5	4

This course is designed to explore the techniques in mathematics which can be used in environment and managerial skills.

Course Outcomes:

At the end of the course, students will be able to

CO1: solve practical problem involving the concepts of interest, simple interest, annuity.

CO2: recognize and apply matrix operations to solve simultaneous equations.

CO3: compute the optimum solution of both balanced and unbalanced transportation problems.

CO4: estimate the optimum solution of the assignment problems.

CO5: assess the best strategy in game theory using dominance rule and graphical method for both pure and mixed strategies.

Unit I **(15 Hours)**

Annuities – Immediate Annuity – Deferred Annuity – Simple Interest – Compound Interest.

Unit II **(15 Hours)**

Matrices – Types of Matrix – Matrix Operation – Inverse of a Matrix – Simultaneous Linear Equations – Method of Reduction.

Unit III **(15 Hours)**

Transportation Problems – Methods of Finding IBFS – MODI Method – Degeneracy – Unbalanced Problems.

Unit IV **(15 Hours)**

Assignment Problems – Hungarian Method – Unbalanced Assignment Problems – Maximization – Travelling Salesman Problem.

Unit V **(15 Hours)**

Game Theory – Introduction - Basic Terminologies – Two Person Zero Sum Game – Games with Saddle Point – Games without Saddle Point Mixed Strategies – Dominance Property of Reducing the Size of the Game – Solution Methods.

Learning Resources:

Text Book(s)

1. P.R Vittal, *Business Mathematics*, third edition, Margham Publications, 2005.

   Unit I: Chapters 11, 17 & 18

   Unit II: Chapter 14

2. V. Sundaresan, K.S Ganapathy Subramanian & K. Ganesan. *Resource Management Techniques*, nineteenth edition, ARS Publications,2019.

   Unit III: Chapter 7 (Sec 7.1 to 7.4)

   Unit IV: Chapter 8 (Sec 8.1 to 8.7 & 8.9)

   Unit V : Chapter 16 (Sec 16.1 to 16.4, 16.6 to 16.7)

References

1. S.C. Gupta, Business *Mathematics*, Sultan Chand & Sons, New Delhi, 2010.
2. P.K Gupta and Man Mohan, *Problems in Operations Research*, Sultan chand &Sons, 2007.
3. S.D Jeyaseelan and V. Sundaresan, *An introduction to Business Mathematics*, S. Chand & co., 2003.
4. V.K. Kapoor and D.C. Sancheti, *Business Mathematics*, Sultan Chand & Sons, New Delhi,2005.
5. C.K. Ranganath, C.S Sampagiram and Y.Rajaram, *Business Mathematics*, Himalaya Publishing House, Mumbai, 2011.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	2	3	2	1	1	2	1	1	1
CO 2	3	2	3	3	2	1	2	1	1	1
CO 3	3	3	3	3	2	1	1	1	1	1
CO 4	3	3	3	3	2	1	2	1	1	2
CO 5	3	3	3	3	3	1	1	1	1	2
Average	3	2.6	3	2.8	2	1	1.6	1	1	1.4

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS2417	Business Mathematics (CIT)	Supportive	5	4

This course is designed to explore the techniques in mathematics and statistics which can be used in environment and managerial skills.

Course Outcomes:

At the end of the course, students will be able to

CO1: analyze the basic principles of sets, functions and relations with examples.

CO2: illustrate the concepts of matrix, determinants and solution of three linear equations.

CO3: discuss the components of time series and determination of trend values.

CO4: apply the theory of probability using Bayes' theorem.

CO5: solve problems using theoretical distributions.

Unit I **(15 Hours)**

Set theory: Basic operations - Universe of sets -Functions -Venn diagrams - symmetric difference - Cartesian products - Set relations - Binary relations.

Unit II **(15 Hours)**

Matrices and Determinants: Definition of a matrix- Types of matrices-Algebra of matrices- Determinants- Calculation of values of determinants upto third order- Adjoint of a matrix – inverse of a matrix through adjoint.

Unit III **(15 Hours)**

Analysis of Time series: Definition – Uses of Time series – Time series models - Components of a time series – Determination of trend – Moving average method - Method of least squares - Measurement of seasonal variations.

Unit IV **(15 Hours)**

Theory of Probability: Concepts –Theorems of probability - Addition & Multiplication theorem – Conditional probability – Baye's Theorem.

Unit V **(15 Hours)**

Theoretical distributions – Binomial-Poisson and Normal Distributions.

Learning Resources:

Text Book(s)

1. D.C. Sancheti and V.K. Kapoor , *Business Mathematics*, Sultan Chand &Sons, 1993.

   Unit I : Chapter 2 (Sec 2.1 to 2.12, 2.19 to 2.22)

   Unit II : Chapter 20 (Sec 20.1 to 20.15, 20.17 to 20.22)

2. R.S.N. Pillai and Bagavathi, *Statistics theory and practice*, S. Chand & sons, New Delhi, 2017.

   Unit III : Chapter 15 (Page no: 591 to 609 & 615 to 623)
   (Problems related to the content)

   Unit IV : Chapter 18 (Page no: 737 to 751)
   (Problems related to the content)

   Unit V : Chapter 19 (Page no: 769 to 800)
   (Problems related to the content)

References

1. Gupta S.C, Kapoor. V. K, *Mathematical Statistics*, Sultan Chand & Sons, 2001.
2. Gupta .S P, *Statistical Methods*, Sultan Chand & Sons, 2001.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	2	2	2	2	1	2
CO 2	3	3	3	3	2	2	2	2	2	1
CO 3	3	3	3	3	2	2	2	2	2	2
CO 4	3	3	3	3	2	2	2	2	2	1
CO 5	3	3	3	3	2	2	2	2	2	2
Average	3	3	3	3	2	2	2	2	1.8	1.6

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS2421	Operations Research (CAI)	Supportive	5	4

This course aims in equipping students with the skills to formulate and solve optimization problems using methods like Linear Programming, Simplex, and Graphical methods. They aim to enhance understanding of resource allocation through Transportation and Assignment Problems, improve project management with PERT/CPM, and develop strategic decision-making skills using Game Theory. These objectives help students apply OR techniques to real-world AI and computer science challenges.

Course Outcomes:

At the end of the course, students will be able to

CO1: formulate Linear Programming Problem (LPP), find its solution by graphical method and identify the special cases of solution.

CO2: compute optimum solution of both balanced and unbalanced transportation problems..

CO3: demonstrate the concept of assignment problem and its solutions

CO4: design new models and solve using PERT/CPM, predict the probability of project completion time.

CO5: Evaluate the best strategy in game theory using dominance and graphical method for both pure and mixed strategy.

Unit I **(15 Hours)**

Introduction to Operations research – Definition – Scope – Objectives – Models and Limitations of Operations Research – Formulation of LPP– Graphical Solution of LPP – Simplex Method.

Unit II **(15 Hours)**

Transportation Problems – Unbalanced Transportation Problem – Finding Basic Feasible Solution – North-west corner rule – Least Cost Method – Vogel's Approximation Method – MODI Method.

Unit III **(15 Hours)**

Assignment Problem – Mathematical Formulation – Hungarian Algorithm – Unbalanced Assignment Problem – Special cases – Traveling Salesman problem.

Unit IV **(15 Hours)**

PERT and CPM techniques – Network Activity – Node – Dummy Activity – Fulkerson Rule – Constructing the Network – Critical Path Analysis – Three time estimates for PERT.

Unit V **(15 Hours)**

Game theory – Introduction – Two person zero sum games – Maximin, Minimax Principle – Saddle Points – Games without saddle points – Solution of 2×2 games – Graphical Method – Dominance Property.

Learning Resources:

Text Book(s)

1. Kanti Swarup, Gupta P.K. & Manmohan, *Operations Research*, Sultan Chand & Sons, Reprint 2020.

   Unit I **:** Chapter 2 & 3

   Unit II **:** Chapter 10 (Sec 10.1 to 10.13, 10.15)

   Unit III : Chapter 11 (Sec: 11.1 to 11.4, 11.7)

   Unit IV : Chapter 25 (Sec: 25.1 to 25.7)

   Unit V **:** Chapter 17 (Sec: 17.1 to 17.7)

References

1. R. Bronson, *Operations Research,* 2nd Edition, Schaum's Outline Series, 1997.
2. B.S. Goel & S.K. Mittal, *Operations Research*, Pragati Prakashan, Meerut, 2000.
3. G. Hadley, *Linear Programming*, Narosa Book Distributors Private Ltd.,1963.
4. J.L. Sharma, *Operations Research Theory and applications*, Macmillan, New Delhi, 2003.

Websites/ e-Learning Resources:

https://www.youtube.com/playlist?list=PLbMVogVj5nJRRbofh3Qm3P6_NVyevDGD_

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	2	3	1	1	2	1
CO 2	3	3	3	3	2	2	1	1	2	1
CO 3	3	3	3	2	3	2	2	1	2	1
CO 4	3	2	3	3	3	2	2	1	2	1
CO 5	3	2	3	2	3	2	1	1	2	1
Average	3	2.6	3	2.6	2.6	2.2	1.4	1	2	1

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS2423	Resource Management Techniques (BBA)	Supportive	5	4

This course in quantitative techniques will equip students with the necessary skills and knowledge to tackle analytical challenges in their academic and professional careers.

Course Outcomes:

At the end of the course, students will be able to

CO1: identify real-world problems that can be modeled using linear programming and grasp the theoretical underpinnings of the simplex method and its importance in solving linear programming problems.

CO2: develop mathematical models for transportation problems from real–world scenarios.

CO3: comprehend the basic principles and structure of the assignment problems including cost minimization and resource allocation.

CO4: plan, schedule and control projects, making them better equipped to manage time, resources and risks in a professional project management environment.

CO5: gain a comprehensive understanding of game theory, its applications and its relevance to various strategic decision making scenarios.

Unit I **(15 Hours)**

Linear Programming Problem (L.P.P.): Mathematical Formulation – Graphical method of the solution of a LPP – General LPP – Canonical and Standard forms of LPP – Solution to LPP by simplex method.

Unit II **(15 Hours)**

Transportation Problem: Mathematical formulation – Finding initial basic feasible solution – Northwest corner rule - Least cost method - Vogel's approximation method –Test for optimal Solution (MODI Method) – Degeneracy in transportation problems – Unbalanced transportation problems.

Unit III **(15 Hours)**

Assignment Problem: Mathematical formulation – Hungarian Method – Unbalanced assignment models – Maximization case and assignment problem – Travelling salesman problem.

Unit IV **(15 Hours)**

Scheduling by PERT and CPM : Basic Terminologies – Rules for constructing a network – Earliest Completion time of a Project and Critical Path - Floats – Program Evaluation Review Technique –Basic differences between PERT and CPM.

Unit V **(15 Hours)**

Game Theory : Two person zero sum games – The maximin - minimax principle – Saddle point and value of the Game – Games without saddle points – Dominance Property – Graphical method for 2 x n or m x 2 games.

Learning Resources:

Text Book(s)

1. V. Sundaresan, K .S. Ganapathy Subramanian, K. Ganesan, *Resource Management Techniques*, A. R. S. Publications, June 2019.
   Unit 1: Chapter 2 (Sec 2.3, 2.5); Chapter 3 (Sec 3.1)
   Unit 2: Chapter 7 (Sec 7.1 to7.4)
   Unit 3: Chapter 8 (Sec 8.1to 8.7, 8.9)
   Unit 4: Chapter 15(Sec 15.1 to15.7)
   Unit 5: Chapter 16 (Sec 16.1 to 16.4,16 .6, 16.7)

References

1. Kapoor. V. K, *Operations Research,* Sultan Chand and sons, 1997.
2. Gupta. P. K and ManMohan, *Problems in Operations Research,* Sultan Chand and Sons, 2010.
3. Arumugam. S & Thangapandian Issac. A, *Operations Research,* New Gamma Publishing House, 2003.
4. Kantiswarup, Gupta and ManMohan, *Operations Research,* Sultan Chand and Sons, 2004.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	2	2	2	2	1	1	1
CO 2	3	3	3	3	3	2	2	1	2	1
CO 3	3	3	3	3	2	1	1	1	2	1
CO 4	3	3	2	3	2	1	1	1	2	1
CO 5	3	3	2	2	3	2	1	1	2	1
Average	3	3	2.6	2.6	2.4	1.6	1.4	1	1.8	1

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS2425	Operations Research (BIT)	Supportive	5	4

The purpose of this course is to introduce some of the quantitative techniques which are essential for Information technology to the students.

Course Outcomes:

At the end of the course, students will be able to

CO1: formulate Linear Programming Problem (LPP), find its solution by graphical method and identify the special cases of solution.

CO2: compute optimum solution of both balanced and unbalanced transportation problems.

CO3: demonstrate the concept of assignment problem and its solutions.

CO4: Evaluate the best strategy in game theory using dominance and graphical method for both pure and mixed strategy.

CO5: design new models and solve using PERT/CPM, predict the probability of project completion time.

Unit I **(15 Hours)**

Introduction to operations research - Linear programming problem (L.P.P) – Mathematical formulation – Graphical solution– Solution to L.P.P by simplex method.

Unit II **(15 Hours)**

Transportation problem – Mathematical formulation – Finding initial basic feasible solution – Northwest corner rule, least cost method and Vogel's approximation method – Moving towards optimality – Unbalanced transportation problem.

Unit III **(15 Hours)**

Assignment problem: Introduction – Mathematical formulation – Hungarian Assignment algorithm – variations of the Assignment problem.

Unit IV **(15 Hours)**

Game theory – Introduction – Two person zero sum games – Maxmin principle - minimax principle – Saddle points – Games without saddle points – Solution of 2×2 games – Graphical method – Dominance property.

Unit V **(15 Hours)**

PERT/CPM – Introduction – Networking – Critical path analysis – Probability considerations in PERT.

Learning Resources:

Text Book(s)

1. Kanti Swarup, Gupta and Man Mohan, *Operations Research*, Sultan Chand and Sons, 2004.

    Unit 1: Chapter 1 (Sec 1. 1, 1.6 & 1.7); Chapter 2 (sec 2.1, 2.2);
    Chapter 3 (Sec 3.1, 3.2); Chapter 4 (sec 4.3)

    Unit 2: Chapter 10 (Sec 10.1, 10.9, 10. 10, 10. 14)

    Unit 3: Chapter 11 (Sec 11.1 to 11. 4)

    Unit 4: Chapter 17 (Sec 17 .1 to 17.7)

    Unit 5: Chapter 21(Sec 21. 1 to 21. 6)

References

1. Kapoor V.K, *Operations Research*, Sultan chand and sons, 1997.
2. Gupta P.K, and Man Mohan, *Problems in Operations Research*, Sultan chand and Sons, 2007.
3. Paneerselvam, *Operations Research*, Prentice Hall, 2004.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	2	3	1	1	2	1
CO 2	3	3	3	3	2	2	1	1	2	1
CO 3	3	3	3	2	3	2	2	1	2	1
CO 4	3	2	3	2	3	2	1	1	2	1
CO 5	3	2	3	3	3	2	2	1	2	1
Average	3	2.6	3	2.6	2.6	2.2	1.4	1	2	1

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS 2427	Linear Algebra (DSC)	Supportive	5	4

This course aims to highlight the importance of linear algebra concepts needed in the field of data science. Linear algebra deals with systems of linear equations and properties of matrices. Emphasis is placed on the development of abstract concepts and applications of vectors system of equations, matrices, vector spaces, linear transformations, eigenvectors and eigenvalues, diagonalization and orthogonality.

Course Outcomes:

At the end of the course, students will be able to

CO1: solve systems of linear equations and understand the relationship between matrices and linear systems.

CO2: illustrate the concept of linear transformations.

CO3: outline a comprehensive understanding of vector spaces and analysis of spaces.

CO4: find eigen values and eigen vectors of a given matrix.

CO5: interpret the properties of inner product spaces.

Unit I **(15 Hours)**

System of linear equations – Row Reduction and Echelon forms – Matrix Equation – Solution set of Linear Systems – Applications of Linear Systems.

Unit II **(15 Hours)**

Vector Equations – Linear Combinations – Span – Linear Independence – Matrix of a Linear Transformations – Linear Models – Inverse of a Matrix – Applications to Computer Graphics.

Unit III **(15 Hours)**

Vector Space – Subspace – Null Space – Column Space – Kernel and Range of Linear Transformations – Linearly Independent Sets – Coordinate Systems – Dimension of a Vector space – Rank.

Unit IV **(15 Hours)**

Eigen Values and Eigen Vectors – Diagonalizing a Matrix – Diagonalization of Symmetric Matrices – Quadratic forms.

Unit V **(15 Hours)**

Inner Product – Length – Angle and Orthogonality – Orthogonal Sets – Orthogonal Projections – Least Square problems – Inner Product spaces – Orthonormal Basis – Gram-Schmidt Process.

Learning Resources:

Text Book(s)

1.David C. Lay, Steven Lay, Judi J. McDonald, *Linear Algebra and its Applications,* Pearson Education, Inc, 5th edition.

Unit I: Chapter 1(Sec 1.1, 1.2, 1.4 to 1.6)

Unit II: Chapter 1(Sec 1.3, 1.7 to 1.10); Chapter 2(Sec 2.2, 2.7)

Unit III: Chapter 4(Sec 4.1 to 4.6)

Unit IV: Chapter 5(Sec 5.1 to 5.3), Chapter 7(Sec 7.1, 7.2)

Unit V: Chapter 6(Sec 6.1 to 6.5 & 6.7)

References

1. Arumugam.S, & Thangapandian Issac. A, *Modern algebra*, New gamma publication House, 2013.
2. Stanley L Grossman, *Elementary Linear algebra,* Wadsworth Publishing Company, 5th edition, 1994.
3. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, *Linear Algebra,* Pearson Education, Inc, 5th edition.
4. Vijay K Khanna, Bhambri.S.K, *A Course in Abstract algebra*, Vikas publishing house Pvt. Ltd, 2013.

Websites/ e-Learning Resources:

1. **https://www.youtube.com/watch?v=vEf0vry_UaA**
2. **https://www.youtube.com/watch?v=xLpl4nSo3RA**
3. **https://www.youtube.com/watch?v=ehwt18bt3h8**

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	2	3	3	1	1	3
CO 2	3	2	3	3	3	2	1	1	1	3
CO 3	3	3	3	3	3	2	1	1	1	3
CO 4	3	3	3	3	3	2	1	1	1	3
CO 5	3	3	3	2	2	3	3	1	1	3
Average	3	2.8	3	2.8	2.6	2.4	1.8	1	1	3

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS2429	Discrete Mathematics (BCA)	Supportive	5	4

The objective of this course is to inculcate the essential mathematical concepts for computer applications and improving their logical thinking as well as to equip the students to understand the concepts on matrix algebra, graph theory with examples.

Course Outcomes:

At the end of the course, students will be able to

CO1: demonstrate the basic principles of sets, relations and functions.

CO2: elucidate the matrix operations, to solve the inverse of a square matrix and simultaneous linear equation. Also, finding the Eigen value and Eigen vectors.

CO3: write an argument using logical notation and determine if the argument is valid or not.

CO4: outline the basic tools in counting principles in combinatorial structures.

CO5: demonstrate different types of graphs and their properties which may be explored through algorithms.

Unit I **(15 Hours)**

Set – Subset – Cardinality of a Set – Cartesian Product – Relations – Equivalence Relations. (Definition and Simple Problems only).

Unit II **(15 Hours)**

Matrix Algebra: Matrix Operations – Inverse of a Square Matrix – Elementary Operations and Rank of a Matrix – Simultaneous Equations – Eigen Values and Eigen Vectors.

Unit III **(15 Hours)**

Logic – Connectives – Well-Formed Formula – Implications – Tautology – Valid Conclusions – Normal Forms – Principle Normal Forms.

Unit IV **(15 Hours)**

Combinatorics – Addition and Multiplication Principle – Permutations – Combinations – Recurrence Relations.

Unit V **(15 Hours)**

Graph – Sub graphs – Graph Isomorphism – Some special classes of Graphs – Tree – Spanning Tree – Kruskal's and Prim's algorithms – Euler graph – Fleury's Algorithm. (Definition and Simple Problems only).

Learning Resources:

Text Book(s)

1. Dr. M.K. Venkataraman, Dr. N. Sridharan and N. Chandrasekaran, *Discrete Mathematics*, National Publishing Company, 2003.

   Unit I : Chapter 1 (Sec 1 to 4, 6, 9); Chapter 2 (Sec 1 to 5).
   Unit II: Chapter 6 (Sec 1 to 5, 7).
   Unit III: Chapter 9 (Sec 1 to 3, 5 to 8, 11, 12).
   Unit V : Chapter 11 (Sec 1 (Except Digraph), 3, 4, 8).

2. Alan Tucker, *Applied Combinatorics*, Fifth Edition, John Wiley & sons. Inc., 2007.
   Unit IV: Chapter 5 (Sec 5. 1, 5.2); Chapter 7 (Sec 7.1).

References

1. G. Shanker Rao, *Mathematical Foundations of Computer Science*, I.K International Publishing House Pvt Ltd, 2006.
2. J.P. Tremblay and R. Manohar, *Discrete Mathematical Structures with Applications Computer Science*, Tata McGraw Hill, 1987.
3. Narsingh Deo, *Graph Theory with Applications to Engineering and Computer Science*, Prentice Hall India, New Delhi, 1989.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	2	2	2	1	2	1	2	2
CO 2	3	3	3	3	2	1	2	1	2	2
CO 3	3	3	2	3	2	1	2	1	2	2
CO 4	3	3	2	3	2	1	2	1	2	2
CO 5	3	3	1	3	2	1	2	1	2	2
Average	3	3	2	2.8	2	1	2	1	2	2

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS2431	Operations Research (COS)	Supportive	5	4

This course aims in equipping students with the skills to formulate and solve optimization problems like Linear Programming Problem using simplex, and graphical methods. Enhancing the understanding of resource allocation through Transportation and Assignment Problems, improve project management with PERT/CPM, and develop strategic decision-making skills using Game Theory. These objectives help students apply OR techniques to real-world challenges.

Course Outcomes:

At the end of the course, students will be able to

CO1: formulate Linear Programming Problem (LPP) and predict solutions of LPP using graphical and simplex methods.

CO2: compute optimum solution of both balanced and unbalanced transportation problems.

CO3: identify the concept of assignment problem and its solutions.

CO4: design new model simulating PERT/CPM, solve PERT/CPM, predict the probability of project completion time.

CO5: compute best strategy in game theory using dominance and graphical method for both pure and mixed strategy.

Unit I **(15 Hours)**

Linear Programming Problem (L.P.P.): Mathematical formulation–Graphical solution–General L.P.P.–Standard form–Canonical form–Solution to L.P.P.by simplex method.

Unit II **(15 Hours)**

Transportation Problem: Mathematical formulation – Finding initial basic feasible solution – North West corner rule – Least cost method -Vogel's approximation method–moving towards optimality – Unbalanced transportation problem.

Unit III **(15 Hours)**

Assignment Problem: Mathematical formulation–Hungarian algorithm– Unbalanced assignment problem – Special cases – Travelling salesman problem.

Unit IV **(15 Hours)**

Networking: Network and Basic components–Rule of network construction –Time calculations –Float or slack values–Critical path–CPM & PERT.

Unit V **(15 Hours)**

Game Theory : Introduction – Two person zero sum games – maximin & minimax principle – Saddle points – Games without saddle points – Solution of 2 x 2 games –Graphical method – Dominance property.

Learning Resources:

Text Book(s)

1. Sundaresan.V, Ganapathy Subramanian K.S, & Ganesan.K, *Resource Management Techniques,* A. R. Publications,12th edition, June 2019.

   Unit I **:** Chapter 2 (Section 2.3 & 2.5), Chapter 3 (Section 3.1)

   Unit II **:** Chapter 7 (Section 7.1-7.4)

   Unit III **:** Chapter 8

   Unit IV **:** Chapter 15(Section 15.1-15.7)

   Unit V **:** Chapter 16 (Section 16.1- 16.4,16 .6 & 16.7)

References

1. S Arumugam. S & Thanga pandian Isaac.A, *Operations Research,* New Gamma Publishing House, 2003.
2. Gupta.P.K and Man Mohan, *Problems in Operation Research,* Sultan Chand and mSons, 2010.
3. Kapoor.V.K, *Operations Research*, Sultan chand and sons,1997.

Websites/e-Learning Resources

https://www.youtube.com/playlist?list=PLbMVogVj5nJRRbofh3Qm3P6_NVyevDGD_

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	3	1	3	1	1	3
CO 2	3	3	3	2	3	2	3	1	1	2
CO 3	3	3	3	3	2	2	3	1	1	2
CO 4	3	3	3	3	3	3	3	1	1	3
CO 5	3	3	3	3	2	2	3	1	1	3
Average	3	3	3	2.8	2.6	2	3	1	1	2.6

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS 2433	Statistics for Behavioural Science (PSY)	Supportive	5	4

This course helps to analyze the behavioural patterns of a group and social problems under study based on the statistical tools.

Course Outcomes:

At the end of the course, students will be able to

CO1: identify statistics as a specialization to be used for behavioural research

CO2: demonstrate scores into a frequency distribution in table form, construct a cumulative frequency distribution and compute percentiles and percentile ranks.

CO3: analyze casual relationships, human behaviour under study by using statistical tests.

CO4: interpret raw data using various parametric and non-parametric methods.

CO5: analyze data using software package.

Unit I **(15 Hours)**

Introduction – Descriptive Statistics – Inferential statistics – Applied Statistics – Variables and Constants – Scales of Measurement – Scales of Measurement and Problems of Statistical Treatment – Central Tendency – The Mode – The Median – The mean – Properties of the Mode – Properties of the Mean – Properties of the Median – Measures of Central Tendency in Symmetrical and Asymmetrical Distributions – Effects of Score Transformations – Frequency Distribution Percentiles and Percentile Ranks – Organizing Qualitative Data – Grouped Scores – Constructing a Grouped Frequency Distribution – Apparent vs Real Limits – Relative Frequency Distribution – Cumulative Frequency Distribution

Unit II **(15 Hours)**

Percentiles and Percentile Ranks – Computation Percentiles from Grouped Data – Computation of Percentile Rank – Graphic Representation of Frequency Distribution – Basic Procedures – The Histogram – The Frequency Polygon – Choosing between a Histogram and a Polygon – The bar Diagram and Pie Chart – Variability and Standard (Z) scores – The Range and Semi Inter Quartile Range – Calculation of the Variance and Standard Deviation: Raw Score Method – Standard Scores (Z) scores – Comparison of z-Scores and Percentile Ranks.

Unit III **(15 Hours)**

Concept of Correlation – Scatter Diagram – Coefficient of Correlation – Concept of Regression – Prediction with Regression Equation – t-test for Significance of Difference between Means of Independent Samples (Large sample: N>30) – t-test for Significance of Difference between Means of Correlated Samples – t-test for Independent Samples (N<30) – t-test for Correlated Samples (N<30) – Concept of Variance – Analysis of Variance – Two Way Analysis of Variance.

Unit IV **(15 Hours)**

Non-parametric Statistics – One Sample and Two Related Sample Tests: Uses of Non Parametric Statistics – One Sample Run Test (one sample) – Sign test - Median test - Chi Square test – Statistics for Related Samples – McNemar test of Significance of Change (two related samples) – Non-Parametric Analysis of Two Independent Samples: Chi Square Test – Median Test – Mann-Whitney U test.

Unit V **(15 Hours)**

A Brief Introduction to SPSS – Getting Help – Data Entry – Storing and Retrieving Data Files – The Statistics Menus – The Output Viewer – The Chart Editor – Programming in SPSS.

Learning Resources:

Text Book(s)

1. King, B.M., Patrick J Rosopa and Minium E W. *Statistical Reasoning in the Behavioural Sciences*, 5th Edition. New Delhi: Wiley student India edition, 2018.

   Unit I: Chapter 1 (1.1 to 1.6),
   Chapter 4 (4.1 to 4.8) and Chapter 2 (2.1 to 2.6)

   Unit II: Chapter 2 (2.7 to 2.9), Chapter 3 (3.1 to 3.5),
   Chapter 5 (5.1, 5.5, 5.11,5.12), Chapter 6 (6.2, 6.3, 6.5),
   Chapter 7 (7.1, 7.2, 7.7)

2. Vimala Veeraraghavan and Suhas Shetgovekar, *Textbook of Parametric and Nonparametric statistics*, Sage publications India Pvt. Ltd, 2016.

   Unit III: Chapter 5 (Page Number: 79 to 85, 90, 94, 95)
   Chapter 7 (Page Number: 113 to 121)
   Chapter 8 (Page Number: 124 to 133)

   Unit IV: Chapter 13 (Page Number: 221 to 243)

Chapter 14 (Page Number: 246 to 263)

3. Sabine Landau and Brian S. Everitt, *A Hand book of Statistical Analyses using SPSS,* Chapman and Hall/CRC Press LLC, 2004.

Unit V: Chapter 1 (1.1 to 1.8)

References

1. Aron A, Aron E N and Coups E J, *Statistics for Psychology*, New Delhi: Pearson Education, 2007.
2. Argyrous, G. *Statistics for research*. New Delhi: Sage South Asia edition, 2011.
3. Gaur A S and Gaur SS, *Statistical methods for practice and research. A guide to data analysis using SPSS.* 2nd edition. New Delhi: Response - Sage publication, 2009.
4. Haslam S Alexander & Mc Garty Craig. *Research Methods & Statistics in Psychology,* New Delhi: Sage Publications India Pvt Limited, 2003.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	2	3	3	2	1	1	1	1	2
CO 2	3	3	3	3	3	1	1	1	2	1
CO 3	3	3	3	3	3	1	2	1	2	2
CO 4	3	2	3	3	3	2	2	1	2	1
CO 5	3	1	3	3	3	3	2	1	2	3
Average	3	2.2	3	3	2.8	1.6	1.6	1	1.8	1.8

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS 2416	Business Statistics(CMC)	Supportive	5	4

The purpose of this course is to develop the numerical and analytical ability with statistical tools. This course equips the students with various statistical tools which can be used in business environment.

Course Outcomes:

At the end of the course, students will be able to

CO1: analyze and interpret statistical data using measures of central tendency, quartiles and Percentiles, recognize the importance of measuring dispersion and solve appropriate problems.

CO2: calculate and interpret the correlation and regression between two variables.

CO3: demonstrate the different methods of computation of index numbers with examples.

CO4: use the basic probability rules and apply probability theory using Bayes' Rule.

CO5: recognize and solve problems using theoretical distributions and tests of significance.

Unit I **(15 Hours)**

Statistical Average: Arithmetic – Geometric and Harmonic Means – Mode – Median – Quartiles and Percentiles – Simple and Weighted Averages – Uses of Different Averages. Dispersion - Range – Quartile Deviation – Mean Deviation and Their Coefficients – Standard Deviation – Coefficient of Variation.

Unit II **(15 Hours)**

Correlation: Karl Person's Coefficient of Correlation – Spearman's Rank Correlation – Concurrent Deviation Method - Regression Equations.

Unit III **(15 Hours)**

Index Numbers – Definition – Uses – Construction of Index Number – Methods – Laspeyre, Paasche, Bowley and Fisher's Ideal Index Number – Tests of Index Number – Cost of Living Index Number.

Unit IV **(15 Hours)**

Theory of Probability: Concepts – Addition & Multiplication Laws of Probability – Conditional Probability – Baye's Theorem.

Unit V **(15 Hours)**

Theoretical distribution – Binomial Distribution – Poisson Distribution - Test of significance for Small Samples – t-test – Chi-Square Test.

Learning Resources:

Text Book(s)

1. R.S.N . Pillai and Bagavathi **,** *Statistics theory and practice*,S. Chand & sons, New Delhi,2017

Unit I : Chapters 9 (pg. no. 124 to 134, 137 to 196);
Chapters 10 (pg. no. 241 to 254, 257 to 267, 279 to 287)
(Problems only)

Unit II: Chapter 12 (pg. no. 396 to 410, 417 to 422);
Chapter 13 (pg. no. 465 to 472, 479 to 480) (problems only)

Unit III: Chapter 14 (problems only).

Unit IV: Chapter 18 (pg. no. 737 to 751)

Unit V: Chapter 19 (pg. no. 769 to 787);
Chapter 20 (pg. no. 831 to 841);
Chapter 21 (pg. no. 847 to 854)

References

1. D.N. Elhance, *Fundamentals of Statistics*, New Century Book House, 2011.
2. S.P. Gupta, *Fundamentals of Statistics*, Sultan Chand Publishers, New Delhi, 2007.
3. S.P. Gupta, *Statistical Methods*, Sultan Chand & Sons, 2001
4. P.R. Dr. Vittal, *Mathematical Statistics*, MARGHAM Publications, 2002.

Websites/ e-Learning Resources:

https://www.youtube.com/playlist?list=PLbMVogVj5nJRRbofh3Qm3P6_NVyevDGD_

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	2	3	3	1	3	2	3	2	2
CO 2	3	2	3	3	1	3	2	3	2	2
CO 3	3	2	3	3	1	3	2	3	2	2
CO 4	3	2	3	3	1	3	1	3	2	2
CO 5	3	2	3	2	1	2	2	3	2	2
Average	3	2	3	2.8	1	2.8	1.8	3	2	2

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS 2418	Business Statistics (CIT)	Supportive	5	4

This Course helps the students to impart basic knowledge about application of statistics to various business situations.

Course Outcomes:

At the end of the course, students will be able to

CO1: demonstrate theoretical, graphical and diagrammatic representation of statistical data.

CO2: interpret statistical data using measures of central tendency and dispersion.

CO3: analyse the relationship between two variables using correlation coefficient and about regression lines.

CO4: explore various index numbers and formulate the procedure to measure the change in variable over the period of time.

CO5: interpret the trend of variation existing in a time series data and demonstrate the basic concepts of probability.

Unit I **(15 Hours)**

Definition of statistics – nature and scope – objectives – limitation of statistics – statistical survey: execution – collection of data – sampling design - collection of data – classification – tabulation – diagrammatic & graphical representation.

Unit II **(15 Hours)**

Measures of central tendencies: Mean and its types – arithmetic mean, geometric mean, harmonic mean, median, mode. Measures of dispersion: Range, quartile deviation, mean deviation, standard deviation, co-efficient of standard deviation, standard error, variance.

Unit III **(15 Hours)**

Correlation analysis: Types of correlation – Karl Pearson's correlation – rank correlation – regression lines.

Unit IV **(15 Hours)**

Index Numbers – Definition – Uses – Construction of Index Number – Methods– Laspeyre, Paasche, Bowley and Fisher's Ideal Index Number – Tests of Index number – Cost of living Index Number.

Unit V **(15 Hours)**

Probability – Addition, Multiplication Theorem – Conditional probability (Simple Problems Only) Sampling theory and Test of significance: Introduction – Estimation – Hypothesis – Standard Error –Tests of Significance for Small Samples – Students' t-Distribution - F test - Chi square test of goodness of fit.

Learning Resources:

Text Book(s)

1. R.S.N.Pillai, Bagavathi, *Statistics theory and practice*, S.chand & company Ltd. 2011.
   - **Unit I** **:** Chapter 1 to 8
   - **Unit II** **:** Chapter 9, 10 (problems related to the content)
   - **Unit III** **:** Chapter 12 (page no. 396 - 404 , 417 - 420) , Chapter 13 (page no. 471 - 480 & 531 - 540) (problems related to the content)
   - **Unit IV** **:** Chapter 14 (problems related to the content)
   - **Unit V** **:** Chapter 18, 20 & 21 (problems related to the content)

References

1. S.C.Gupta, V.K. Kapoor, *Fundamentals of Mathematical statistics*, S.chand & company Ltd., 10th edition, 2000.
2. S.Arumugam & Isaac, *Statistics* , New gamma publishers, 2008.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	3	3	2	2	1	1	2	1
CO 2	3	3	3	3	2	2	1	1	2	1
CO 3	3	3	3	2	2	3	2	1	2	1
CO 4	3	2	3	2	2	3	2	1	2	1
CO 5	3	2	3	2	2	3	2	1	2	1
Average	3	2.6	3	2.4	2	2.6	1.6	1	2	1

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS2420	Research Methodology for Biochemistry (BCH)	Supportive	5	4

This course is designed for to know the basic components of research, acquaint on the experimental design and literature survey. Also, to analyse the data and find out the significance statistically. Especially to highlight the importance of computation in research and provide mechanics of writing a research report hands-on experience in designing and working on small projects.

Course Outcomes:

At the end of the course, students will be able to

CO1: explain the types of research and formulate and plan the research.

CO2: design experimental setup, review the literature, compile and document the data.

CO3: analyze and validate the experimental data using statistical tools.

CO4: interpret the data using computational tools.

CO5: compile and draft a research report, present results findings and publish ethically.

Unit I **(15 Hours)**

Characteristics and types of Research, Research Methods versus Methodology, Research designs in Biochemistry: experimental, in vitro, in vivo, in situ, clinical trials. Identification and criteria of selecting a research problem (Hypothesis); Formulation of objectives; Research plan and its components.

Unit II **(15 Hours)**

Experimental design - Objective, Design of work, Guidelines for design of experiments, Literature Search - Databases for literature search, Material and methods, Designing biological experiments, Compilation and documentation of data

Unit III **(15 Hours)**

Measures of variation - standard deviation, Non-linear regression, Standard error. Analysis of variance for one-way and two-way classified data and multiple comparison procedures. Significance - students “t” test, chi-square test.

Unit IV **(15 Hours)**

Basics of MS word, MS Excel: tabulation, calculation and data analysis, preparation of graphs, histograms and charts. Power Point - preparation of presentations and scientific poster designing.

Unit V **(15 Hours)**

Scientific writing for journals - Preparation of Abstract, Impact factor, h-index, i-10 index, citation index, Dissertation/Thesis writing: format, content and chapterization, writing style, drafting titles & sub-titles, captions and legends. Writing results, discussion and conclusions. Bibliography and references, referencing style - Harvard and Vancouver systems, Appendices and acknowledgement; Ethical issues in research; Intellectual property right and plagiarism.

Learning Resources:

Text Book(s)

1. R. Kothari, *Research Methodology: Methods and Techniques,* New Age International, 2004.
   Unit I: Chapter 1, 2
   Unit II: Chapter 3, 4
   Unit III: Chapter 7, 10, 11
2. E Balagurusamy, *Fundamentals of Computers,* Tata McGraw Hill Education Private Limited, New Delhi, 2009
   Unit IV: Chapter 12(Sec 12.1 to 12.5)
3. N. Gurumani, *Research Methodology for biological Sciences*, MJP Publishers, 2014.
   Unit V: Chapter 2, 3, 4, 7

References

1. S.M. Coley, C.A. Scheinberg, "*Proposal Writing*", Sage Publications, 1990.
2. R.A. Day, *How to Write and Publish a Scientific Paper*, Cambridge University Press, 1992.
3. B.L. Garg, R. Karadia, F. Agarwal, and U.K. Agarwal, *An introduction to Research Methodology*, RBSA Publishers, 2002.
4. S.C. Sinha, and A.K. Dhiman, *Research Methodology*, EssEss Publications. 2 volumes, 2002.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	2	3	3	2	2
CO 3	3	3	3	3	3	3	3	2	2	2
CO 4	3	3	3	3	1	2	2	3	1	2
CO 5	3	3	3	3	3	3	2	3	2	2
Average	3	3	3	3	2.8	2.6	2.6	2.8	2	2.2

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS2422	Biostatistics (MIC)	Supportive	5	4

This Course helps the students to characterize the basic techniques in statistics will enhance their ability to validate their experimental results.

Course Outcomes:

At the end of the course, students will be able to

CO1: explore the fundamentals of statistics, data types and the ways to present it.

CO2: interpret various central measures and dispersion.

CO3: analyse the relationship between two variables using correlation and regression.

CO4: explore sampling methods and various tests of inferential statistics.

CO5: interpret the results using ANOVA.

Unit I **(15 Hours)**

Definition of statistics – characteristics of statistics – uses of statistics in biology – data types – collection of data – classification – tabulation – diagrammatic representation.

Unit II **(15 Hours)**

Measures of central tendencies: Mean and its types – arithmetic mean, geometric mean, harmonic mean, median, mode. Measures of dispersion: Range, quartile deviation, mean deviation, standard deviation, co-efficient of standard deviation, standard error, variance.

Unit III **(15 Hours)**

Correlation analysis: Types of correlation – Karl Pearson correlation – rank correlation – regression lines.

Unit IV **(15 Hours)**

Sampling: Types of sampling – parameters – null and alternate hypothesis – test of significance of small samples – T test, F test and Chi-square test for goodness of fit.

Unit V **(15 Hours)**

Analysis of variance: One way, two way classification and Latin square design.

Learning Resources:

Text Book(s)

1. Pranabkumar Banarjee, *Introduction to Biostatistics*, S.chand & company Ltd. 2011.

Unit I **:** Chapter 1, 2, 3

Unit II **:** Chapter 4, 5

Unit III **:** Chapter 13, 14

Unit IV **:** Chapter 9, 10, 12 (related topics only)

Unit V **:** Chapter 15

References

1. Bernard Rosner, *Fundamentals of Biostatistics*, Brooks/Cole, USA, Seventh edition, 2010.
2. R.S.N.Pillai and Bagavathi, *Statistics theory and practice*, S.chand & company Ltd. 2011.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	3	3	2	2	1	1	2	1
CO 2	3	3	3	3	2	2	1	1	2	1
CO 3	3	3	3	2	2	3	2	1	2	1
CO 4	3	2	3	2	2	3	2	1	2	1
CO 5	3	2	3	2	2	3	2	1	2	1
Average	3	2.6	3	2.4	2	2.6	1.6	1	2	1

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS2428	Resource Management Techniques(DSC)	Supportive	5	4

The purpose of this course is to impart the knowledge of formulation of Linear Programming Problem for life problems and find optimal solutions using the graphical Methods and Simplex Method. It also introduces to the learner basic tools of solving transportation, assignment, game theory and related problems which are essential for Data Science.

Course Outcomes:

At the end of the course, students will be able to

CO1: formulate Linear Programming Problem (LPP) and predict solutions of LPP using graphical and simplex methods.

CO2: compute optimum solution of both balanced and unbalanced transportation problems using different techniques

CO3: identify the concept of assignment problem and its solutions by Hungarian method

CO4: compute best strategy in game theory using dominance and graphical method for both pure and mixed strategy

CO5: design new models imitating PERT/CPM, solve PERT/CPM, predict the probability of project completion time.

Unit I **(15 Hours)**

Introduction to operations research – Linear programming problem (L.P.P) – Mathematical formulation – Graphical solution – Solution to L.P.P by simplex method.

Unit II **(15 Hours)**

Transportation problem – Mathematical formulation – Finding initial basic feasible solution – Northwest corner rule, least cost method and Vogel's approximation method – Moving towards optimality- MODI Method.

Unit III **(15 Hours)**

Assignment problem: Introduction – Mathematical formulation – Hungarian Assignment algorithm – Traveling Salesman Problem.

Unit IV **(15 Hours)**

Game theory – Introduction – Two-person zero sum games – Maximin principle - minimax principle – Saddle points – Games without saddle points – Solution of 2 x 2 games – Graphical method – Dominance property.

Unit V **(15 Hours)**

PERT/CPM – Introduction – Networking – Critical path analysis – Probability considerations in PERT.

Learning Resources:

Text Book(s)

1. Kanti Swarup, Gupta P.K. & Manmohan, *Operations Research*, Sultan Chand & Sons, Reprint 2020.

Unit I **:** Chapter 1 (Sec. 1. 1, 1.6, 1.7); 2 (2.1, 2.2); 3 (3.1, 3.2); 4 (4.3).

Unit II **:** Chapter 10 (Sec. 10.1 to 10.13 & 10.15),

Unit III **:** Chapter 11 (Sec. 11.1 to 11.4 & 11.7).

Unit IV **:** Chapter 17 (Sec. 17.1 to 17.7)

Unit V **:** Chapter 25 (Sec. 25.1 to 25.7)

References

1. Kapoor V.K, *Operations Research*, Sultan Chand and sons, 1997.
2. Gupta P.K. and Man Mohan, *Problems in Operations Research*, Sultan Chand and Sons, 2007.
3. Paneerselvam. R, *Operations Research*, Prentice Hall, 2004.

Websites/ e-Learning Resources

https://www.youtube.com/playlist?list=PLbMVogVj5nJRRbofh3Qm3P6_NVyevDGD_

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	2	2	2	1	2	2
CO 2	3	3	2	3	2	2	2	1	1	2
CO 3	3	3	3	3	2	2	2	1	2	1
CO 4	3	3	3	3	3	2	2	1	2	2
CO 5	3	3	2	2	2	2	2	1	2	1
Average	3	3	2.6	2.8	2.2	2	2	1	1.8	1.6

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS 2430	Operations Research (BCA)	Supportive	5	4

To introduce certain quantitative techniques in operations research will enhance the analytical ability of the students.

Course Outcomes:

At the end of the course, students will be able to

CO1: formulate Linear Programming Problem (LPP) and predict solutions of LPP using graphical and simplex methods.

CO2: compute optimum solution of both balanced and unbalanced transportation problems.

CO3: identify the concept of assignment problem and its solutions.

CO4: compute best strategy in game theory using dominance and graphical method for both pure and mixed strategy.

CO5: design new models imitating PERT/CPM, solve PERT/CPM, predict the probability of project completion time.

Unit I **(15 Hours)**

Linear Programming Problem (L.P.P.): Mathematical formulation – Graphical solution – General L.P.P. – Standard form – Canonical form – Solution to L.P.P. by Simplex method.

Unit II **(15 Hours)**

Transportation Problem : Mathematical formulation – Finding initial basic feasible solution – Northwest Corner rule - Least Cost method - Vogel's approximation method – moving towards Optimality – Unbalanced transportation problem.

Unit III **(15 Hours)**

Assignment Problem: Mathematical formulation – Hungarian algorithm – Unbalanced assignment problem – Special cases – Travelling Salesman problem.

Unit IV **(15 Hours)**

Networking: Network and Basic components – Rule of network construction – Time calculations – Float or slack values – Critical path – CPM & PERT.

Unit V **(15 Hours)**

Game Theory : Introduction – Two person zero sum games – Maximin & Minimax principle – Saddle points – Games without saddle points – Solution of 2 x 2 games –Graphical method – Dominance property.

Learning Resources:

Text Book(s)

1. Sundaresan.V, Ganapathy Subramanian K.S, & Ganesan. K, *Resource Management Techniques,* A. R. Publications,12th edition, June 2019.

   Unit I : Chapter 2 (Sec 2.3 to 2.5); Chapter 3 (Sec 3.1)

   Unit II : Chapter 7 (Sec 7.1 to 7.4)

   Unit III: Chapter 8

   Unit IV: Chapter 15(Sec 15.1 to 15.7)

   Unit V : Chapter 16 (Sec 16.1 to 16.4, 16 .6 & 16.7)

References

1. Arumugam. S & Thangapandian Isaac.A, *Operations Research*, New Gamma Publishing house, 2003.
2. Gupta. P.K and Man Mohan, *Problems in Operation Research*, Sultan Chand and Sons, 2010.
3. Kapoor.V.K , *Operations Research*, Sultan chand and sons , 1997.

Websites/ e-Learning Resources

https://www.youtube.com/playlist?list=PLbMVogVj5nJRRbofh3Qm3P6_NVyevDGD_

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	3	3	2	2	2	2	2	2
CO 2	3	3	2	3	2	2	2	1	2	2
CO 3	3	3	2	3	2	2	2	2	2	2
CO 4	3	3	3	3	3	2	2	1	2	2
CO 5	3	3	3	3	2	2	2	2	2	1
Average	3	3	2.6	3	2.2	2	2	1.6	2	1.8

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS3341	Office Automation	GE	4	3

The objective of the course is to facilitate the students to introduce the basic tools in computer software.

Course Outcomes:

At the end of the course, students will be able to

CO1: prepare documents, letters and do necessary formatting of the document.

CO2: construct formulas, including the use of built in functions, create charts using Microsoft Excel.

CO3: manipulate slides to enhance the look of the slides as well as whole presentation by inserting a picture, objects, formatting etc.

CO4: create a database in Microsoft Access.

CO5: use the internet applications and explain various email services.

Unit I **(12 Hours)**

MS Word – Basic Operations Performed in MS Word: Creating, Saving, Editing, Formatting and Printing a document – Finding and replacing text – Spelling checking – Column and tables – graphics.

Unit II **(12 Hours)**

MS Excel – Accessing MS Excel – Basic Operations: Creating, Saving, Modifying , Renaming, Deleting, Moving and Editing a worksheet – Creating a chart – Formulae – Naming ranges and using statistical data – Mail Merge from Excel to Word.

Unit III **(12 Hours)**

MS PowerPoint – Accessing MS PowerPoint – Basic Operations: Creating, Designing, Saving, Adding slides and Printing the presentation – Running a slide show.

Unit IV **(12 Hours)**

MS Access – Accessing MS Access – Creating a database – Creating a database table – Defining relationships – Creating database query,

Unit V **(12 Hours)**

The Internet and World Wide Web: Introduction – History of Internet – Internet Applications – Understanding the World Wide Web – Web Browsers – Browsing the internet – Using a Search Engine – Email Service.

Learning Resources:

Text Book(s)

1. E Balagurusamy, *Fundamentals of Computers*, Tata McGraw Hill Education Private Limited, New Delhi, 2009.

Unit I **:** Chapter 12 (Sec 12.3)

Unit II **:** Chapter 12 (Sec 12.4)

https://spreadsheeto.com/mail-merge-excel/

Unit III **:** Chapter 12 (Sec 12.5)

Unit IV **:** Chapter 12 (Sec 12.6)

Unit V **:** Chapter 15 (Sec 15.1 to 15.8)

References

1. Alan R. Neibaner, *Microsoft word for windows*, Made easy, The basics and beyond, Tata McGraw Hill,New Delhi,1999.
2. Torben Lage Frandsen, *Microsoft office word* 2007, e –publication.
3. Torben Lage Frandsen, *Microsoft office Excel* 2007, e –publication.
4. Torben Lage Frandsen, *Annexure B, Microsoft office power point* 2007, e-publication.
5. Wallace Wang, *Microsoft Office 2019 for Dummies*, John Wiley & Sons, Inc.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	2	2	1	1	2	1
CO 2	3	3	3	3	2	2	1	1	2	1
CO 3	3	3	3	2	2	3	2	1	2	1
CO 4	3	2	3	2	2	3	1	1	2	1
CO 5	3	2	2	2	2	2	1	1	2	1
Average	3	2.6	2.8	2.4	2	2.4	1.2	1	2	1

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS 3343	Biostatistics	GE	4	3

This Course helps the students to characterize the basic techniques in statistics will enhance their ability to validate their experimental results.

Course Outcomes:

At the end of the course, students will be able to

CO1: explore the fundamentals of statistics, data types and the ways to present it.

CO2: interpret measures of central tendencies.

CO3: evaluate measures of dispersion.

CO4: measure the relationship between two variables using correlation and regression.

CO5: analyse sampling methods and various tests of inferential statistics.

Unit I **(12 Hours)**

Definition of statistics – characteristics of statistics — data types – collection of data – classification – tabulation – diagrammatic representation.

Unit II **(12 Hours)**

Measures of central tendencies: arithmetic mean, weighted mean, median, mode, combined mean and related problems.

Unit III **(12 Hours)**

Measures of Dispersion: range, mean deviation, standard deviation, combined standard deviation and variance.

Unit IV **(12 Hours)**

Correlation Analysis: Types of correlation – Karl Pearson's coefficient of correlation – rank correlation – regression lines.

Unit V **(12 Hours)**

Sampling: types of sampling – parameters and statistic – null and alternate hypothesis – test of significance of small samples – t test – F test – Chi square.

Learning Resources:

Text Book(s)

1. Palanichamy. S & Manoharan, Statistical methods for biologists, Palani paramount publications, 1990.

   Unit I **:** Chapter 1, Chapter 2(Sec 2.1 to 2.4)

   Unit II **:** Chapter 3

   Unit III **:** Chapter 4

   Unit IV **:** Chapter 7

   Unit V **:** Chapter 10

References

1. Bernard Rosner, *Fundamentals of Biostatistics*, Brooks/Cole, USA, Seventh edition, 2010.
2. R.S.N.Pillai and Bagavathi, *Statistics theory and practice,* S.chand & company Ltd. 2011.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	2	2	1	1	2	1
CO 2	3	3	3	3	2	2	1	1	2	1
CO 3	3	3	3	2	2	3	2	1	2	1
CO 4	3	2	3	2	2	3	2	1	2	1
CO 5	3	2	3	2	2	3	2	1	2	1
Average	3	2.6	3	2.4	2	2.6	1.6	1	2	1

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS3342	Speed Arithmetic	GE	4	3

The objective of this course provides an opportunity for the students to develop the ability to make calculations faster and accurately using several new and interesting techniques. The need for developing accurate calculations at the minimum time is getting prominent with many entrance examinations having special on arithmetic ability. This course aims at giving training to those aspiring to compete in such examinations.

Course Outcomes:

At the end of the course, students will be able to

CO1: calculate the problems on multiplication by numbers.

CO2: derive the problems from rapid multiplication two digits and three digits

CO3: solve the problems on two digit and three digit multiplier

CO4: crack the various division method

CO5: determine the square roots and finding shortcuts,

Unit I **(12 Hours)**

Multiplication: Multiplication by eleven– Multiplication by twelve –Multiplication by six– Multiplication by seven– Multiplication by five – Multiplication by eight and nine.

Unit II **(12 Hours)**

Rapid Multiplication: Two digits by two digits – Long multiplicands –Three digit multipliers –Multipliers of any length.

Unit III **(12 Hours)**

Speed Multiplication: Multiplication by a single digit– Multiplication by two-digit numbers – Long number by two digit multiplier –Three digit multipliers.

Unit IV **(12 Hours)**

Division: Short division–Long division by factors–Standard long division–Direct division– Division by addition.

Unit V **(12 Hours)**

Square roots: Estimating square roots–Calculating square roots–Fun Shortcuts.

Learning Resources:

Text Book(s)

1. Ann Cutler and Rudolph Mcshane, *Trachtenberg Speed System of Basic Mathematics*, Doubleday & Company, Inc. Garden City, New York 1960.

   Unit I : Chapter 1 (Sec 1.1 to 1.7)

   Unit II : Chapter 2

   Unit III: Chapter 3

2. Bill Handley, *Speed Mathematics Secret Skills for Quick Calculation*, John Wiley & Sons 2003.

   Unit IV: Chapters 11 to 15

   Unit V : Chapters 17 to 19.

References Books

1. Hentry Ernest Dudeney, *Amusement in Mathematics*, Dover Publications, 1965.
2. Martin Gardner, *Mathematical Magic*, Penguin Books, 1987.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	2	1	3	1	2	2
CO 2	2	2	3	3	2	1	3	1	2	2
CO 3	3	3	3	3	2	1	3	1	2	2
CO 4	3	2	3	3	3	1	3	1	1	2
CO 5	3	3	3	3	3	2	3	1	2	2
Average	2.8	2.6	3	3	2.4	1.2	3	1	1.8	2

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS3344	Wonders of the Sky	GE	4	3

The objective of the course is to introduce the marvels of the celestial realm and deepen their understanding of the interconnectedness between the Earth and the cosmos. By exploring concepts such as celestial coordinates, diurnal motion, lunar phases, eclipses and time measurement. Through theoretical learning students will develop the skills to observe, analyze and interpret celestial phenomena.

Course Outcomes:

At the end of the course, students will be able to

CO1: plot and predict the celestial objects and apply the concept of diurnal motion.

CO2: demonstrate and locate positions on Earth's surface, explain the significance of phenomena such as the dip of the horizon and twilight in observational astronomy

CO3: distinguish between sidereal and synodic months and interpret the phases of the Moon.

CO4: differentiate between solar and lunar eclipses, predict eclipse events. Analyze the concept of ecliptic limits and the synodic period of the nodes of the lunar orbit.

CO5: calculate the equation of time accurately and evaluate the development of calendars. Demonstrate the conversion between different time measurement systems.

Unit I **(12 Hours)**

Celestial co-ordinates – Diurnal motion.

Unit II **(12 Hours)**

Zones of earth: Terrestrial Latitudes and Longitudes – Dip of horizon Twilight.

Unit III **(12 Hours)**

Relation between sidereal and synodic months – Elongation – Phase of moon – Path of the moon with respect to the sun.

Unit IV **(12 Hours)**

Solar eclipse – Lunar eclipse – Ecliptic limits – Synodic period of the nodes of lunar orbit.

Unit V **(12 Hours)**

Equation of time – Seasons – Calendar – Conversion of time.

Learning Resources:

Text Book(s)

1. S. Kumaravelu, Susheela Kumaravelu, *Astronomy*, SK Publishers, 2007.

Unit I : Chapter 2 (Sec 39 to 64, 69, 72, 80)

Unit II : Chapter 3 (Sec 87, 88, 91 to 94, 106 to 111, 116)

Unit III : Chapter 12 (Sec 229 to 240)

Unit IV : Chapter 13 (Sec 256 to 259)

Unit V : Chapter 7 (Sec 166 to 168, 173 to 184)

References

1. Michael Zeilik, *Astronomy The Evolving Universe*, John Wiley & sons, 1988.
2. George O. Abell, David Morrison, Sidney C. Wolff, *Exploration of the Universe*, Saunders College Publishing, 1987.

Websites/ e-Learning Resources

https://www.youtube.com/watch?v=tahgEMwlpoI

https://www.youtube.com/watch?v=c-N3u3IufK4

https://www.youtube.com/watch?v=IAocHt3xro0

https://www.pbslearningmedia.org/resource/345fcdce-f8c4-46e6-a6f7-562532f87bec/solar-eclipse-awesome-totality/

https://www.youtube.com/watch?v=23iHlChL5zo

https://www.youtube.com/watch?v=Mx9AJJSKIL4

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	2	2	3	2	2	2	2	2	1
CO 2	3	3	2	3	2	2	2	1	2	2
CO 3	3	3	2	2	3	3	1	2	1	1
CO 4	3	2	2	2	2	3	2	2	2	1
CO 5	3	3	2	3	3	3	1	1	3	2
Average	3	2.6	2	2.6	2.4	2.6	1.6	1.6	2	1.4

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS1231	Arithmetic and Mathematical Logic	NME	3	2

The course is intended for the students who are not majoring in mathematics as a non- major elective. The basic structure in mathematics called set is introduced by means of real-life examples. The idea of truth table and its consequence in resolving situations in which the truth value is either true or false is studied at length.

Course Outcomes:

At the end of the course, students will be able to

CO1: apply the basic concepts of quantitative and arithmetic ability to solve problems in competitive exams.

CO2: interpret the data.

CO3: outline the basic principles and operations on sets.

CO4: write symbolic representation of statements.

CO5: analyse the validity of a statement using truth table.

Unit I **(9 Hours)**

Average – Percentage – Profit and Loss – True Discount.

Unit II **(9 Hours)**

Odd man out series – Data interpretation.

Unit III **(9 Hours)**

Operations on set – Algebra of sets – Finite and Infinite set.

Unit IV **(9 Hours)**

Truth tables – Disjunction – Conjunction – Implication.

Unit V **(9 Hours)**

Laws of Logic – Tautology – Contradiction – Principal Conjunctive and Principal Disjunctive Normal forms with two variables (Truth table only).

Learning Resources:

Text Book(s)

1. R. S. Aggarwal, *Quantitative Aptitude*, S .Chand and Company Ltd, 2020.

   Unit I : Sec I: 6, 11, 12 and 32

   Unit II: Sec I: 35; Sec II: 36 and 37

2. M. K. Venkataraman, N. Sridharan & N. Chandrasekaran, *Discrete Mathematics*, The National Publication Company

   Unit III : Chapter 1 (Sec 1.1 to 1.6); chapter 4 (Sec 4.2)

   Unit IV: Chapter 9 (Sec 9.1 to 9.3)

   Unit V : Chapter 9 (Sec 9.6 to 9.8 and 9.12)

References

1. Seymour Lipschutz, *Schaum's theory and problems of set theory*, Mc-Graw – Hill, 1964.
2. R. S. Stoll, *Set Theory and Logic*, Eureka publishing House, 1997.
3. J. P. Tremblay, R. Manohar, *Discrete Mathematical Structure with applications to Computer science*, Tata Mc-Graw – Hill, 2011.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	2	2	1	1	1	1	1	1
CO 2	3	3	3	2	2	1	1	1	2	2
CO 3	3	2	3	2	2	1	2	1	2	2
CO 4	3	3	3	3	2	1	2	1	1	2
CO 5	3	2	3	3	2	1	2	1	2	2
Average	3	2.6	2.8	2.4	1.8	1	1.6	1	1.6	1.8

Strong - 3 **Medium-2** **Low-1**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS1233	Mathematics for Life	NME	3	2

This course attempts to show what mathematics is, how it has developed from man's efforts to understand and model nature, how the mathematical approach to real problem can be accomplished. The course aims at enabling the students to acquire mathematical knowledge for technical proficiency.

Course Outcomes:

At the end of the course, students will be able to

CO1: compile the brief history of calendars, compare and contrast various number systems.

CO2: demonstrate speed arithmetic for multiplication and division.

CO3: outline few graph theory models in real life.

CO4: compile daily/monthly/annual astronomical events.

CO5: demonstrate with a diagram the conditions favourable for lunar and solar eclipse.

Unit I **(9 Hours)**

History and types of calendar - Various number bases subsist in the history – Number puzzles and Logical puzzles.

Unit II **(9 Hours)**

Speed arithmetic- Complementation rule - Product near the base 10^k- Division - Square root.

Unit III **(9 Hours)**

Konigsberg bridge problem - Jordan curve – Planarity - Map coloring.

Unit IV **(9 Hours)**

Synodic month - Sidereal month - Relation between synodic and sidereal month - Elongation of Moon - Phase formula.

Unit V **(9 Hours)**

Lunar eclipse - Types and condition for its occurrence - Partial and total Solar eclipse - Condition for the occurrence of solar eclipse.

Learning Resources:

Text Book(s)

1. Kumaravel and Mrs. Kumaravel, *Astronomy*, Shri Vishnu arts, Sivakasi, 2004.

   Unit I: Chapter 7(Sec 3).

   Unit IV: Chapter 12.

   Unit V: Chapter 13.

2. J.T.Glover, *Vedic Mathematics*, Mothilal Banarsidass publishers, 1995.

   Unit II: Chapters: 2 to 5.

3. S.Arumugam and S.Ramachandran, *Invitation to Graph Theory*, Sci. Tech Publications (India) Pvt. Ltd., 2004.

   Unit III: Chapter 1; Chapter 2 (Sec 2.0 to 2.2); Chapter 8 (Sec 8.0 to8.2); Chapter 9

References

1. Arthur berry, *Astronomy*, Dover publication, 1991.
2. W.Blurn, G.Booker, P.Galbraith and Ian D. Hurtles *Mathematical models*, Harwood publisher, Chichester, 1993.
3. Derek Allan Holton & John Clarke, *A first look at Graph Theory*, World Scientific Publishing Co. Ltd., 1995.
4. George J. Summer, *The great book of puzzles and teasers*, Jaico publishing house, 1989.

Websites/ e-Learning Resources

Unit I: https://www.indiabix.com/puzzles/logical-puzzles/3

https://www.math.chalmers.se/Math/Grundutb/GU/MAN250/S04/Number_Systems.pdf

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	1	3	2	1	2	1
CO 2	3	3	3	3	1	3	2	1	2	1
CO 3	3	3	3	2	1	3	1	1	2	1
CO 4	3	2	3	2	1	3	2	2	2	2
CO 5	3	2	3	2	1	3	2	2	2	2
Average	3	2.6	3	2.4	1	3	1.8	1.4	2	1.4

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS1232	Recreational Mathematics	NME	3	2

The course teaches recreational component of mathematics rather than rigorous aspect, and helps the students understand how mathematics is blended into everyday activities and the environment surrounding.

Course Outcomes:

At the end of the course, students will be able to

CO1: create magic squares of different orders.

CO2: demonstrate fallacies and paradoxes with examples.

CO3: compute products and divisions using speed arithmetic.

CO4: simple combinatorial rules with real time examples.

CO5: design recurrence relation for simple models.

Unit I **(9 Hours)**

Magic squares – Definition – History – Creation of magic square – odd order (2m+1) – Single even order (2(2m+1)) – Double even order (4m).

Unit II **(9 Hours)**

Fallacies – Paradoxes.

Unit III **(9 Hours)**

Multiplication rules – Divisibility rules.

Unit IV **(9 Hours)**

Combinatorics – Rule of sum – Rule of product – Combination – Permutations – Basic level problems.

Unit V **(9 Hours)**

Recurrence relations – Tower of Hanoi problem – Fibonacci numbers.

Learning Resources:

Text Book(s)

1. Rouseball, H.S.M. Coxter, *Mathematical Recreations and essays* 13thedition, Dover Publications, 2003.

   Unit I : Chapter7 (page no. 193 to 199)

2. E.A. Maxwell, *Fallacies in mathematics*, Cambridge University press, 1969.

   Unit II : Chapter 1 and 6.

3. Jagadguru Swami Sri Bharathi Krishnatirthaji maharaja, *Vedic mathematics*, Banarsidass publishers, Delhi 2006.

   Unit III : Chapter 2 and 3.

4. V.K. Balakrishnan, *Schaum's outline of combinatorics*, Tata McGraw–Hill publishing company Limited, Delhi 1995.

   Unit IV : Chapter 1 (Basic level problems)

   Unit V : Chapter 3 (Basic level problems)

References

1. D.Cohen, *Combinatorics*, Wiley, 1978.
2. A.W.Tucker, *Applied Combinatorics*, John & Sons Wiley, 2000.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	1	2	2	1	1	1	1	1	1
CO 2	3	2	3	2	2	1	1	1	2	2
CO 3	3	1	2	2	2	1	2	1	2	2
CO 4	3	2	3	3	2	1	2	1	1	2
CO 5	3	2	3	3	2	1	2	1	2	2
Average	3	1.6	2.6	2.4	1.8	1	1.6	1	1.6	1.8

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS1234	Ancient Indian Mathematics	NME	3	2

The objective of this course is to train the students with fundamental concepts of mathematics and to equip the students with application of the sutras, it ensures both speed and accuracy and enhances computational skills.

Course Outcomes:

At the end of the course, students will be able to

CO1: compute the multiplication and division by different methods.

CO2: evaluate the factorization of quadratics and factorization of cubes.

CO3: solve the simple equations by Sunyam.

CO4: determine the quadratic equation and cubic equation.

CO5: finding the square root by Vargamula Method and cube roots.

Unit I **(9 hours)**

Multiplication by Nikhilam Method – Multiplication by Urdhva-Tiryak Method – Division by Nikhilam Method.

Unit II **(9 hours)**

Factorization of Quadratics – Factorization of Cubics.

Unit III **(9 hours)**

Simple equations First principle – Simple equations by Sunyam.

Unit IV **(9 hours)**

Quadratic equation – Cubic equation.

Unit V **(9 hours)**

Square Root – Cube roots of Exact cubes.

Learning Resources:

Text Book(s)

1. Sri Bharatikrishna Tirthaji, *Vedic Mathematics*, Motilal Banarsidass, New Delhi, 1981.

Unit I : Chapter II, III, IV.

Unit II : Chapter VII, VIII, IX.

Unit III : Chapter XI, XII.

Unit IV : Chapter XXXIV, XXXV

Unit V : Chapter XVII, XVIII.

References

1. K.R. Williams, *Discover Vedic Mathematics*, Vedic Mathematics Research Group, 1984.
2. K.R. Wiliams and M. Gaskell, *The Cosmic Calculator*, Motilal Banarsidass, 2002.
3. A.P. Nicholas, Williams, J. Pickles, *Vertically and Crosswise*, Inspiration books, 1984.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	2	2	2	1	2	1	2	2
CO 2	3	3	3	3	2	1	2	1	2	2
CO 3	3	3	2	3	2	1	2	1	2	2
CO 4	3	3	2	3	2	1	2	1	2	2
CO 5	3	3	1	3	2	1	2	1	2	2
Average	3	3	2	2.8	2	1	2	1	2	2

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT2261	Introduction to Data Science using R	SEC	3	2

Data Science is a combination of statistical methods, modelling techniques and programming knowledge. This course develops, the concepts of data science using a programming language R.

Course Outcomes:

At the end of the course, students will be able to

CO1: describe data preparation and modelling.

CO2: explore and classify data.

CO3: illustrate basic program in R using variables, constants, R operators and R if statements.

CO4: develop program using data type in R, vector, plotting and to make matrix, array and list.

CO5: frame data, factor, table functions, math function using R program.

Unit I **(9 Hours)**

Introduction to Data Science – Data Science Process–Data Preparation and Modeling.

Unit II **(9 Hours)**

Objectives of Data Exploration – Datasets – Types of Data – Data Visualization– Classification– Decision Tree – Rule Indication – Support Vector Machine.

Unit III **(9 Hours)**

R Variables and Constants – R Operators – R if Statements.

Unit IV **(9 Hours)**

Data Types in R – Vector–Basic Plotting – Matrix – Array – List.

Unit V **(9 Hours)**

Data Frame – Factors– Table Function – Function in R – Math Functions in R– Set Operations in R.

Learning Resources:

Text Book(s)

1. Dr. M. Davamani Christober, *Concepts of Data Science using R*, Kanthagapookal pathipagam, 2021.

    Unit I **:** Chapter 2 (Sec 2.1 to 2.7)

    Unit II **:** Chapter 3 (Sec 3.1 to 3.9)

    Unit III **:** Chapter 4 (Sec 4.1 to 4.4)

    Unit IV **:** Chapter 4 (Sec4.5 to 4.7); Chapter 5 (Sec 5.1 to 5.3)

    Unit V **:** Chapter 5 (Sec 5.4 to 5.9)

References

1. Davy Cielen, Arno D.B. Meysman, Mohamed Ali, *Introducing Data science*, Manning Publication Co, 2016.
2. Annalyn Ng, *Data Science for the Layman*, Shroff Publishers First edition,2018.
3. Jured. P. Lander,*R for everyone*, *advance Analytics and Graphics*, Addison–Wesley, USA 2014.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	2	2	1	1	2	1
CO 2	3	3	3	3	2	2	1	1	2	1
CO 3	3	3	3	2	2	3	2	1	2	1
CO 4	3	2	3	2	2	3	2	1	2	1
CO 5	3	2	3	2	2	3	2	1	2	1
Average	3	2.6	3	2.4	2	2.6	1.6	1	2	1

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS2263	Mathematical Reasoning	SEC	3	2

This course aims at developing logical thinking and mathematical reasoning. The science of coding and decoding is a hallmark in this era of communication and networking. A logical deduction is an important tool for any sequential programming which is an essence of the present electronic era.

Course Outcomes:

At the end of the course, students will be able to

CO1: decipher codes for messages.

CO2: predict the relation with verbal reasoning.

CO3: analyze the sense of directions.

CO4: use logical deductions to verify the validity of the conclusion.

CO5: differentiate cause and effect, derive conclusions from passage.

Unit I **(9 Hours)**

Coding and Decoding – Letter decoding, Direct letter coding, Number/symbol coding – Matrix coding – Substitution – Deciphering message word codes – Deciphering number and symbol codes for messages – Jumbled coding.

Unit II **(9 Hours)**

Blood relation – Deciphering jumbled up descriptions – Relation puzzle – Coded relations.

Unit III **(9 Hours)**

Puzzle test: Classification type – Seating/placing arrangements – Comparison type – Sequential order of things – Selection based on given conditions – Family based puzzles.

Unit IV **(9 Hours)**

Logical deduction – Arguments – Assumptions – Courses of Actions – Conclusions.

Unit V **(9 Hours)**

Deriving conclusions from passages – Theme deduction – Cause and effect reasoning.

Learning Resources:

Text Book(s)

1. R.S. Aggarwal, *A Modern Approach to verbal & non-verbal reasoning*, S.chand & company Ltd., 2006.

    Unit 1: section I: 4

    Unit 2: section I: 5

    Unit 3: section I: 6

    Unit 4: section II: 1 to 5

    Unit 5: section II: 6 to 8

References

1. R.S Aggarwal, *A Modern Approach to verbal reasoning*, S. Chand & company Ltd., 2006.
2. R.S Aggarwal, *A Modern Approach to non-verbal reasoning*, S. Chand & company Ltd., 2006.
3. R.S Aggarwal, *A Modern Approach to logical reasoning*, S. Chand & company Ltd., 2006.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	1	1	1	1	2	2
CO 2	3	2	3	2	1	1	1	1	1	2
CO 3	3	3	3	2	1	1	1	1	1	2
CO 4	3	2	2	3	1	1	1	1	1	2
CO 5	3	3	3	3	1	1	1	1	1	2
Average	3	2.6	2.8	2.6	1	1	1	1	1.2	2

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT2262	LaTeX	SEC	3	2

Produce high-quality typesetting especially for mathematical text. Explore the usage of Bibliography and cross reference.

Course Outcomes:

At the end of the course, students will be able to

CO1: type set mathematical formulae using LaTeX.

CO2: use the preamble of LaTeX file to define document class and layout options

CO3: define and use new commands within LaTeX

CO4: apply BibTeX to maintain bibliographic information and to generate a bibliography for a particular document.

CO5: create a research paper and book.

Unit I **(9 Hours)**

Basics in LaTeX – Simple typesetting – Fonts – Type size – Document class - Page style – Page numbering – Parts of a document – Dividing a document.

Unit II **(9 Hours)**

Packages – Special characters – Delimiters – Matrices – Tables – Typesetting mathematics and theorems – Custom commands – New operators – Symbols – Graphics in LaTeX.

Unit III **(9 Hours)**

Table of contents – Index – Glossary – Footnotes, marginal notes and endnotes.

Unit IV **(9 Hours)**

Bibliographic databases – To do cross references using LaTeX.

Unit V **(9 Hours)**

Introduction to parts of a paper and book – Creating all the components for a paper and book.

Learning Resources:

Text Book(s)

1. Stefan Kottwitz, *LaTeX Beginner's Guide*, Published by Packt Publishing Ltd. March

2011.

Unit I **:** Chapter 2 & Chapter 3 (up to page no. 92)

Unit II **:** Chapter 5 & 8

Unit III **:** Chapter 3 (from page no. 84) & 7 (up to page no. 176)

Unit IV **:** Chapter 6 & Chapter 7 (from page no. 177)

Unit V **:** Chapter 10

References

1. *LATEX Tutorials* A PRIMER Indian TEX Users Group Trivandrum, India, 2003,
2. Tim Love, *LATEX maths and graphics,* May 11, 2012.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	3	3	3	3	3	1	1	1	1	1
CO 2	3	2	2	2	3	1	1	1	1	1
CO 3	3	3	3	2	3	1	1	1	1	1
CO 4	3	3	2	3	3	1	1	1	1	1
CO 5	3	2	3	3	3	1	1	1	1	1
Average	3	2.6	2.6	2.6	3	1	1	1	1	1

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAS2264	Mathematical Puzzles	SEC	3	2

Mathematical Puzzles is a course focusing on the techniques used in both mathematical and non-mathematical problem solving.

Course Outcomes:

At the end of the course, students will be able to

CO1: interpret arithmetic and algebraical problems.

CO2: explore geometrical problems.

CO3: explore chessboard problems.

CO4: analyse magic square problems.

CO5: explore famous puzzles of great mathematicians.

Unit I **(9 Hours)**

Money puzzles – age and kinship puzzles – clock puzzles – locomotion puzzles – digital puzzles – various arithmetical and algebraical problems.

Unit II **(9 Hours)**

Dissection puzzles – Greek cross puzzles – Various dissection puzzles – Patchwork puzzles – various geometrical puzzles.

Unit III **(9 Hours)**

Chess board problems – statistical chess puzzles – the guarded chessboard – dynamical chess puzzles – various chess puzzles.

Unit IV **(9 Hours)**

Magic square problems – subtracting – multiplying and dividing magic – magic squares of primes.

Unit V **(9 Hours)**

Cattle problems (Archimedes) - dividing the square (Diophantus) - wine problem (Diophantus) - amicable numbers (Ibn Qoarra) - Qoarra's rule - Eulers Rule - the sailors, the coconuts and the monkey (P.Dirac) - unknown address (Ramanujan).

Learning Resources:

Text Book(s)

1. Henry Earnest Dudeney, *Amusement in Mathematics*, Thomas Nelson and sons Ltd. London.

   Unit I **:** Chapter 1(Page no. 6 to 17)

   Unit II **:** Chapter 2 (Page no. 27 to 49)

   Unit III **:** Chapter 7 (Page no. 89 to 105)

   Unit IV **:** Chapter 12 (Page no. 119 to 125)

2. Miodrag S. Petkovic, *Famous Puzzles of Great Mathematicians*, American Mathematical Society, Providence Rhode Island, 2009.

   Unit V **:** Chapter 3 (Page no. 41 to 47, 52, 57)

References

1. Martin Gardner, *The Second Scientific American Book of Mathematical puzzles and diversions,* The University of Chicago Press, 1987.
2. W.W. Rouse Ball, *Mathematical Recreations and Essays*, Macmillan and Co., Limited New York. 1905.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	3	3	2	2	1	1	2	1
CO 2	3	3	3	3	2	2	1	1	2	1
CO 3	3	3	3	2	2	3	2	1	2	1
CO 4	3	2	3	2	2	3	2	1	2	1
CO 5	3	2	3	2	2	3	2	1	2	1
Average	3	2.6	3	2.4	2	2.6	1.6	1	2	1

Strong– 3 Medium– 2 Low– 1

Course Code	Name of the Course	Category	Hrs/Wk.	Credits
24MAT/MAS3261	Mathematics for Competitive Exams	SEC	3	2

This course is designed for non-major students who intent to apply for various competitive examinations. Adequate training is given so that they will overcome the fear of numbers with the required level of speed and accuracy. This will provide strategies and methods to solve problems in Mathematics section of any competitive examinations.

Course Outcomes:

At the end of the course, students will be able to

CO1: express the efficiency in dealing with multiplication and division on numbers

CO2: identify and demonstrate the use of arithmetic mean, geometric mean and harmonic mean in real life situations.

CO3: effectively use inclusion and exclusion principle for counting.

CO4: demonstrate the use of mathematical logic as a tool for solving problems

CO5: enumerate the techniques and tools in calculating measures of standard geometric objects.

Unit I **(9 Hours)**

Numbers – Divisibility – Problems on Numbers – H.C.F and L.C.M.

Unit II **(9 Hours)**

Simplification – Arithmetic Mean – Geometric Mean – Harmonic Mean.

Unit III **(9 Hours)**

Sets – Venn Diagram – Set Operations – Inclusion and Exclusion Principle.

Unit IV **(9 Hours)**

Mathematical Logic – Conjunction – Disjunction – Negation – Implications – Truth Tables – Conditional Biconditional – Tautologies and Contradictions – Disjunctive and Conjunctive Normal Forms.

Unit V **(9 Hours)**

Measures of Standard Geometric Objects.

Learning Resources:

Text Book(s)

1. R. S. Aggarwal, *Quantitative Aptitude*, S. Chand & company Ltd., Revised edition, 2008.

   Unit I **:** Chapters 1, 7 &2

   Unit II **:** Chapter 4 & 6

   Unit V **:** Chapters 24 & 25

2. Discrete Mathematics, *Schaum's outline series*, McGraw Hill, 2010.

   Unit III **:** Chapter 1(Sec 1.1 to 1.6, and 1.9)

   Unit IV **:** Chapter 4 (Sec 4.1 to 4.4, 4.8, 4.5 and 4.13)

Reference Books

1. S. Arumugam & A.Thangapandian Issac, *Statistics*, New gamma publication House, 2013.
2. Shyam Saraf and Abhilasha Swarup, Quantitative Aptitude and Reasoning, Cengage India Private Limited, 2019
3. J.P.Tremblay and R.Manohar, *Discrete Mathematical Structure with applications to computer science*, Tata McGraw - Hill, 2011.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	1	1	2	2	2	2
CO2	3	3	3	3	1	1	2	2	2	2
CO3	3	3	3	3	2	1	2	2	2	2
CO4	3	3	3	3	2	1	2	2	2	2
CO5	3	3	3	3	2	1	2	2	2	2
Average	3	3	3	3	1.6	1	2	2	2	2

Strong – 3 Medium – 2 Low – 1

Department of Mathematics (UG)

Value Added Courses

w.e.f. 2024-2025

Sem	Course Code	Course Title	Hours/Wk.	Credits
2	24MAT/MAS122V	Mathematics Behind Games	2	2
3	24MAT/MAS221V	Mathematics for RRB/SSC/TNPSC Aspirants	2	2
5	24MAT/MAS321V	Mathematics for CAT/MAT and TANCET Aspirants	2	2

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS122V	Mathematics Behind Games	Value Added Course	2	2

The objective of the course is to know the application of mathematics in various games.

Course Outcomes:

At the end of the course, students will be able to

CO1: explore mathematics is in computer game.

CO2: demonstrate Probability and statistical approach in Casino

CO3: complete Rubik's cube with minimum time using group theory.

CO4: play basketball using math concept.

CO5: Conquer Chess game with statistics and probability approach.

Unit I **(6 Hours)**

Mathematics in Computer games – Introduction – Zelda: Breath of the Wild – Geometry, Vector transformation, Path Finding – Graph Theory.

Unit II **(6 Hours)**

Maths behind Casino – Probability and Statistical approach.

Unit III **(6 Hours)**

A Mathematical approach to Solving Rubik's Cube – Group Theory.

Unit IV **(6 Hours)**

Mathematics in Sports – Basket Ball – Trigonometry and Geometry.

Unit V **(6 Hours)**

Mathematics on Chess Board - N- Queen problem – Statistics and probability.

Learning Resources:

Websites/ e-Learning Resources

1. https://nrich.maths.org/1374
2. https://personal.math.ubc.ca/~cass/courses/m308/projects/rtran/rtran.pdf
3. https://jwilson.coe.uga.edu/EMAT6680/Huffman/Mathematics%20in%20Sports/MathematicsSports.html

4. https://interestingengineering.com/culture/mathematics-behind-casino-gaming
5. https://en.wikipedia.org/wiki/Gambling_mathematics
6. https://www.hunter.cuny.edu/dolciani/Images%20and%20Files/files/workshop-powerpoints/Mathematics%20In%20Sports%20adaptation%202020%20edits.pdf
7. https://www.sciencebuddies.org/science-fair-projects/project-ideas/Sports_p064/sports-science/basketball-the-geometry-of-banking-a-basket
8. https://en.wikipedia.org/wiki/Eight_queens_puzzle
9. https://www.geeksforgeeks.org/n-queen-problem-backtracking-3/
10. https://www.ucd.ie/mathstat/t4media/18%20Febchessboard.pdf

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	3	2	2	2	2	2	1
CO2	3	3	2	3	2	2	2	1	2	2
CO3	3	3	2	2	3	3	1	2	1	1
CO4	3	2	2	2	2	3	2	2	2	1
CO5	3	3	2	3	3	3	1	1	3	2
Average	3	2.6	2	2.6	2.4	2.6	1.6	1.6	2	1.4

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS221V	Maths for RRB/SSC/TNPSC	Value Added Course	2	2

The objective of the subject is to prepare students for the quantitative aptitude and reasoning sections of various competitive exams, such as the Railway Recruitment Board (RRB), Staff Selection Commission (SSC), and Tamil Nadu Public Service Commission (TNPSC) exams.

Course Outcomes:

At the end of the course, students will be able to

CO1: perform arithmetic with whole numbers, fractions and decimals.

CO2: simplify mathematical expressions and equations, calculate percentages, and compute HCF.

CO3: solve ratio problems and apply proportional reasoning in various contexts.

CO4: compute simple and compound interest and determine the principal, rate in financial problems.

CO5: calculate area and volume of various geometric shapes and apply these calculations to real-world contexts.

Unit I **(6 Hours)**

Numbers: Whole Numbers – Prime and Composite Numbers – Prime Factorization – Fractions and Decimals.

Unit II **(6 Hours)**

Simplification – Percentage – Highest Common Factor (HCF) – Lowest Common Multiple (LCM).

Unit III **(6 Hours)**

Ratio and Proportion – Time and Work.

Unit IV **(6 Hours)**

Simple Interest – Compound Interest.

Unit V **(6 Hours)**

Area – Volume and Surface Area.

Learning Resources:

Text Books(s)

1. R.S. Aggarwal, *Quantitative Aptitude*, S. Chand & company Ltd, 2008.

   Unit I : Chapter 1 and 3

   Unit II : Chapter 2, 4 and 11

   Unit III : Chapter 13 and 17

   Unit IV : Chapter 22 and 23

   Unit V : Chapter 24 and 25

References

1. Oswaal, *Objective Quantitative Aptitude*, Oswaal Books & Learning Pvt. Ltd., 2023.

Websites/ e-Learning Resources

https://www.youtube.com/watch?v=J2dde2VG4rI

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	3	2	2	2	2	2	2	3
CO 2	3	3	3	3	2	2	2	1	2	3
CO 3	3	3	3	3	2	3	2	2	2	3
CO 4	3	2	3	2	2	3	2	2	2	2
CO 5	3	3	3	3	2	3	2	1	2	2
Average	3	2.8	3	2.6	2	2.6	2	1.6	2	2.6

Strong – 3 Medium – 2 Low – 1

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MAT/MAS321V	Mathematics for CAT, MAT and TANCET Examinations	Value Added Course	2	2

This course will enable the students to develop their quantitative skills that strengthen their edge over others in MAT, CAT and TANCET examinations.

Course Outcomes:

At the end of the course, students will be able to

CO1: express the efficiency in dealing with numbers and progressions.

CO2: identify and demonstrate the use of average and alligations.

CO3: demonstrate the use of percentage as a tool for solving problems.

CO4: effectively use ratio, proportion, variation, time, distance and work.

CO5: identify the rules governing permutation, combination and logarithms and solve simple problems.

Unit I **(6 Hours)**

Numbers – Problem on numbers – progression.

Unit II **(6 Hours)**

Average – Alligations.

Unit III **(6 Hours)**

Percentage – Profit and loss – Simple and compound interest.

Unit IV **(6 Hours)**

Ratio proportion and variation – Time, work and distance.

Unit V **(6 Hours)**

Logarithms – Permutation and combination – Probability.

Learning Resources:

Text Books

1. Arun Sharma, *How to prepare for Quantitative aptitude for the CAT examination*, Tata McGraw Hill Education Private Limited, 2011.
   (**Chapters 1 to 17**) (**Theory Only**)

2. S. Ramasamy, *Q-Bank*, Sura's Publications 2024. (**Problems Only**)
3. *MAT 13+solved papers yearwise*, Learn Publications Seventh Edition 2024. (**Problems Only**)

References

1. Nishit K. Singha, *The Pearson guide to the Quantitative aptitude for CAT*, Dorling Kindersley Pvt. Ltd. India, 2007.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	2	2	3	2	2	1	1	1	1	1
CO 2	2	1	2	3	2	2	1	1	1	1
CO 3	2	1	3	1	2	1	1	1	1	1
CO 4	1	1	2	1	2	1	1	1	1	1
CO 5	1	2	3	1	2	1	1	1	1	1
Average	2	1	3	2	2	1	1	1	1	1

Strong – 3 Medium – 2 Low – 1