ALAGAPPA UNIVERSITY, KARAIKUDI
NEW SYLLABUS UNDER CBCS PATTERN FOR AFFILIATED COLLEGES WITH
EFFECT FROM THE ACADEMIC YEAR 2022-2023 ONWARDS

B.Sc. MATHEMATICS
Programme Structure

Sem.	Part	Course Code	Courses	Title of the Paper	T/P	Credit	Hours/ Week	Max. Marks		
								Int.	Ext.	Total
I	I	2211T	T/OL	Tamil/Other Languages-I	T	3	6	25	75	100
	II	712CE	E	Communicative English -I	T	3	6	25	75	100
	III	22BMA1C1	CC	Differential Calculus and Trigonometry	T	5	5	25	75	100
		22BMA1C2	CC	Classical Algebra	T	4	4	25	75	100
		-	AL-IA	Statistics – I (or) Physics/ Chemistry / Computer Science	T	3	3	25	75	100
		-	AL-IA	Practical- Respective Allied Theory Course	P	2	2	40	60	100
	IV	22BVE1	SEC -I	Value Education	T	2	2	25	75	100
				Library			2			
				Total		22	30	190	510	700
II	I	2221T	T/OL	Tamil/Other Languages-II	T	3	6	25	75	100
	II	722CE	E	Communicative English - II	T	3	6	25	75	100
	III	22BMA2C1	CC	Analytical Geometry and Vector Calculus	T	5	5	25	75	100
		22BMA2C2	CC	Integral Calculus	T	4	4	25	75	100
		-	AL-IB	Statistics – II (or) Physics/ Chemistry /Computer Science	T	3	3	25	75	100
		-	AL-IB	Practical- Respective Allied Theory Course	P	2	2	40	60	100
	IV	22BES2	SEC-II	Environmental Studies	T	2	2	25	75	100
				Library			2			
				Total		22	30	190	510	700
III	I	2231T	T/OL	Tamil/Other Languages-III	T	3	6	25	75	100
	II	2232E	E	English for Enrichment-I	T	3	6	25	75	100
	III	22BMA3C1	CC	Differential Equations	T	5	5	25	75	100
		22BMA3C2	CC	Abstract Algebra	T	4	4	25	75	100
		-	AL-IIA	Statistics – I (or) Physics/ Chemistry /Computer Science	T	3	3	25	75	100
		-	AL-IIA	Practical- Respective Allied Theory Course	P	2	2	40	60	100
	IV	22BE3	SEC-III	Entrepreneurship	T	2	2	25	75	100
		-	NME-I	Adipadai Tamil AdvanceTamil IT Skills for Employment/MOOC'S	T	2	2	25	75	100
				Total		24	30	215	585	800
	I	2241T	T/OL	Tamil/Other Languages -IV	T	3	6	25	75	100
	II	2242E	E	English for Enrichment-II	T	3	6	25	75	100
		22BMA4C1	CC	Sequences and Series	T	4	4	25	75	100
		22BMA4C2	CC	Linear Algebra	T	4	4	25	75	100

		22BMA4C3	CC	Transform Techniques	T	3	3	25	75	100
	III	-	AL-IIB	Statistics – II (or) Physics/ Chemistry / Computer Science	T	3	3	25	75	100
IV		-	AL-IIB	Practical- Respective Allied Theory	P	2	2	40	60	100

				Course	T					
	IV	-	NME-II	Adipadai Tamil AdvanceTamil Small Business Management/MOOC'	T	2	2	25	75	100
				Total		**24**	**30**	**215**	**585**	**800**
V	III	22BMA5C1	CC	Real Analysis	T	4	5	25	75	100
		22BMA5C2	CC	Graph Theory	T	4	5	25	75	100
		22BMA5C3	CC	Operations Research - I	T	4	4	25	75	100
		22BMA5C4	CC	Numerical Analysis	T	4	4	25	75	100
		22BMA5P1/ 22BMA5P2	CC	Practical-I – Choose any ONE (A) A Practical Approach to Optimization Techniques (B) MS Office with Lab	P	4	5	40	60	100
		22BMA5P3/ 22BMA5P4	CC	Practical-II - Choose any ONE (A) An Algorithmic Approach in Numerical Analysis (B) LaTex	P	4	5	40	60	100
				Career development/employability skills			2			
				Total		**24**	**30**	**180**	**420**	**600**
VI	III	22BMA6I		Internship		**24**	**30**	**150**	**250**	**400**
				Or						
		22BMA6E1		Complex Analysis	T	6	6	25	75	100
		22BMA6E2		Operations Research - II	T	6	6	25	75	100
		22BMA6E3	DSE	Mechanics	T	6	6	25	75	100
		22BMA6E4		Number Theory	T	6	6	25	75	100
				Library/ Yoga etc			2			
				Career development/employability skills/Fieldtrip		-	4	-	-	
						24	**30**	**100**	**300**	**400**
				Or						
		22BMA6PR		Project		6	10	25	75	100
		22BMA6E1		Complex Analysis	T	6	6	25	75	100
		22BMA6E2		Operations Research -II	T	6	6	25	75	100
		22BMA6E3		Mechanics	T	6	6	25	75	100
			others	Library/Yoga /Career development /employability skills/Field trip etc.			2			
				Total		**24**	**30**	**100**	**300**	**400**
				Grand Total		**140**	**--**	**--**	**--**	**4000**

Sem.	Part	Course Code	Title of the Paper	Credit	Hours/ Week	Max. Marks		
						Int.	Ext.	Total
I	III	71BEPP	Professional English for Physical Science-I	4	5	25	75	100
II		72BEPP	Professional English for Physical Science-II	4	5	25	75	100
III		*	Professional English for Physical Science-III	4	5	25	75	100
IV			Professional English for Physical Science-IV	4	5	25	75	100

*The Syllabus of Professional English for III & IV Semester will be provided after Receiving the syllabus from TANSCHE.

As per TANSCHE, the Professional English book will be taught to all four streams apart from the existing hours of teaching/additional hours of teaching (1hour/day) as a 4 credit paper as an add on course on par with Major paper and completion of the paper is a must to continue his/her studies further.

- TOL-Tamil/Other Languages,
- E–English
- CC-Core course–Core competency, critical thinking, analytical reasoning, research skill & teamwork
- Allied –Exposure beyond the discipline
- AECC—Ability Enhancement Compulsory Course(Professional English & Environmental Studies) -Additional academic knowledge, psychology and problem solving etc.,
- SEC-Skill Enhancement Course-Exposure beyond the discipline (Value Education, Entrepreneurship Course, Computer application for Science etc.,
- NME -Non Major Elective–Exposure beyond the discipline
- DSE– Discipline specific elective –-Student choice– either or
  - Internship
  - If internship–Marks = Internal = 150 (75+75) two midterm evaluation through Viva voce and External = 250 marks (Report = 150+VivaVoce =100) = Total 400 marks
  - Theory papers or
  - Project +3 theory papers.
- MOOCs– Massive Open Online Courses.
- T- Theory, P- practical

Semester - I					
Course code: 22BMA1C1	**Core Course - I** **DIFFERENTIAL CALCULUS AND TRIGONOMETRY**		**T/P** T	**C** 5	**H/W** 5
Objectives	➢ To find the rate of change of a quality with respect to other. ➢ To understand the concepts of differential calculus in depth. ➢ To analyze the behavior of various curves.				
Unit -I	Successive differentiation – Expansion of functions - Leibnitz formula – Max and Min of function of two variables.				
Unit-II	Sub tangent and Subnormal – Polar coordinates - Angle between the tangents - Slope of the tangent –Angle of intersection of two curves.				
Unit- III	Envelopes – Curvature – Circle, Radius and Centre of Curvature – Evolutes.				
Unit- IV	Application of DeMovire's Theorem – Expansions of sin $n\theta$, cos $n\theta$, tan $n\theta$ - Expansions of $\sin\theta$ and $\cos\theta$ in ascending powers of θ – Expansions of $sin^n\theta$ and $cos^n\theta$ interms of multiple angles				
Unit -V	Hyperbolic functions – Inverse hyperbolic functions.				

Textbooks

Narayanan, S., & Manicavachagom Pillay, T.K. (2015). *Calculus (Vol. I)*. S.Viswanathan (Printers and Publishers) Pvt. Ltd.

Narayanan, S., & Manicavachagom Pillay, T.K. (2009). *Trigonometry*. S.Viswanathan (Printers and Publishers) Pvt. Ltd.

Reference Books

Arumugam, S., & Thangapandi Isaac, A. (2014). *Calculus* (Vol. I). Palayamkottai: New Gamma Publishing House.

Venkataraman, M. K., & Manorama, S. (2001). *Calculus & Fourier Series*. Chennai: The National Publishing Company.

Outcomes	Students will be able to ➢ Find maxima and minima of function of two variables. ➢ Expand $cos^n\theta$, $sin^n\theta$ and $tan^n\theta$ in terms of θ.

Semester - I				
Course code:	Core Course - II	T/P	C	H/W
22BMA1C2	**CLASSICAL ALGEBRA**	T	4	4
Objectives	➢ To study the Relations between the roots and coefficients of equations. ➢ To understand the concepts of Various Inequalities and Series.			
Unit -I	Theory of Equations: – Relation between roots and coefficients – Symmetric functions of roots – Formation of equation – Transformation of equation.			
Unit-II	Reciprocal equation – Descartes' rule of signs – Diminishing and Increasing the roots – Newton's method of divisors – Horner's method.			
Unit- III	Inequalities: – A.M., G.M., H.M. and Applications – Cauchy Schwartz Inequality – Weierstrass Inequality.			
Unit -IV	Binomial, Exponential and Logarithmic series			
Unit -V	Summation of Series – Approximations			

Textbooks

Manicavachagom Pillay, T.K., Natarajan, T., & Ganapathy, K.S. (2013). *Algebra* (Vol I). S.Viswanathan Printers and Publishers Pvt. Ltd.

Manicavachagom Pillay, T.K., Natarajan, T., & Ganapathy, K.S. (2013). *Algebra* (Vol II). S.Viswanathan Printers and Publishers Pvt. Ltd.

Reference Books

Arumugam, S., & ThangapandiIssac. A. (2011). *Theory of Equations, Theory of Numbers and Trigonometry*. Palayamkottai: New Gamma Publishing House.

Venkataraman, M. K., & Manoramma, S. (2002). *Theory of Equations, Theory of Numbers and Inequalities*. Chennai: The National Publishing Company.

Outcomes	Students will be able to ➢ Describe the relation between roots and coefficients. ➢ Transform the equation through roots multiplied by a given number. ➢ Solve the reciprocal equations.

Semester - II				
Course code: 22BMA2C1	**Core Course - III** **ANALYTICAL GEOMETRY AND VECTOR CALCULUS**	**T/P** T	**C** 5	**H/W** 5
Objectives	➢ To introduce the concept of three dimensional coordinate geometry in depth. ➢ To understand the concept of vector integration, gradient and volume integral.			
Unit -I	Intersection of two lines - Coplanar lines – Angle between a line and a plane - Length of perpendicular from a point to a line – Shortest distance - Distance between two skew lines			
Unit-II	Sphere: Equation of a sphere in various forms – Tangent line and tangent plane - Section of a sphere and problems.			
Unit- III	Cone: Equation of a cone in various forms, simple problems - Cylinder: Equation of right circular cylinder, simple problems			
Unit -IV	Vector differentiation – Gradient, Curl, Divergence, Vector identities and problems			
Unit- V	Vector integration – Line integral – Surface integral - Volume integral - Green's Theorem, Stokes theorem, Gauss's Theorem (Statements and verification only).			

Textbook

Arumugam, S., & ThangaPandi Isaac, A. (2014). *Analytical Geometry of 3D and Vector Calculus.* Palayamkottai: New Gamma Publishing House

Reference Books

Manicavachagom Pillay, T.K., & Natarajan, T. (2001). *A text book of Analytical Geometry Part II – Three Dimensions*. S.Viswanathan (Printers and Publishers) Pvt. Ltd.

Venkataraman, M.K., &Manorama, S. (2001). *Analytical Geometry 3D and Vector Calculu*s. Chennai: National Publishing Company.

Narayanan, S., & Manicavachagom Pillay, T.K. (1997). *Vector Calculus*. S.Viswanathan (Printers and Publishers) Pvt. Ltd.

Outcomes	Students will be able to ➢ Describe the various forms of equation of a Plane, Straight line, Sphere, Cone and Cylinder. ➢ Find the angle between planes, Bisector planes, Perpendicular distance from a point to a plane, Image of a line on a plane and Intersection of two lines ➢ Compute the angle between a line and a plane and length of perpendicular from a point to a line.

Semester - II					
Course code:	**Core Course - IV**		**T/P**	**C**	**H/W**
22BMA2C2	**INTEGRAL CALCULUS**		**T**	**4**	**4**
Objectives	➢ To evaluate integration of irrational functions and improper integrals. ➢ To understand the concepts of double and triple integration.				
Unit -I	Definite Integrals and their properties.				
Unit-II	Reduction formula for $\sin^n x$, $\cos^n x$, $\tan^n x$, $\sin^m x \cos^n x$ – Bernoulli's formula.				
Unit -III	Double integrals – Change of variables – Jacobian.				
Unit- IV	Triple integrals.				
Unit -V	Beta and Gamma Integrals – Properties and Problems.				

Textbooks

Narayanan, S., & Manicavachagom Pillay, T.K. (2016). *Calculus* (Vol.II). S.Viswanathan Printers and Publishers Pvt. Ltd.

Narayanan, S., & Manicavachagom Pillay, T.K. (2004). *Calculus* (Vol.III). S.Viswanathan Printers and Publishers Pvt. Ltd.

Reference Books

Narayanan, S. *(2012). Integral Calculus.* S.Chand & Co.

Venkataraman, M.K., & Manorama, S. (2001). *Calculus and Fourier series*. Chennai: The National Publishing Company.

Outcomes	Students will be able to ➢ Explain properties of Beta functions. ➢ Solve Basic Integral Calculus problems. ➢ Explain properties of definite integrals. ➢ Prove reduction formulae and solve some problems by using this formula. ➢ Evaluate double and triple integrals.

	Semester - III			
Course code:	**Core Course - V**	**T/P**	**C**	**H/W**
22BMA3C1	**DIFFERENTIAL EQUATIONS**	**T**	**5**	**5**
Objectives	➢ To gain logical skills in the formation of differential equations. ➢ To expose students to use differential equations as a powerful tool in problem solving and to inculcate the application of differential equation in real world problems.			
Unit -I	Exact Differential Equations – Conditions for equation to be exact –Working rule for solving it and problems – Equations of the first order but of higher degree – Equations solvable for p, x, y, Clairaut's form – Equations that do not contain (i) x explicitly (ii) y explicitly – Equations homogenous in x and y – Linear Equation with constant coefficients.			
Unit-II	Linear equations with variable coefficients – Equations reducible to the linear equations – Simultaneous Differential Equations – First order and first degree – Simultaneous linear Differential Equations.			
Unit III	Linear equations of the Second order – Complete Solution given a known integral – Reduction to Normal form – Change of the independent variable – Variation of parameters			
Unit IV	Linear equations of second order with variable coefficients - Total Differential Equations – Necessary and Sufficient condition of integrability of Pdx + Qdy + Rdz = 0, Rule for solving it.			
Unit V	Partial Differential Equations of the First order – Classifications of Integrals – Derivations of Partial Differential Equations – Special methods – Standard forms – Charpit's method.			

Textbook

Narayanan, S., & Manicavachagom Pillay, T.K. (2015). *Differential Equations and its Applications*. S.Viswanathan (Printers and Publishers) Pvt. Ltd.

Reference Books

Arumugam, S., & Thangapandi Issac, A. (2014). *Differential Equations and its Applications*. Palayamkottai: New Gamma Publishing House.

Venkatraman, M.K. (1985). *Engineering Mathematics*. S.V. Publications.

Outcomes	Students will be able to ➢ Extract the solution of differential equations of the first order and of the first degree by variables separable, Homogeneous and Non-Homogeneous methods. ➢ Find a solution of differential equations of the first order and of a degree higher than the first by using methods of solvable for p, x and y. ➢ Compute all the solutions of second and higher order linear differential equations with constant coefficients, linear equations with variable coefficients. ➢ Solve simultaneous linear equations with constant coefficients and total differential equations.

Semester - III					
Course code:	**Core Course - VI**		**T/P**	**C**	**H/W**
22BMA3C2	**ABSTRACT ALGEBRA**		**T**	**4**	**4**
Objectives	➢ To develop an understanding of fundamental algebraic structures. ➢ To introduce the structure and characteristics of groups and rings.				
Unit -I	Groups: Definition and Examples – Elementary Properties of a Group – Equivalent Definitions of a Group – Permutation Groups – Definitions and examples.				
Unit-II	Subgroups – Cyclic Groups – Order of an Element – Cosets and Lagrange's Theorem.				
Unit- III	Normal Subgroups and Quotient Groups – Isomorphism – Homomorphism.				
Unit- IV	Rings: Definitions and Examples – Elementary properties of rings – Isomorphism – Types of Rings – Characteristic of a ring – Subrings.				
Unit -V	Ideals – Quotient rings – Integral Domain - Homomorphism of rings.				

Textbooks

Arumugam, S., & Thangapandi Issac, A. (2003). *Modern Algebra.* Chennai: SciTech Publications Pvt. Ltd.

Khanna, V. K., & Bhambri, S.K. (2017). *A Course in Abstract Algebra* (Unit – IV & Unit – V). Vikas Publishing House Pvt. Ltd.

Reference Books

Herstein, N. (1975). *Topics in Algebra*. (Student 2nd edition). John Wiley India Pvt. Ltd.

Vasishta, A.R., &. Vasishtha, A.K. (2015). *Modern Algebra*. Meerut: Krishna Prakashan Mandhir Media Pvt. Ltd.

Outcomes	Students will be able to ➢ Define subgroup, Center, Normalizer of a subgroup. ➢ Find cycles and transpositions of a given permutations. ➢ Prove Lagrange's theorem, Euler's theorem and Fermat's theorem. ➢ Define normal subgroups, quotient groups and index of a subgroup. ➢ Understanding the concept of the rings and integral domain.

Semester - IV					
Course code: 22BMA4C1	**Core Course - VII**		**T/P**	**C**	**H/W**
	SEQUENCES AND SERIES		**T**	**4**	**4**
Objectives	➢ To understand the concept of convergence of a real sequence. ➢ To discuss the techniques of testing the behavior of infinite series.				
Unit -I	Sequences: Definition and examples for Sequences, Convergence, Divergence. Oscillation, Monotonic and Bounded sequences, Subsequence and Cauchy sequence. Theorems on Algebra of Limits.				
Unit-II	Theorems on Monotonic sequence – Theorem on Cauchy sequence - Cauchy general Principle of convergence - Behavior of Geometric sequence.				
Unit- III	Infinite series: Series of positive terms - Cauchy's General Principle of Convergence - Comparison test – Harmonic series.				
Unit- IV	Kummer's test – Raabe's test – D' Alembert's ratio test – Cauchy's root test – Gauss test and Problems.				
Unit- V	Cauchy Condensation test – Cauchy's integral test - Alternating series – Absolute convergence – Conditionally convergence (Theorems) - Leibnitz's test and Problems.				

Textbook

Arumugam, S., & ThangapandiIssac, A. (2015). *Sequences and Series*. Palayamkottai: New Gamma Publishing House.

Reference Book

Manicavachagom Pillay, T.K., Natarajan, T., & Ganapathy, K.S. (1999). *Algebra* (Vol. I). S. Viswanathan (Printers and Publishers) Pvt. Ltd.

Outcomes	Students will be able to ➢ Understand different types of sequence. ➢ Discuss the behavior of the geometric sequence. ➢ Prove properties of convergent and divergent sequence. ➢ Verify the given series is convergent or divergent by using different tests.

Semester - IV					
Course code: 22BMA4C2	**Core Course - VIII**		**T/P**	**C**	**H/W**
	LINEAR ALGEBRA		**T**	**4**	**4**
Objectives	➢ Intended to develop an understanding of linear algebraic structures. ➢ To understand of the concept of linear transformations and their matrix representation.				
Unit -I	Vector Spaces – Definition and examples – Subspaces – Linear Transformation – Span of a set.				
Unit-II	Linear Independence – Basis and Dimension – Rank and Nullity.				
Unit- III	Matrix of a Linear Transformation – Inner Product Space – Definition and examples – Orthogonality – Orthogonal complement.				
Unit- IV	Algebra of Matrices – Types of Matrices – The inverse of a matrix – Elementary Transformations – Rank of a Matrix– Simultaneous Linear Equations.				
Unit- V	Characteristic Equation and Cayley – Hamilton theorem - Eigen Values and Eigen Vectors - Bilinear forms – Quadratic forms.				

Textbook

Arumugam, S., &ThangapandiIssac, A. (2003). *Modern Algebra*. Chennai: SciTech Publications (India) Pvt. Ltd.

Reference Books

Sharma, J. N., & Vashistha, A. R. (1981). *Abstract Algebra.* Meerut: Krishna Prakasam Mandir.

Vasistha, A.R. (2019). *Modern Algebra*. Meerut: Krishna Prakashan Publication.

Outcomes	Students will be able to ➢ Critically analyze and construct mathematical arguments that relate to the study of introductory linear algebra. ➢ Use computational techniques and algebraic skills essential for the study of systems of linear equations matrix algebras, vector spaces, Eigen values, Eigen vectors, orthogonality and diagonalization.

Semester - IV				
Course code: 22BMA4C3	**Core Course - IX** **TRANSFORM TECHNIQUES**	**T/P** T	**C** 3	**H/W** 3
Objectives	➤ To introduce the concept on Laplace, Fourier and Z – transform of different functions. ➤ To learn the application of Laplace transform to solve Differential Equations and Z – transform to solve Different equations.			
Unit -I	Laplace Transform – Definition – Laplace Transform of Standard functions — Laplace Transform of Periodic functions.			
Unit-II	Inverse Laplace Transforms – Standard formulae – Solving Ordinary Differential Equations with constant coefficients - Variable coefficients and simultaneous linear equations using Laplace Transform.			
Unit- III	Fourier Series – Definition – To find the Fourier coefficients of Periodic functions of period 2π.			
Unit- IV	Fourier Transforms – Complex form of Fourier Integral Formula – Fourier Integral theorem –Fourier Sine and Cosine.			
Unit -V	Z Transforms – Definition – Properties – Z Transforms of some basic functions and Problems – Inverse Z Transforms – Methods to find the inverse Z Transform.			

Textbooks

Narayanan, S., & ManicavachagomPilla, T.K. (2014). *Calculus* (Vol. III). S.Viswanathan (Printers and Publishers) Pvt. Ltd.

Veerarajan, T. (2004). *Engineering Mathematics*. New Delhi: Tata McGraw Hill Publishing Company Limited.

Reference Books

Singaravelu, A. (2015). *Transforms and Partial Differential Equations.* Chennai: MeenakshiAgency.

Vittal, P.R. (2000). *Differential Equations*, *Fourier and Laplace Transforms, Probability*. Margham Publications.

Outcomes	Students will be able to ➤ Ability to compute the Fourier series of the function with one variable. ➤ Understand the nature of the Fourier series that represent even and odd functions. ➤ Understand the concepts of Fourier transforms to the real world problems of circuit analysis and control system design. ➤ Apply z-transforms to solve the difference equations.

Semester - V					
Course code: 22BMA5C1	**Core Course- X**		**T/P**	**C**	**H/W**
	REAL ANALYSIS		**T**	**4**	**5**
Objectives	➢ To enhance the knowledge of abstract mathematics on the real line. ➢ To introduce the concepts for understanding and analyzing mathematics on the metric space.				
Unit -I	Countable and Uncountable sets – Metric spaces – Definition and examples – Bounded sets in a metric space – Open Ball in a metric space – Open sets.				
Unit-II	Subspace – Interior of a set – Closed sets – Closure – Limit point – Dense sets – Complete Metric Space.				
Unit- III	Continuity – Homeomorphism – Uniform continuity.				
Unit- IV	Connectedness – Definition and examples – Connected subsets of R – Connectedness and Continuity.				
Unit- V	Compact Metric spaces – Compact subsets of R - Compactness and Continuity.				
Textbook Arumugam, S., & Thangapandi Issac, A. (2015). *Modern Analysis*. Palayamkottai: New Gamma Publishing House.					
Reference Books					
Goldberg, R.R. (2017). *Methods of Real analysis*. New Delhi: IBM Publishing.					
Rudin, W. (2012). *Principles of Mathematical Analysis*. Singapore: McGraw-Hill International Editions.					
Outcomes	Students will be able to ➢ Learn the concepts for understanding and analyzing abstract mathematics on the matric space. ➢ Acquire the knowledge of real functions, limit of functions and their properties.				

Semester - V					
Course code: 22BMA5C2	**Core Course- XI**		**T/P**	**C**	**H/W**
	GRAPH THEORY		**T**	**4**	**5**
Objectives	➢ To introduce basic concept of graph theory. ➢ To develop theoretical aspects of graph theory. ➢ To apply graph theory based tools in solving practical problems.				
Unit -I	Definition and examples – Subgraphs – Isomorphism – Ramsey Numbers – Independent sets – Coverings - Intersection graphs – Line graph - Matrices – Degree sequences – Graphic sequences.				
Unit-II	Walks, trials, paths – Connectedness and Components – Bipartite graph – Cut point – Bridge - Trees – Characterization of trees – Center of a tree.				
Unit- III	Planarity – Euler's formula – Characterization of planar graphs - Thickness, Crossing Number and outer planarity.				
Unit- IV	Chromatic number – Chromatic Index – Five colour theorem – Four colour problem - Chromatic polynomials and their properties.				
Unit- V	Directed graphs – Connectivity in digraph - Strong orientation graphs – Tournaments.				

Textbooks

Arumugam. S., & Ramachandran, S. (2001). *Invitation to Graph Theory*. Scitech Publications (India) Pvt. Ltd.

Choudam, S.A. (2019). *A first course in Graph Theory*. Laxmi Publications Pvt. Ltd. (Unit – V)

Reference Books

Balakrishnan, R., & Ranganathan, K. (2007). *A Text Book of Graph Theory*. New Delhi: Ane Books India.

Clark, J., & Holton, D.A. (2005). *A First Look at Graph Theory*. New Delhi: Allied Publishers.

Harary, F. (2001).*Graph Theory*. Narosa Publishing Company.

Narasingh, D. (1974).*Graph Theory with Applications to Engineering and Computer Science* New Delhi: Prentice Hall of India.

Outcomes	Students will be able to ➢ Understand fundamental definitions of graph theory. ➢ Learn a clear perspective of solving real life problems using graph theory. ➢ Use a combination of theoretical knowledge and independent mathematical thinking for creative research in graph theory.

Semester - V					
Course code:	**Core Course- XII**		**T/P**	**C**	**H/W**
22BMA5C3	**OPERATIONS RESEARCH - I**		**T**	**4**	**4**
Objectives	➢ To formulate linear programming problem for simple mathematical models. ➢ To develop mathematics skills to analyse and solve linear programming problems in a wide range of applications.				
Unit -I	Linear Programming problem – Mathematical formulation of the problem – Illustration on Mathematical formulation of linear programming problems – Graphical solution method – Some exceptional cases – General linear programming problem – Canonical and Standard forms of L.P.P – Simplex method.				
Unit-II	Use of Artificial variables (Big M method) – Two Phase method - Duality in linear programming – General primal and dual pair – Formulating a Dual problem – Primal–Dual pair in matrix form – Duality Theorems – Complementary Slackness Theorem – Duality and Simplex method – Dual simplex method.				
Unit -III	Introduction – L.P. formulation of T.P. – Existence of solution in T.P. – The Transportation table – Loops in T.P. – Solution of a Transportation problem – Finding an initial basic Feasible solution (NWCM – LCM – VAM) – Degeneracy in TP – Transportation Algorithm (MODI Method) – Unbalanced T.P – Maximization T.P.				
Unit -IV	Assignment problem – Introduction – Mathematical formulation of the problem – Test for optimality by using Hungarian method – Maximization case in Assignment problem.				
Unit- V	Sequencing problem – Introduction – Problem of sequencing – Basic terms used in Sequencing– n jobs to be operated on two machines – n jobs to be operated on K machines.				

Textbook

  Swarup, K., Gupta, P.K., & Mohan, M. (2008). *Operations Research*. New Delhi: Sultan Chand & Sons.

Reference Books

  Gupta, P.K., & Hira, D.S. (2004). *Operations Research*. New Delhi: S.Chand & Co.

  Taha, H.A. (2017). *Operations Research–An Introduction*. Pearson Prentice Hall.

Outcomes	Students will be able to ➢ Develop a general understanding of the operation research methodology to decision making. ➢ Identify best techniques to solve a specific problem in linear model of operation research.

Semester - V				
Course code: 22BMA5C4	**Core Course- XIII**	**T/P**	**C**	**H/W**
	NUMERICAL ANALYSIS	**T**	**4**	**4**
Objectives	➢ To expose the students to various tools in solving numerical problems. ➢ To prepare the students for competitive examinations like GATE, CSIR-NET, SLET, etc.			
Unit -I	Solution of Algebraic and Transcendental equations – Introduction, Bisection Method - Iteration Method - Method of False Position - Newton Raphson Method.			
Unit-II	Interpolation: Finite differences – Forward differences - Backward differences - Central differences - Symbolic relations - Newton's formula for Interpolation – Interpolation with unevenly spaced points – Lagrange's Interpolation formula.			
Unit- III	Numerical Differentiation and Integration – Introduction, Numerical Differentiation – Cubic Spline method – Maximum and Minimum values of a tabulated function - Numerical Integration – Trapezoidal Rule and Simpson's 1/3 and 3/8 rules.			
Unit- IV	Matrices and Linear system of Equations – Gaussian Elimination Method - Modification of the Gauss Method to compute the inverse – Iterative Method – Jacobi and Gauss Seidal Methods.			
Unit- V	Numerical Solutions of Ordinary Differential Equations – Solution by Taylor Series - Picard's Method of Successive Approximations - Runge – Kutta Methods.			
Textbook Sastry, S.S. (2012). *Introductory Methods of Numerical Analysis*. New Delhi: PHI Learning Pvt. Ltd. **Reference Books** Kandasamy, P., Thilagavathy, K.,& Gunavathy, K.(2008).*Numerical Methods*. S.Chand Publications. Arumugam, S., ThangapandiIssac, A., & Somasundaram, A. (2013). *Numerical Analysis with Programming in C.* Palayamkottai: New Gamma Publishing House.				
Outcomes	Students will be able to ➢ Learn a sufficient exposure in constructing difference tables and to use newton's forward and backward formula for interpolation in equal intervals. ➢ Understand the numerical integration by using trapezoidal and Simpson's rule.			

	SEMESTER V			
Course Code	**Core Practical – I(A)**	**T/P**	**C**	**H/W**
22BMA5P1	**A PRACTICAL APPROACH TO OPTIMIZATION TECHNIQUE**	**P**	**4**	**5**
Objectives	➢ To enlighten the students in the field of operations research. ➢ To train the students to apply OR techniques in business and management problems			

Linear Programming Problems
1. Formulate a real life situation into an LPP and solve it using graphical method.
2. Formulate a real life situation into an LPP and solve it by selecting the appropriate method among simplex method, two phase simplex method, Big-M method and duality. Explain why you choose this method to solve this problem.
3. Solve LPP with unrestricted variables.

Transportation Problems
4. Explain Modified Distribution method for obtaining optimum solution to the given transportation problem. Solve a TP using this method.
5. Solve a transportation problem with prohibited route.
6. Solve a transportation problem with maximization objective.

Assignment Problems
7. Explain Hungarian algorithm for solving assignment problem and apply this algorithm to solve an assignment problem with maximization objective.
8. Solve an assignment problem with restricted assignment, that is, restrict to condition.
9. Solve an assignment problem with condition assignment, that is, facilitative condition.
10. Formulate a Crew assignment problem into an AP and solve it.

Outcomes	Students will be able to ➢ Acquire knowledge about the transportation and assignment problems. ➢ Understand to solve real life oriented problems.

Tutor's Guide

- All the Questions can be solved by applying the concepts through the pen and paper mode. (Solving through computer is not necessary for this paper, but if students are interested then they can do on their own).
- For Question: 1, select a problem with atleast 4 constraints.
- For Question: 2, Practice atleast three problems in each case.
- Practice atleast three problems for all 10 questions in the observation notebook.
- Write exactly one problem for all questions from the observation notebook with your own choice from the three.

Guide to write the record notebook

- For Questions 1 to 10 write the formulation and the algorithm of the method used in the right hand side page of the record notebook; solution of particular problem in the left hand side page of the record notebook.
- Write the objective of the problem first, then write the mathematical formation if any, then write the algorithm used as said in the previous point, finally write the solution as result.

Semester - V					
Course code: 22BMA5P2	**Core Practical – I(B)**		**T/P**	**C**	**H/W**
	MS OFFICE WITH LAB		**P**	**4**	**5**
Objectives	➢ To develop the knowledge of computer. ➢ To know the importance of Word, Excel and Power Point.				
Unit -I	MS Word introduction - Word for Windows – Creating a Document - Changing the Format Text – Cut, Copy, Paste - Advanced format (borders, tables, pictures) - Define Document and Tool - Saving your Work - Setting your Page - Preview the Document.				
Unit-II	MS Word's Master Document - Find and Replace - Define Template Styles - Toolbars - Headers and Footers - Spelling Check - Grammar Check, Hyphenation - Auto Correct - Bullets and Numbers - Table Creation - Mail Merge.				
Unit- III	MS Excel Introduction – Explanations for Excel page (row, column, and cells) - How to enter data - Usage of Formula and Functions and Creating Excel Chart (Area, Bar, Column, Doughnut, Line, Pie, Radar and 3-D Charts).				
Unit- IV	Data Manipulation – Setting Printer Range – Resize the Margin – Various types of Functions (Statistical Mathematical String, Logical Date and Time) – Data Query - Fill Table.				
Unit- V	What is Power Point – why – Use – Define Presentation and Wizard – Power Point Slide Changer – Adding Slide message – Slide Show - What is Access – What is Database – What are Tables, Queries, Forms – Creating a Table using Wizard – Creating a Form using a Wizard.				
Textbook Davenport, J., Greaves, C., Groh, M.,& Hallberg, E. (1994).*Inside Microsoft Office Professional*. New Riders Publishing. Chapters: 1, 2, 3, 8, 9, 10, 12, 16, 17, 19, and 20					
Outcomes	Students will be able to ➢ Enrich the knowledge in formatting document of varies types. ➢ Prepare Excel worksheets and Power Point design.				

SEMESTER V					
Course Code	**Core Practical -II(A)**		**T/P**	**C**	**H/W**
22BMA5P3	**AN ALGORITHMIC APPROACH IN NUMERICAL ANALYSIS**		**P**	**4**	**5**
Objectives	➢ To know the applications behind various numerical methods. ➢ To apply the concepts to solve mathematical problems.				

Problems

1. Explain the secant method for solving algebraic equations. Execute this method with an example.
2. Explain Ramanujan's method to find the smallest root of algebraic or transcendental.
3. Explain Stirling's formula for interpolation with an example.
4. Explain Bessel's formula for interpolation with an example.
5. Explain Laplace - Everett formula for interpolation with an example.
6. Explain Newton's divided difference for interpolation with an example.
7. Explain Boole's rule for numerical integration with an example.
8. Explain Weddle's rule for numerical integration with an example.
9. Explain Gauss-Jordan method and hence solve the system of linear equations.
10. Explain Gauss-Seidal method and hence solve the system of linear equations.
11. Explain Milne's predictor-corrector method to solve ordinary differential equations with an example.
12. Explain Adam-Bashforth predictor-corrector method to solve ordinary differential equations with an example.

Outcomes

Students will be able to

- Establish the advantages of operations research.
- Gain a thorough knowledge of operations research for problems solving.

Tutor's Guide

- All the Questions can be solved by applying the concepts through the pen and paper mode. (Solving through computer is not necessary for this paper, but if students are interested then they can do on their own).
- Practice atleast three problems for all questions in the observation notebook.
- Write exactly one problem for all questions from the observation notebook with your own choice from the three.

Guide to write the record notebook

- For all the Questions write the algorithm of the method used, in the right hand side page of the record notebook; solution of particular problem in the left hand side page of the record notebook.
- Write the objective of the problem first, then write the basic concepts involved in that problem, then write the algorithm used, as said in the previous point, finally write the solution as result.

	Semester - V			
Course code: 22BMA5P4	**Core Practical – II(B)**	**T/P**	**C**	**H/W**
	LaTex	**P**	**4**	**5**
Objectives	➢ Understand richness of Latex rather than using M.S word for documentation. ➢ Proficient in documentation using mathematical symbols, graphs and tables.			
Unit -I	Text formatting - TEX and its offspring - What is different in LATEX 2ϵ - Distinguishing LaTex 2ϵ - Basics of a LaTex file.			
Unit-II	Command names and Arguments – Environments – Declarations - Lengths - Special Characters – Spaces and Carriage Returns - Quotation Marks - Hyphens and Dashes, Printing Command Characters- The Date – Exercises.			
Unit- III	Document class - Page style - Parts of the document - Table of contents – Automatic entries - Printing the table of contents - Fine-Tuning text – Line breaking - Page breaking - Displayed Text – Changing font – Emphasis - Choice of font size - Font attributes - Centering and indenting - Lists.			
Unit- IV	Tables - Printing literal text - Footnotes and Marginal notes.			
Unit -V	Mathematical environments - Main elements of math mode - Mathematical symbols – Greek letters - Function names - Additional elements - Fine–tuning mathematics – Horizontal spacing - Selecting font size in formulas.			

Textbook

Kopka, H., & Patrick, W. D. (1999). *A Guide to LATEX* (3rd Ed). London: Addison – Wesley.

Reference Book

Kavitha, V., & Mallikarjunan, M. (2013). *Fundamentals of Latex for Mathematicians*. Germany: Physicists and Engineers, LAP Lambert Academy Publishing.

Outcomes	Students will be able to ➢ Understand basic concepts of Text formatting and LaTex file ➢ Demonstrating command names and arguments. ➢ Apply the commands to create document layout and displayed output ➢ Create Table, Printing Text, Foot notes and marginal notes ➢ Apply LaTex commands to mathematical formulae.

Semester - VI					
Course code: 22BMA6E1	**DSE-I**		**T/P**	**C**	**H/W**
	COMPLEX ANALYSIS		**T**	**6**	**6**
Objectives	➢ To introduce the basic concepts in complex analysis. ➢ Intended to develop an understanding of complex integration and evaluation of definite integrals.				
Unit -I	Complex numbers: Modulus Amplitude and Product of Complex Numbers – Equations of Straight line, Circle – Reflection points - Concyclic point - Inverse point - Meaning of Mod $\left(\frac{z-z_1}{z-z_2}\right)$ and amp $\left(\frac{z-z_1}{z-z_2}\right)$				
Unit-II	Analytic function – C.R equations – C.R. equations in Polar forms – Harmonic functions.				
Unit- III	Bilinear transformation - Cross ratio - Fixed points–Transformations which map real axis to real axis – Unit circle to unit circle and real axis to unit circle. $w = z^2,\ w = z^{\frac{1}{2}},\ w = e^z,\ w = \frac{1}{z}, w = \sin z,\ w\ =\ \frac{1}{2\left(z+\frac{1}{z}\right)}.$				
Unit -IV	Complex Integration - Cauchy Integral Theorem – Cauchy Integral Formula - Derivatives of Analytic Function - Moreras Theorem - Cauchy's Inequality - Liouvilles Theorem – Fundamental Theorem of Algebra – Taylor's Theorem – Taylor Laurentz Series.				
Unit -V	Singular Points – Argument Principle - Rouche's Theorem – Calculus of Residue – Residue Theorem – Evaluation of Definite Integrals.				

Textbook

Arumugam, S., Thangapandi Isaac, A., & Somasundaram, A. (2017). *Complex Analysis*. Chennai: Scitech Publications (India) Pvt. Ltd.

Reference Books

Gupta, P.P., Gupta, R.K., &Gupta, S.(1992).Complex Variables. Meerut: Kedarnath Ramnath.

Manicavachagom Pillay, T.K. (1994). *Complex Analysis*. S.Viswanathan (Printers and Publishers) Pvt. Ltd.

Sharma, J. N. (1997). *Functions of a Complex Variable*. Krishna Prakasan Media (P) Ltd.

Outcomes	Students will be able to ➢ Understand the importance of analytic function. ➢ Demonstrate and understand the concepts in complex integration.

Semester - VI				
Course code:	**DSE-II**	**T/P**	**C**	**H/W**
22BMA6E2	**OPERATIONS RESEARCH – II**	**T**	**6**	**6**
Objectives	➢ To introduce the various techniques of operations research. ➢ Make the students to solve real life problems in business and management.			
Unit -I	Replacement problem and System Reliability – Introduction – Replacement of Equipment / Assert that Deteriorates Gradually – Replacement of Equipment that fails suddenly.			
Unit-II	Inventory Control – Introduction – Types of Inventories – Reason for carrying Inventories – Costs Associated with Inventories – Factors affecting Inventory Control – The Concept of EOQ – Deterministic Inventory problems with no shortages, with shortages - Problems of EOQ with Price Breaks.			
Unit- III	Queuing Theory – Introduction – Queuing System – Elements of Queuing System – Operating Characteristics of a Queuing System – Deterministic Queuing System – Probability Distributions of Queuing Systems – Classification of Queuing models – Definition of Transient and Steady States – Poisson Queuing Systems – (M/M/1) : (∞/FIFO), (M/M/1) : (∞/SIRO), (M/M/1) : (N/FIFO) - Generalized Model Birth – Death Process.			
Unit- IV	Network Scheduling by PERT / CPM – Network Basic Components – Drawing Network – Critical path Analysis – PERT Analysis – Distinction between PERT and CPM.			
Unit -V	Game Theory – Two Person Zero – Sum Games – Basic Terms – Maximin – Minimax Principle – Games without Saddle Points – Mixed Strategies – Graphical solution of $2 \times$ n and m $\times$ 2 games – Dominance Property – General solution of m $\times$ n rectangular games.			

Textbook

Swarup, K., Gupta, P.K., & Mohan, M. (2008). *Operations Research*. New Delhi: Sultan Chand & Sons, Educational Publishers.

Reference Books

Gupta, P.K., & Hira, D.S. (2004). *Operations Research*. New Delhi: S.Chand & Co.

Kalavathy, S. (2002). *Operations Research*. New Delhi: Vikas Publishing House.

Taha, H.A. (2017). *Operations Research–An Introduction*. Pearson Prentice Hall.

Outcomes	Students will be able to ➢ Understand the mathematical techniques to model and analyze decision problems with effective application to real life in optimization of objectives. ➢ Formulate simple reasoning and learning optimization problems. ➢ Analyze a problem and select a suitable strategy. ➢ Apply an approximate method to obtain a solution for a problem.

Semester - VI					
Course code: 22BMA6E3	**DSE-III**		**T/P**	**C**	**H/W**
	MECHANICS		**T**	**6**	**6**
Objectives	➢ To understand the concept of different forces and moments and their equilibrium with reference to a coordinate system. ➢ To widen appreciation of the variety of phenomena covered by mechanics and the techniques available to handle them. ➢ To provide an adequate foundation for further self – study.				
Unit -I	Forces acting at a point – Resultant and Components – Definitions – Simple cases of finding the Resultant – Parallelogram law of Forces – Analytical Expression for the resultant of two forces acting at a point – Triangle Law of Forces – Perpendicular Triangle of forces – Converse of Triangle of forces – The Polygon Law of forces – Lami's Theorem – An Extended form of the Parallelogram law of forces – Parallel forces – Resultant of like parallel forces – Unequal unlike parallel forces – Moments – Physical significance – Geometrical representation – Sign and unit of the moment – Varigon's theorem.				
Unit-II	Friction – Laws of friction Theorems – Equilibrium of a particle on a rough inclined plane – (i) Under a force parallel to the plane – (ii) Under any forces – Problems on Friction – Uniform String under the action of gravity – Equation of the common catenary – Axis, Vertex, Directrix, Span and Sag – Tenson at any point.				
Unit- III	Projectile – Definition – fundamental principles – Path of the Projectile – Characteristics of the motion of a projectile – Simple Harmonic motion – Equation of Velocity – Displacement – Periodic time – Frequency – Amplitude – Composition of S.H.M.				
Unit -IV	Impact of two bodies – Collision of elastic bodies - Fundamental laws of Impact – Newton's Experimental law – Impact of a smooth sphere on a fixed smooth plane – Direct Impact of two smooth spheres – Loss of kinetic energy due to Direct Impact – Oblique Impact of two smooth spheres – Loss of Kinetic energy due to Oblique Impact.				
Unit- V	Motion under a Central Force – Differential Equation of Central Orbits – Perpendicular from the pole on the tangent – Formulae in Polar Coordinates – Pedal Equation of the Central Orbit – Pedal equation of some of the well known curves – Velocities in a central orbit – Two folded problems.				

Textbooks

Venkataraman, M. K. (2014). *Statics*. Tiruchirapalli: Agasthiyar Publications.

Venkataraman, M. K. (2017). *Dynamics*. Tiruchirapalli: Agasthiyar Publications.

Reference Books

Cholton, F. (1962). *Mechanics of Mathematics for Engineers*. Wiley.

Duraipandian, P. (1984). *Mechanics*. Chennai: Emerald Publishers.

Narayanan, S. (1986). *Dynamics*. Chennai: S.Chand & Co.

Narayanan, S. (1986). *Statics*. Chennai: S.Chand & Co.

	Vasuky, M. (2020). *Mechanics* (1st Ed.). Madurai: Shanlax Publications.
Outcomes	Students will be able to ➢ Understand the concepts of statics and dynamics applicable in real life. ➢ Acquire wide knowledge of handling problems related to mechanics. ➢ Acquire sufficient knowledge for further studies in mechanics at a higher level.

	Semester - VI			
Course code:	**DSE-IV**	**T/P**	**C**	**H/W**
22BMA6E4	**NUMBER THEORY**	**T**	**6**	**6**
Objectives	➢ To study the concept of mathematical induction, prime numbers and division algorithms. ➢ To understand the concepts of congruence and quadratic reciprocity.			
Unit -I	Divisibility– Euclidean Algorithm – Primes – Fundamental theorem of Arithmetic.			
Unit-II	Congruences – Fermat, Euler and Wilson's Theorems – Lagrange Theorem – Chinese Remainder Theorem – Solution of Congruence.			
Unit -III	Quadratic Residues – Euler's Criterion – Gauss Lemma – Quadratic Reciprocity law.			
Unit- IV	Arithmetic Functions – Number of divisors– Sum of divisors – Euler's phi function –Mobius function – Mobius inversion formula – Greatest integer function – Related problems.			
Unit -V	Numbers of Special Form – Perfect Numbers – Mersenne Primes and Amicable Numbers – Fermat Numbers – Pepin's Test – Diophantine Equation – Pythagorean Triplets.			

Textbook

   Burton, D. M. (2012). *Elementary Number theory*. Universal book stall.

Reference Books

   Andrews, G. E. (1994). *Number theory*. Hindustan Publishing Corporation.

   Apostol, T. M. (1998). *Introduction to analytic number theory*. Narosa publishing house.

   Narayanan, S., & Manicavachagom Pillay, T.K. (2012). *Algebra* (Vol. I). S.Viswanathan (Printers and Publishers).

   Niven, I., & Zuckerman, H.S. (2015). *An introduction to the theory of numbers*. Wiley eastern.

Outcomes	Students will be able to ➢ Recall the basic concepts of divisibility. ➢ Demonstrate renowned theorems in solving congruence. ➢ Discuss on quadratic congruence equations. ➢ Analyze various arithmetical functions. ➢ Identify the numbers of special form and apply divisibility rules in solving Diophantine equations.