Sem.	Part	Sub. No	Subject Status	Subject Title	Hrs / Week	Cre-dits	Mark				
							Maximum			Passingminimum	
							Int.	Ext.	Tot.	Ext.	Tot.
III	I	13	Language	Tamil/Other Languages	6	4	25	75	100	30	40
	II	14	Language	English	6	4	25	75	100	30	40
	III	15	Core-III Ppaer-V	Sequences and Series	6	4	25	75	100	30	40
		16	Allied-II	Statistics-I OR Physics with Practicals / Chemistry with Practicals	6	3	25	75	100	30	40
				/ Computer Science	5	4	25	75	100	30	40
		17	Skill Based core	Vector Calculus	4	4	25	75	100	30	40
	IV	18	Non - Major Elective	Any one of the following 1.1) Mathematics for Competitive Examinations-I 1.2) Fundamentals of Statistics-I	2	2	25	75	100	30	40
		19	Common	Yoga*	2	2	25	75	100	30	40
IV	I	20	Language	Tamil / Other Languages	6	4	25	75	100	30	40
	II	21	Language	English	6	4	25	75	100	30	40
	III	22	Core-IV Paper-VI	Abstract Algebra	6	4	25	75	100	30	40
		23	Allied-II	Statistics-II OR Physics with Practicals / Chemistry with Practicals / Computer Science	6	3	25	75	100	30	40
					5	5	25	75	100	30	40
		24	Skill Based Core	Trigonometry, Laplace Transforms and Fourier Series	4	4	25	75	100	30	40

	IV	25	Non- Major Elective	Any one of the Following : 2.1) Mathematics for Competitive Examinations – II 2.2) Fundamentals of Statistics – II	2	2	25	75	100	30	40
		26	Common	Computers for Digital Era*	2	2	25	75	100	30	40
	V		Extension Activities	NCC / NSS / YRC / YWF / PE	-	1	-	-	-	-	-

V	III	27	Core-V Paper-VII	Linear Algebra	5	4	25	75	100	30	40
		28	Core-VI Paper-VIII	Real Analysis	5	4	25	75	100	30	40
		29	Core-VII Paper-IX	Statics	5	4	25	75	100	30	40
		30	Core-VIII Paper-X	Transforms and their Applications	5	4	25	75	100	30	40
		31	Major Elective-I Paper-XI	Any one of the following 1.1. Programming in C 1.2.Discrete Mathematics 1.3.Combinatorial Mathematics	4	4	25	75	100	30	40
		32	Major Elective – II Paper-XII	Any one of the following: 2.1 - Operations Research- I 2.2 - Stochastic Process 2.3. MS Office	4	4	25	75	100	30	40
	IV	33	Skill Based Common	Personality Development	2	2	25	75	100	30	40

VI	III	34	Core-IX Paper-XIII	Complex Analysis	5	4	25	75	100	30	40
		35	Core-X Paper-XIV	Graph Theory	5	4	25	75	100	30	40
		36	Core-XI Paper-XV	Number Theory	4	4	25	75	100	30	40
		37	Core-XII Paper-XVI	Dynamics	4	4	25	75	100	30	40
		38	Core-XIII Paper-XVII	Numerical Methods	4	4	25	75	100	30	40
		39	Major Elective-III Paper-XVIII	Any one of the following: 3.1Astronomy 3.2 Fuzzy Mathematics 3.3.Mathematical Modeling	4	4	25	75	100	30	40
		40	Major Elective-IV Paper-XIX	Any one of the following: 4.1.Operations Research - II 4.2.Coding Theory 4.3.Python	4	4	25	75	100	30	40

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Semester – III
CORE – III
Paper - V(6hrs /week)
SEQUENCES AND SERIES – I (90 hours) (AMMA31)

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Objectives:

❖ To acquire basic ideas of classical analysis.
❖ To study the be haviour of sequences and series.

Course Learning Outcomes: It enables the students to

1.accommodate the concept of different types of sequences and series.

2. know how to apply various tests to test the convergence of series.

UNIT – 1:

Real number system: The field of axioms, the order axioms, the rational numbers, the irrational numbers, upper bounds, maximum element, least upper bound (supremum). The completeness axiom, absolute values, the triangle inequality Cauehy – Schwartz's inequality. (Text Book 1:)

UNIT – 2:

Sequences: Bounded sequences – monotonic sequences – Convergent sequences – divergent and oscillating sequences – The algebra of limits.   (Text Book 2)

UNIT – 3:

 Behaviour of monotonic sequences – Cauchy's first limit theorem – Cauchy's second limit theorem – Cesaro's theorem – subsequences – Cauchy sequence – Cauchy's general principle of convergence.   (Text Book 2)

UNIT – 4:

Series: Infinite series – n^{th} term test – Comparison test – Kummer's test –
D Alembert's ratio test – Raabe's test – Gauss test – Root test.   (Text Book 2)

UNIT – 5:

  Alternating series – Leibnitz's test – Tests for Convergence for series of arbitrary terms – Multiplication of series – Abel's theorem – Merten's theorem – Power series – Radius of Convergence.   (Text Book 2)

Text Books:

• Tom.M Apostol – Mathematical Analysis, Narosa Publishing house, New Delhi. II Edition.. for unit – 1.
• S. Arumugam and Thangap and iIssac- " Sequences and series " – Scitech Publications, Chennai. for unit - 2,3,4 & 5.

Book for Reference:

• Elements of Real analysis Shanti Narayan & Dr.M.D.Raishinghania S.Chand & Co.,Revied Edition.
• Ellina Grigorieva - Methods of Solving Sequence and series Problem-Springer Link.
• Richard R. -" Methods of real analysis" Goldberg (Oxford and IBH Publications Co.) 1

SKILL BASED CORE – PAPER I   **(4hrs/week)**
VECTOR CALCULUS   **(60 hours) (ASMA3A)**

Objectives:

❖ To lay a good foundation of vector differentiation and vector integration.
❖ To solve problems related to this.

Course Learning Outcomes: It enables the students to

1.recognize the importance of integration.

2.relate the line integral, surface integral and volume integral.

UNIT – 1:

Vector point functions – Scalar point functions – Derivative of a vector and derivative of sum of vectors – Derivative of product of a scalar and vector point function – The vector operator ∇ - Gradient.

UNIT – 2:

Divergence – Curl, solenoidal, irrotational vectors –Laplacian operator.

UNIT – 3:

Integration of point function – Line integral – Surface integral.

UNIT – 4:

Volume Integral – Gauss divergence theorem (Statement without Proof) – Problems.

UNIT – 5:

Green's theorem and Stoke's theorem (Statement without Proof) – Problems.

Text Book:

Duraipandian and Laxmi Duraipandian, Vector Analysis- Emerald Publishers(Revised Edition, Reprint 2005).

Books for References:

- Dr. S. Arumugam and others –Vector Calculus, New Gamma Publishing House.(2006).
- Susan. J. C – Vector Calculus (4th Edition), Pearson Education, Boston (2012).
- Murray Spiegel - Vector analysis – Schaum Publishing company, New York (2009).

Semester - III

Non – Major Elective Paper – I   (2hrs/week)

MATHEMATICS FOR COMPETITIVE EXAMINATION – I   (30hours) (ANMA3A)

Objectives:

- ❖ To learn the techniques for solving aptitude problems
- ❖ To enable the students prepare themselves for various competitive examinations

Course Learning Outcomes: It enables the students to

1. understand the techniques to solve the problems easily.
2. apply simple ideas to solve problems.

UNIT – 1:

Simplification, averages.

UNIT – 2:

Ratio and Proportion.

UNIT – 3:

Partnership - Percentage.

UNIT – 4:

Profit and Loss.

UNIT – 5:

Problems on Numbers.

Text Book:

1. R. S. Agarwal - Objective Arithmetic, Published by S.Chand & Co Ltd.Edition(2018).

Books for Reference:

- R. S. Aggarwal, Arithmetic Subjective and objective, Published by S.Chand and.Co.Ltd. Revised Edition.
- Rajesh Verma -Fast track objective arithmetic, Arihant Publications(India) Limited., Revised Edition.

Semester – III

Non – Major Elective Paper – I   (2hrs/week)

FUNDAMENTALS OF STATISTICS – I   (30 hours) (ANMA3B)

Objectives:

- ❖ To introduce the new concept Measures of central tendency to other major students.
- ❖ To study about correlation, regression and to solve the simple problems.

Course Learning Outcomes: It enables the students to

1. know formulas to find mean, median mode.
2. understand correlation and regression.

UNIT – 1:

Classification of datas – Bar Diagram – Pie chart.

UNIT – 2:

Measures of central tendency: Mean, median, mode (with frequency).

UNIT – 3:

Measures of dispersion: Range – standard deviation, Variance – Quartile deviation.

UNIT – 4:

Correlation – Rank correlation (Problems only)

UNIT – 5:

Regression equations (Problems only)

Text Book:

Dr. S. Arumugam, A.Thangapandi Issac- Statistics, New Gamma Publishing House, Palayamkottai. (2016)

Books for Reference:

- S. P. Gupta - Elementary Statistical Methods, Sultan Chand & Sons,2017).
- T. Veerarajan Fundamentals of mathematical Statistics,Yes Dee Publishing Pvt,Ltd..(2017)

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Semester – IV
Core – IV
Paper-VI (6hrs/week)
ABSTRACT ALGEBRA (90 hours) (ASMA41)

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Objectives:

- ❖ To acquire the knowledge about the concept of groups, rings and fields.
- ❖ To study the concept of homomorphism.

Course Learning Outcomes: It enables the students to

1. grasp the concept of cyclic groups, normal subgroups.
2. know the fundamental theorems of homomorphism and how to apply it.

UNIT – 1:

Groups – definition and examples – subgroup – order of an element – centre of a group – Normaliser and Centralizer – Product of two Subgroups – order of HK – Intersection and union of subgroups.

UNIT – 2:

Cyclic groups – generators of a cyclic group – cosets – Lagrange's theorem – Euler's theorem – Fermat's theorem.

UNIT – 3:

Normal Subgroups: Quotient groups – Group Homomorphism – Canonical homomorphism – Kernel of a homomorphism – Isomorphism – Automorphism – Inner automorphism – Permutation groups – Cayley's theorem.

UNIT -4:

Rings: Definition and examples – Types of rings – Elementary properties of a ring – Integral domain – Field – Subrings – Subfields – Ideals – Principal ideal – Quotient ring – Maximal and prime ideals – Principal ideal domain – UFD.

UNIT -5:

Homomorphism of rings – Isomorphism – Kernel of a homomorphism – Fundamental theorem – Polynomial rings – Division algorithm.

Text Book:

S.Arumugam and A.Thangapandi Issac " Modern Algebra " - Scitech Publications, Private limited. (2008)

Books for Reference:

1. M. L. Santiago, Modern Algebra - McGraw Hill Education India Pvt. Limited,(2002).
2. T. K. ManickaVachagam pillai and others - Modern Algebra – S.Visvanathan Publishers (2011).
3. Visvanathan nayak, Modern Algebra -Emerald Publishers, Reprint 1992.

Skill Based Core – Paper – II   (4hrs/week)
TRIGONOMETRY, LAPLACE TRANSFORMS AND FOURIER SERIES (60 hours) (ASMA4A)

Objectives:

> ❖ To understand the concept of Trigonometry.
> ❖ To acquire knowledge about Laplace transform and its inverse.
> ❖ To study the concept of Fourier series and solve problems in Fourier series.

Course Learning Outcomes: It enables the students to

> 1. know the relation between hyperbolic function and circular function.
>
> 2. understand the concept of even and odd function.

UNIT – 1:

> Trigonometry: Expansion of sinnx, cosnx, tannx and expansions of $\sin^n x$ and $\cos^n x$.

UNIT – 2:

> Hyperbolic functions – Relation between hyperbolic functions and circular functions – Inverse hyperbolic functions – Logarithm of a complex number –Summation of series using C+ iS method.

UNIT – 3:

> Laplace transforms – Inverse Laplace transforms.

UNIT – 4:

> Solving linear differential equations with constant coefficients and simultaneous equations using Laplace Transforms.

UNIT -5:

> Fourier Series – Definition – Finding Fourier coefficients for a given periodic function with period 2π and 2l – odd and even functions – Half range series.

Text Book:
> 1. Arumugam. S and Thangapandi Issac. A – Trigonometry and Fourier Series.
> 2. T. K. Manickavachagam Pillai and S. Narayanan – Differential equations and its applications.

Books for reference:
- T. Veerarajan – Algebra and Trigonometry – YES DEE Publishing pvt. Ltd., Chennai.(2020).
- Ray Hanna .J – Fourier Series, Transforms and Boundary value Problems, Dover Publications New York, 2008.

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Semester – IV

Non – Major Elective Paper – II (2hrs/week)

MATHEMATICS FOR COMPETITIVE EXAMINATION – II (30 hours) (ANMA4A)

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Objectives:

❖ To learn the techniques for solving aptitude problems.

❖ To motive the students for attending various competitive examinations.

Course Learning Outcomes: It enables the students to

1.learn the simple techniques to solve problems.

2.get confidence to attend the various competitive examination.

UNIT – 1:

Simple interest and Compound interest.

UNIT – 2:

Time and work.

UNIT – 3:

Time and Distance.

UNIT – 4:

Chain Rule.

UNIT – 5:

Pipes and Cistern

Text Book:

1. R. S. Agarwal - Objective Arithmetic, Published by S.Chand & Co Ltd.Edition(2018).

Books for Reference:

- Rajesh Verma -Fast track objective arithmetic, Arihant Publications(India) Limited., Revised Edition.
- R. S. Aggarwal, Arithmetic Subjective and objective, Published by S.Chand and.Co.Ltd. Revised Edition.

Semester - IV

Non – Major Elective Paper –II (2hrs/week)

FUNDAMENTALS OF STATISTICS II   (30 hours)   (ANMA4B)

Objectives:

- ❖ To know the concept of attributes.
- ❖ To study index numbers and simple problems.

Course Learning Outcomes: It enables the students to

1.realise the importance of curve fitting.

2. calculate different types of index numbers.

UNIT – I

Theory of attributes – two attributes.

UNIT – II

Index number - weighted index number.

UNIT – III

Consumer Price index number - conversion of index number .

UNIT – IV

Time series - measurement of trends.

UNIT – V

Curve fitting – Straight line – Parabola - Exponential curve.

Text Book:

Dr. S. Arumugam, A.Thangapandi Issac- Statistics, New Gamma Publishing House, Palayamkottai (2016).

Books for Reference:

- S. P. Gupta - Elementary Statistical Methods, Sultan Chand & Sons,2017).
- T. Veerarajan Fundamentals of mathematical Statistics, Yes Dee Publishing Pvt.Ltd.Edition . (2017)

Semester - V

Core –V

Paper – VII (5hrs/week)

LINEAR ALGEBRA (75 hours)   (AMMA51)

Objectives:

❖ To acquire knowledge about vectors spaces, Inner product spaces and linear transformations.
❖ To solve problems in matrices.

Course Learning Outcomes: It enables the students to

1. understand the relation between matrix and linear transformation.
2. learn the method of finding Eigen values and Eigen vectors of a matrix.
3. study the concept of linear dependence and independence sets, basis.

UNIT – 1:

Vector spaces: Definition and examples – Elementary properties – subspaces – linear transformations – Fundamental theorem of homomorphism.

UNIT – 2:

Span of a set – linear dependence and independence – basis and dimension – theorems.

UNIT – 3:

Rank and Nullity theorem – matrix of a linear transformation – Inner product space – Definition and examples – orthogonality – orthogonal complement – Gram Schmidt orthogonalization process.

UNIT – 4:

Matrices – Elementary transformation – Inverse – rank – Cayley Hamilton theorem – Application of Cayley Hamilton theorem.

UNIT – 5:

Eigen values and Eigen vectors – Properties and problems – Bilinear forms – Quadratic forms – Reduction of quadratic form to diagonal form.

Text Book:

S.Arumugan & Thangapandi Issac, Modern Algebra- Scitech publication, Reprint (2008).

Books for Reference:

- Sharma J.N and Vashistha A. R. Linear Algebra - Krishna Prakash Nandir 1981.
- John B. Fraleish – A first Course in Abstract Algebra 7th edition, Pearson, 2002.
- N. Ramabhadran & R. Balakrishnan , Text book of algebra –Vikas Publishing Co. Revised Edition 1985.

Paper-VIII (5hrs/week)

REAL ANALYSIS (75 hours)   (AMMA52)

Objectives:

- ❖ To acquire knowledge about the real number system and metric spaces.
- ❖ To study the concepts of connectedness and compactness.

Course Learning Outcomes:

1. grasp the basic concept interior and closure of a set.
2. accommodate the notions of various metric spaces.

UNIT – 1:

Metric spaces – Examples – bounded sets – open ball – open sets – subspaces – interior of a set.

UNIT – 2:

Closed sets – closure – limits points – dense sets – complete metric space – Cantor's intersection theorem – Baire's category theorem.

UNIT – 3:

Continuity – Homomorphism – Uniform Continuity – Discontinuous functions of **R**.

UNIT – 4:

Connectedness – Connected subsets of **R** – Connectedness and continuity – Contraction mapping theorem.

UNIT – 5:

Compactness – Compact metric spaces – Compact subsets of **R** – Heine Borel theorem – Equivalent characterisations for compactness – Compactness and Continuity.

Text Book:

Dr. S. Arumugan, Modern Analysis – Yes Dee Publishing Pvt.Ltd. Reprint (2019). .

Book for Reference:

- Richard R.Goldberg -Methods of Real Analysis - Oxford and IBH Publishing Co. New Delhi.
- R Visvanathan nayak, Real Analysis -Emerald Publishers, Reprint 1992.
- Real Analysis – Viswanath Naik. K, Emerald Publishers , Chennai.

Semester - V

Core-VII

Paper- IX   (5hrs/week)

STATICS (75 hours)   (AMMA53)

Objectives:

   ❖ To provide the basic knowledge of equilibrium of a particle.
   ❖ To develop a working knowledge to handle practical problems.

Course Learning Outcomes: It enables the students to

   1. rcognize the concept of friction.
   2. know the method to solve the problems related to that.

UNIT – 1:

   Forces acting at a point – Parallelogram law of forces – Triangle of forces – Lami's theorem – Problems.

UNIT – 2:

   Parallel forces and moments – resultant of two parallel forces – resultant of two unlike unequal parallel forces – Varigon's theorem – Problems.

UNIT – 3:

   Equilibrium of three forces acting on a rigid body – three coplanar forces theorem – Problems.

UNIT – 4:

   Friction – Laws of friction – angle of friction – equilibrium of a particle (i) on a rough inclined plane   (ii) under a force parallel to the plane (iii) under any force – Problems.

UNIT – 5:

   Equilibrium of strings – equation of the common catenary – tension at any point – geometrical properties of common catenary – Problems.

Text Book:

   M. K. Venkatraman – Statics, Agasthiar Publications, Trichy (2020).

Books for reference:

   1. S. Narayanan, Statics S. Chand and Company, New Delhi(1985).
   2. K. Viswanatha Naik and M. Kari, Statics Emerald Publishers,Chennai.
   3. I.Rajeswari –Mechanics- Saras Publication,(2016).

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Semester -   V

Core-VIII

Paper – X (5hrs/week)

TRANSFORMS AND THEIR APPLICATIONS (75 hours) (AMMA54)

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Objectives:

- ❖ To develop the knowledge of Transforms.
- ❖ To solve problems in Fourier Transforms and Z- transforms.

Course Learning Outcomes: It enables the students to

1. develop the Knowledge on Fourier & Z Transforms.
2. get notions to solve the problems related to that.

UNIT – 1:

Fourier Transforms – Properties of Fourier Transforms.

UNIT – 2:

Infinite Fourier Cosine and Sinne Transforms – Properties.

UNIT – 3:

Finite Fourier Transforms.

UNIT – 4:

Z -transforms – Properties.

UNIT – 5:

Inverse Z -transforms.

Text Book:

Singaravelu .A– Eingineering mathematics (volume III) – Meenakshi Agency, Chennai(2019).

Books for Reference:

1. Muthucumaraswamy.R - Transforms and Partial Differential Equation Equations –Yes Dee Publications – Second Edition(2019).
2. A. Gangatharan, Engineering Mathematics (volume I) – Prentice Hall of Iindia Pvt.Ltd. (2007).
3. Dr.C.Muthulakshmi @ Saisikala and R.Ponraj - Transforms and their applications, Charulatha Publication (2020).

Semester - V

Major Elective – I

Paper – XI   (4hrs/week)

1.1 PROGRAMMING IN C   (60 hours)   (AMMA5A)

Objectives:

- ❖ To study the basic concept and structure of C program.
- ❖ To train the students to write simple C programs.

Course Learning Outcomes: It enables the students to

1. gain Knowledge to write programs in C.

2. train the students to acquire knowledge in C language.

UNIT – 1:

Introduction – Character set – C tokens – keywords and identifiers – Constants – Variables and Data types.

UNIT – 2:

Operators – Arithmetic, relational, logical assignment, increment and decrement, Conditional, Bitwise special operators – Precedence of operators – Managing input and output operators – get char(), putchar, scanf() and printf().

UNIT – 3:

Decision making and branching: Simple if, if else, nested if and the else if ladder statements – The switch statement – The ?: operator – The go to statement. Decision making and looping: Introduction – while, Do while and for statement – jumps in loops.

UNIT – 4:

One dimensional and two dimensional arrays – declaration, initialization of arrays – Multidimensional arrays, Character arrays and strings : Declaring and initializing string variables – Reading and writing of strings – string handing functions.

UNIT – 5:

User defined functions – Definition of function – return values and their types – function calls – function declaration – Category of functions – Nesting of functions – recursion.

Text Book:

E. Balaguruswamy - Programming in ANSI C –Tata McGraw Hill Publishing company limited – III Edition (2017).

Books for references:

1. C. Reema Thareja, Programming in C- Oxford University Press (2018).
2. Ramasamy et.al.-Programming in C- Scetech Publication (INDIA) Pvt.Ltd. II Edition(2015).
3. Ashok N.Kamathane - Programming with Ansi and Turbo C – Dorling Kindersley (India) Pvt.Ltd,(2009).

Semester - V
Major Elective – I
Paper – XI (4hrs/week)
1.2 DISCRETE MATHEMATICS (60 hours) (SMMA5B)

Objectives:

- ❖ To study concepts of mathematics logic.
- ❖ To understand the basics of Lattices and Boolean Algebra.

Course Learning Outcomes: It enables the students to

1. know the number system and codes.
2. get basic ideas of Decimals, Binary, Octal and Hexadecimal and Gray code.

UNIT – 1: (Mathematical logic)

Statement and notation – Connectives – Negation – Conjunction – Disjunction – Statement formula and truth table – Conditional and biconditional – Well defined formulae – tautologies.

UNIT – 2:

Normal forms – The theory of interference for the statement calculus – The Predicate – The theory of inference for the Predicate Calculus.

UNIT – 3: (Algebraic structures)

Groups and monoids – Simple properties – Group codes.

UNIT – 4: (Lattices and Boolean algebra)

Lattices and posets – Properties of lattices – special lattices – Boolean algebra – Gating networks – Minimal sums of products.

UNIT – 5: (Number system and codes)

Decimal, Binary, Octal, Hexadecimal – Conversion from one to another – Binary addition, subtraction, multiplication and division – BCD – Weighted excess time – Gray code.

Text Book:

Tremblay and Manohar – Discrete mathematical structures with application to Computer Science (Tata McGraw Hill) New Delhi 1997.

Books for Reference:

1. M. K. Venkataraman and others – Discrete mathematic - The National Publishing Pvt.Ltd.(2000).
2. G. Balaji – Discrete mathematics – Balaji Publishers Chennai (2013).
3. T. Veerarajan – Discrete mathematics Tata McGraw Hill – 2009.

Semester - V

Major Elective I

Paper – XI (4hrs/week)

1.3 COMBINATIONAL MATHEMATICS (60 hours) (AMMA5C)

Objectives:

- ❖ To know the basic concepts of Pairings.
- ❖ To understand relations.

Course Learning Outcomes: It enables the students to

1.develop Block design & Square block designs.

2. study the basic concept of Permutations.

UNIT – 1:

Selections and Binomial coefficients – Permutations – Ordered selections – unordered selections – Miscellaneous Problems.

UNIT – 2:

Parings Problems – Pairings within a set – Pairing between sets.

UNIT – 3:

Recurrence – Fibonacci – type relations using generating functions – Miscellaneous methods.

UNIT – 4:

The inclusion – Exclusion Principles.

UNIT – 5:

Block designs – square block designs.

Text Book:

Ian C.Andersen – A first course in combinatorial mathematics – Clarendon Press, Oxford(1989).

Books for Reference:

1. Ralph P. Grimaldi,B.V.Ramona – Discrete and combinatorial mathematics – an applied introduction (IV edition).

Semester - V

Major Elective - II

Paper – XII   (4hrs/week)

2.1 OPERATIONS RESEARCH – I   (60 hours) (AMMA5D)

Objectives:

- ❖ To introduce the various techniques of operations research.
- ❖ To make the students to solve real life problems.

Course Learning Outcomes: It enables the students to

1. learn the relationship between Primal and Dual Problems.
2. study about transportation Problem.

UNIT – 1:

Linear Programming Problem: Mathematical formulation of LPP – Graphical method, Simplex method – Artificial variable technique.

UNIT – 2:

Concept of Duality – Primal and Dual problems – Duality – Dual Simplex method.

UNIT – 3:

Transportation Problem: North-west Corner rule – Matrix-Minima method – Vogel's approximation method – MODI method – Degeneracy and unbalanced Transportation problem.

UNIT – 4:

Assignment Problem: Hungarian method – Unbalanced assignment problems.

UNIT – 5:

Sequencing Problem: n jobs and two machines – n jobs and three machines – 2 jobs and m machines.

Text Book:

KantiSwarup, P. K. Gupta and Manmohan – Operations Research – Sultan Chand and sons – 2006,   12th edition.

Books for Reference:

- Gupta P. K and D. S. Hira – Operations Research – S. Chand & Sons-VII Edition.
- B. J. Ranganath and A. S. Srikantappa – Operations Research – Yes Dee Publishing House, Chennai (2017).
- Hamdy A. Taha – Operations research, An introduction - 8th Edition Prentice – Hall India (2006).

Semester – V
Major Elective – II
Paper – XII (4hrs/week)

2.2 STOCHASTIC PROCESS (60 hours) (AMMA5E)

Objectives:

❖ To understand the concepts of Stochastic process.
❖ To know Markov chains.

Course Learning Outcomes: It enables the students to

1. enrich the Knowledge in determination of Higher Transition Probabilities.
2. understand the generalisation of Poisson process.

UNIT – 1:

Generating functions – Laplace transform of probability distribution – Classification of distribution – Stochastic process – introduction – specification of stochastic process.

UNIT – 2:

Markov chains – Definition and examples – Higher transition probabilities – Generalisation of independent Bernoulli Trails – classification of states and chains – Determination of Higher Transition Probabilities – stability of Markov systems – Graph Theoretic approach.

UNIT – 3:

Markov chain with Denumerable number states – Reducible chains – Statistical inference for Markov chains – Markov chain with continuous state space – Non homogeneous chains.

UNIT – 4:

Markov process with discrete state space – Poisson process – Poisson process and related distributions – Generalisation of Poisson process – Birth and Death process.

UNIT – 5:

Markov process with Discrete state space – Derived Markov chains – Erlang Process.

Text Book:

J. Medhi – Stochastic Process – New Age International Publishers Pvt. Ltd. Third Edition.

Book for Reference:

1. Suddhendu Biswas – Applied Stochastic Process – New Central Agency Pvt. Ltd., Kolkatta (2012).
2. Paul G.Hoel,Sidney Port & Charles J.Stone – Introduction to Stochastic process –Waveland Press – Boston(1987).

Semester - V
Major Elective – II

Paper – XII (4hrs/week)

2.3   M.S OFFICE   (60 hours)   (SMMA5F)

Objectives:

- ❖ To develop the knowledge of computer.
- ❖ To know the importance of Word, Excel and PowerPoint.

Course Learning Outcomes: It enables the students to

1. enrich the knowledge in formatting document of various types.
2. prepare excel worksheets & PowerPoint Design.

UNIT – 1:

MS Word: Creating a document – saving, printing, editing and closing the document – copying, pasting, finding and replacing a text – adding headers and footers.

UNIT – 2:

Formatting a document – Turning Bold on/off – Underline on/off – highlight on/off – changing font size – page setup – changing margins – bullets and numbering – working with tables – changing the column width and row height – inserting or deleting a row/column – mail merge.

UNIT – 3: MS Excel:

Creating a worksheet – entering, editing, deleting data in cells – saving and previewing the worksheet – entering formulas – Working with basic functions – SUM, AVERAGE, MAX and MIN – sorting.

UNIT – 4:

Formatting a worksheet – inserting, deleting a row/column, changing font size – Graphs and charts – Simple calculations using mathematical, Statistical logical functions.

UNIT – 5: MS Power point:

Creating a simple presentation – adding transition effects to a presentation – adding sound effects to a presentation – creating hyperlinks between slides – changing the backward – inserting images on slides.

Text Book:

Dr. P. Rizwan Ahmed,“ Office Automation 2010 ”, Margham Publications 2016.

Books for reference:

1. Stephen.L.Nelson & Julia Kelly - The Compete Reference”,TataMc Graw Hill Publishing company Ltd(2001).
2. Sumner Mary-“Enterprise Resource Planning” Pearson Education,.I-Edition2004.

Semester – VI
Core – IX

Paper – XIII (5hrs/week)

COMPLEX ANALYSIS (75 hours) (AMMA61)

Objectives:

- ❖ To understand the concepts of complex variables.
- ❖ To learn about elementary transformations in complex variables.

Course Learning Outcomes: It enables the students to

1. know the concept of complex integration, Cauchy integral formula.
2. understand the importance of singularity and residues.

UNIT – 1: (Analytic functions)

Functions of a complex variable – Derivatives – Cauchy – Riemann equations –sufficient conditions– Polar form– Analytic functions– Harmonic functions**.**

UNIT – 2: (Integrals)

Definite integrals – Contours – Cauchy – Goursat theorem – anti-derivatives and independence of path–Cauchy Integral formula – Morera's theorem.

UNIT – 3: (Series)

Taylor's series – Examples – Laurent's series – Zeros of analytic functions –Residues–Residue theorem–Principal part of functions–Residues at poles.

UNIT – 4: (Evaluation of Integrals)

Evaluation of improper real integrals – improper integrals involving sines and cosines – Definite integrals involving sines and cosines**.**

UNIT – 5: (Transformations)
Basic properties–Bilinear maps–fixed points.

Text Book:

- Arumugam.S and T. Issac–"Complex Analysis" –Scitech Publishing House–Chennai,(2002).

Books for Reference :

1. Churchill.R.V. and J.W.Brown–"Complex variables and Applications"– McGraw Hill International Editions – IX Edition,2013.
2. Ponnuswamy.S "Foundations of Complex Analysis", Narosa Publication House, NewDelhi, II Edition 2005.
3. Duraipandian.P and Lakshmi Duraipandian–"ComplexAnalysis"–Emerald Publications, Chennai (2001).

Core – X

Paper – XIV (5hrs/week)

GRAPH THEORY (75 hours)   (AMMA62)

Objectives:

- ❖ To introduce the notion of graph theory and its applications
- ❖ To learn the techniques in graph theory

Course Learning Outcomes: It enables the students to

1. know different types of graphs.
2. understand the concepts of walks, trails and paths.

UNIT – 1:

Definition and examples of graphs – degrees - subgraphs – isomorphism – independent sets and coverings – matrices – operation on graphs.

UNIT – 2:

Degree sequences – graphic sequences – walks – trails and paths – connectedness and components–connectivity.

UNIT – 3:

Eulerian graphs – Hamiltonian graphs – characterization of trees – centre of a tree.

UNIT – 4:

Definition and properties of planar graphs – chromatic number and chromatic index.

UNIT – 5:

Chromatic polynomials – definition and basic properties of digraphs – paths and connectedness in digraphs.

Text Book:

Arumugam.S & S.Ramachandran–Invitation to graph Theory, Scitech publications,Chennai, 2002.

Books for reference:

- Kumaravelu.S and Susheela Kumaravelu – Graph theory- Nagercoil,2002.
- Narasingh Deo–Graph theory with application to engineering and computer science, Prentice – Hall of India pvt.Ltd., NewDelhi,1979.

Semester – VI

Core – XI

Paper – XV (4hrs/week)

NUMBER THEORY (60 hours) (AMMA63)

Objectives:

- ❖ To highlight the beauties in the world of numbers
- ❖ To prepare the students for coding through congruence

Course Learning Outcomes: It enables the students to

1. learn Fermat's Theorem & Wilson's Theorem.
2. understand the importance of Division algorithm.

UNIT -1:

Peano's Axioms – Mathematical induction – The Binomial Theorem – Early Number Theory.

UNIT – 2:

Division Algorithm – GCD – Euclidean Algorithm –The Diaphantine Equation ax+by=c.

UNIT – 3:

The fundamental Theorem of Arithmetic – The Sieve of Eratosthenes – The Goldbach conjecture.

UNIT – 4:

Basic properties of congruences – Linear congruence and the Chinese Remainder Theorem.

UNIT – 5:

Fermat's Theorem – Wilson's Theorem – The Fermat – Kraitchik Factorization Method.

Text Book:

David.M.Burton-ElementaryNumberTheory-Tata McGraw Hill Education Pvt. Ltd- (SixthEdition)-2007.

Books for Reference :

- Ivan Nivenand. H, Zuckerman-An Introduction to Theory of Numbers,Cambridge University Press -2019.
- Kumaravelu.S, and Susheela Kumaravelu -Elements of Number Theory-Nagercoil,2002.

Semester – VI

Core – XII

Paper – XVI (4hrs/week)

DYNAMICS   (60 hours)   (AMMA64)

Objectives:

> ❖ To provide a basic knowledge of the behavior of objects in motion
> ❖ To develop a working knowledge to handle practical problems

Course Learning Outcomes: It enables the students to

1. develop the Knowledge in Projectiles.
2. learn about the differential equation of central orbit.

UNIT – 1:

> Projectiles – Equation of path – range–maximum height – time of flight – range on an inclined plane   - problems.

UNIT – 2:

> Collision of elastic bodies – Laws of impact – direct and oblique impact-Problems.

UINT – 3:

> Simple Harmonic Motion (SHM) in a straight line- Geometrical representation –composition of SHM of the same period in the same line and along two perpendicular directions–problems**.**

UNIT – 4:

> Motion under the action of central forces – velocity and acceleration in polar co-ordinates– problems.

UNIT – 5:

> Differential Equation of central orbit - pedal equation of central orbit – problems to find the law of force towards the pole when the orbit is given.

Text Book:

> Venkatraman, M.K.- A Text Book on Dynamics, Agasthiar Publication, Trichy,2020.

Books for Reference:

1. Narayanan, S-Dynamics, S.Chand & company, 16th Edition,1986, NewDelhi.

2 . Duraipandian.P, LaxmiDuraipandian and Muthamizh Jayaprgasam-Mechanics S.Chand & Company (2003).

3. I.Rajeswari –Mechanics- Saras Publication,Nagercoil,(2016).

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Semester – VI
Core –XIII
Paper – XVII (4hrs/week)
NUMERICAL METHODS (60 hours)   (AMMA65)

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Objectives:

- ❖ To introduce the finite differences
- ❖ To solve numerical problems by different methods

Course Learning Outcomes: It enables the students to

1. recognize numerical differentiation and integration.
2. understand the concepts of solving various numerical problems by using different methods.

UNIT – 1:

Solution of Numerical algebraic and Transcendental Equations : Bisection method– Newton's method. Criterion of order of convergence of Newton's method. Regula False method – Gauss elimination – Gauss Jacobi – Gauss Seidal method.

UNIT – 2:

Finite Difference: First and higher order differences – Forward and backward differences – Properties of Operator – Differences of a polynomial –Factorial Polynomial.

UNIT – 3:

Interpolation: Newton's Forward–backward, Gauss forward–backward interpolation formula– Bessel's formula. Divided differences – Newton's divided difference formula – Lagrange's interpolation formula.

UNIT -4:

Numerical Differentiation and Integration: Newton's forward and backward differences for differentiation – Derivatives using Bessel's formula – Trapezoidal rule, Simpson's 1/3rule & 3/8rule.

UNIT – 5:

Difference Equations: Definition – order and degree of difference equation – Linear difference equation – Finding complementary function – particular Integral – simple applications.

Text Book:

Venkatraman.M.K - Numerical methods in Science and Engineering National Publishing Company - V Edition 1998.

Books for Reference:

1. Kandasamy.P.K.Thilagavathy and K.Gunavathy, Numerical Methods, S.Chand & Company Ltd. Edn. 2006.
2. Autar Kaw and Egwwn Enc Kalu – Numerical methods with Application Abidet. Autokaw.com 2nd Edtion , 2011.
3. Dr.A.Singaravelu Statistics & Numerical Methods, Meenakshi Agency (2012).

Semester – VI
Major Elective – III
Paper – XVIII (4hrs/week)
3.1 ASTRONOMY   (60 hours)   (AMMA6A)

Objectives:
- ❖ To introduce the exciting world of Astronomy to students
- ❖ To understand the movements of the celestial sphere

Course Learning Outcomes: It enables the students to

1. know the Kepler's laws of the Planetary motion.
2. study the concept of the fundamental formula of Spherical trigonometry.

UNIT – 1:

Spherical Trigonometry : Spherical triangle – The fundamental formula of Spherical trigonometry, the sine, cosine, four parts and Napier formula (without proof) and simple problems.

UNIT – 2:

The Celestial Sphere: Celestial co-ordinates – Diurnal motion – Rising and setting of a star – sidereal time – circumpolar stars – Morning and evening stars - Twilight.

UNIT – 3:

Earth – length of a day – Refraction – Tangent formula – Cassini's formula – Effects of refraction.

UNIT – 4:

Geocentric parallax – Effects – Heliocentric parallax – Effects.

UNIT – 5:

Kepler's laws – verification of Kepler's laws – True anomaly, mean anomaly, Eccentric anomaly - Relation between them.

Text Book:

- Kumaravelu.S and Susheela Kumaravelu –Astronomy for degree classes, Rainbow Printers, Nagercoil (2005).

Book for Reference :

- Ramachandran.G.V –Astronomy, Mission Press, Palayamkottai,1965.

Major Elective –III

Paper – XVIII (4hrs/week)

3.2 FUZZY MATHEMATICS (60 hours)   (AMMA6B)

Objectives:

❖ To introduce fuzzy concepts to students.
❖ To facilitate the students to study fuzzy operations and fuzzy numbers.

Course Learning Outcomes: It enables the students to

1. form a clear idea about Fuzzy sets.
2. learn the concepts of Fuzzy operations & Fuzzy numbers.

UNIT – 1:

Crisp Sets – Fuzzy Sets – Basic Types – Basic Concepts – Characteristics and Significance of Paradigm Shift.

UNIT – 2:

Additional properties of α-cuts – representations of fuzzy sets – Extension principle for fuzzy sets**.**

UNIT – 3:

Fuzzy set operations – Fuzzy complements – Fuzzy intersections: t-norms – Fuzzy Unions: t-conforms –Combinations of operations.

UNIT -4:

Fuzzy Numbers – Linguistic variables – Arithmetic operations on intervals – Arithmetic operations of fuzzy numbers – Lattice of fuzzy numbers – Fuzzy Equations.

UNIT – 5:

Fuzzy Decision Making – Individual Decision Making – Multi – person decision making – Fuzzy linear Programming.

Text Book:

GeorgeJ.Klir and BoBo Yuan–Fuzzy sets and Fuzzy Logic Theory Applications, Prentice Hall of India, 2002, New Delhi.

Book for Reference:

• GeorgeJ.KlirandTina. A.Folger–Fuzzy sets, uncertainty and Informations – Prentice Hall of India, 2003, New Delhi.

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Semester – VI
Major Elective – III
Paper – XVIII (4hrs/week)

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3.3 MATHEMATICAL MODELLING   (60 hours)   (AMMA6C)

Objectives:

❖ To study the mathematical models through ODE and difference equations.
❖ To train the students to develop mathematical models in real life problems.

Course Learning Outcomes: It enables the students to

1. get training to develop mathematical models in real life problems.
2. make mathematical models through O.D.E. understand the concepts of solving various numerical problem by using different methods.

UNIT – 1:

(Mathematical modeling through O.D.E(First order)):   Linear growth and Decay models – Non –linear growth and Decay models – Compartment Models – Dynamics Problems – Geometrical Problems**.**

UNIT – 2:

Population dynamics – Epidemics – Compartment Models – Economics, Medicine, Arms race, Battles and International Trade.

UNIT – 3:

(Mathematical Modelling through O.D.E.(Second order)):   Planetary motion – circular motion – Motion of satellites – Modelling through linear difference equations of second order.

UNIT – 4:

(Mathematical Modelling through difference equations):   Basic theory of difference equation with constant coefficients – Economics and Finance – Population dynamics   and genetics   – Probability   theory.

UNIT – 5:

(Modelling through graphs):   Solutions that can be modelled through graphs - models in terms of directed graphs, signed graphs – weighted digraphs and unoriented graphs**.**

Text Book:

• Kapur.J.N – Treatment as in "Mathematical Modelling" New Age International Publishers, 2004.

Books for Reference :

1. Kapur.J.N–Mathematical Modelling in Biology and Medicine – East West Press – 1985.
2. Singh – Mathematical Modelling, International Book house –2003.
3. Frank R.Giordano, MauriceD.Weir and WilliamP.Fox,- A first course in mathematical modelling, Thomson Learning, London and New York, 2003.

Semester – VI
Major Elective – IV
Paper – XIX (4hrs/week)
4.1 OPERATIONS RESEARCH – II (60 hours) (AMMA6D)

Objectives:
- ❖ To introduce Games and strategies.
- ❖ To understand networking problems.

Course Learning Outcomes: It enables the students to

1. acquire knowledge about queuing model.
2. solve life oriented problems.

UNIT – 1:

Games and Strategies: Two Person Zero sum Games – The Maximin – Minimax Principle – Games without Saddle Points – Mixed Strategies – Graphical Solution of 2xn and mx2 games– Dominance Property.

UNIT – 2:

Replacement of items that deteriorate with time – replace mentage of a machine taking money value into consideration – replacement of items that completely fail suddenly and Staffing Problems.

UNIT – 3:

Queing models: General concept and definitions – characteristics – properties of Poisson process Models(M/M/1:/FCFS),(M/M/1:N/FCFS),(M/M/S:/FCFS).

UNIT – 4:

Network scheduling by PERT/CPM: Network and basic components – Rules of Network Construction – Time Calculation in network – Critical Path Method –PERT Calculation.

UNIT – V:

Inventory Control : Introductions– Types of Inventories – Inventory decisions–Deterministic inventory Problem – EOQ problems without shortages**.**

Text Book:

KantiSwarup,P.K.GuptaandManmohan–OperationsResearch–SultanChand&Sons– 2006, 12th Edition.

Books for Reference :
- Gupta.P.KandD.S.Hira –OperationsResearch– S.Chand & sons – VII Edition..
- B.J.RanganathandA.S.Srikantappa–Operations Research, Yes Dee Publishing House, Chennai (2017).
- Hillier,F.S.andG.J.Lieberman – Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore,2009.
- HamdyA.Taha,-Operations Research, An Introduction,8th Ed.,Prentice–HallIndia,2006.
- Hadley.G.- Linear Programming, Narosa Publishing House, NewDelhi,2002.

Major Elective – IV

Paper – XIX (4hrs/week)
4.2 CODING THEORY (60 hours) (AMMA6E)

Objectives:

- ❖ To introduce coding and decoding concepts.
- ❖ To develop the students in the field of coding theory.

Course Learning Outcomes: It enables the students to

1. acquire knowledge about different codes.
2. understand the concepts of coding and decoding.

UNIT – 1:

Basic assumptions–Correcting and detecting error patterns–information rate–effects of error correction and detection – finding the most likely code word transmitted.

UNIT – 2:

Linear codes – two important–subspaces independence – basis, dimension–matrices – Bases for C and C^+ generating matrices on coding.

UNIT – 3:

Parity check matrices– equivalent codes–distance of a linear code–Linear codes – cosets – MLD for linear codes– Reliability of IMLD for linear codes.

UNIT – 4:

Someboundsforcodes–perfectcodes–hammingcodes–extendedcodes–TheextendedGolaycode–decodingtheextendedGolaycode–Golaycode**.**

UNIT – 5:

Polynomialsandwords–introductiontocycliccodes–introductiontocycliccodes – Polynomial encoding and decoding – finding cyclic codes – Dual cyclic codes**.**

Text Books:

- • Coding theory, the essentials–Marcel Dekker, Inc. Madtrison Avenue, New York.

Books for Reference:

*. Elwyn Berlekamp – Algebraic Coding Theory – Springer -1970.

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Semester – VI

Major Elective – IV

Paper – XIX   (4hrs/week)

4.3 PYTHON   (60 hours)   (AMMA6F)

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Objectives:

❖ To Know the basic concept and structure of Python program.

❖ To Develop   Student's Programming skills.

Course Learning Outcomes: It enables the students to

1. use string function in python.
2. understand the fundamental concepts to write a Python program

UNIT – 1:

Basics of Python Programming: Features – History – Future – Python Interpreter and Interactive mode – Writing and Executing First Python Program – Value and Types – Data Types – Operators and Expressions – Operations on Strings – Type Conversion – Comments – Functions and Modules. Chapter 2: Section 2.1 – 2.22

UNIT – 2:

Control Flow Statements: Introduction to Decision control Statements – Conditional Branching – Loops Structures – Nested Loops – Break – Continue – Pass – Else Statement Used with Loops.   Chapter 3: Section 3.1 – 3.8

UNIT – 3:

Functions: Introduction – Defining a function – Function Call – Variable Scope and Life time – Fruitful Function – Lambda – Function Composition – Documentation Strings – Recursive Functions.   Chapter 4:   Section 4.1 – 4.8, 4.10 (Omit 4.9)

UNIT – 4:

Strings: Concatenating, Appending and Multiplying Strings – Immutable – Formatting Operator – Built – in String Methods and Functions – Slice Operation – Comparing Strings – Iterating String.   Lists, Tuples and Dictionaries: Sequence – Lists.
Chapter 5: Section 5.1 – 5.5, 5.8, 5.9 (Omit 5.6, 5.7)

UNIT – 5:

Lists, Tuples and Dictionaries: Tuple – Dictionaries – File Handling: Opening and Closing Files – Reading and Writing Files – Error and Exception Handling: Introduction – Handling Exceptions. Chapter 6: Section 6.4 – 6.5 (Omit 6.3) ,Chapter 7: Section 7.4, 7.5, Chapter 8: Section 8.1, 8.2

Text Book:

"Problem solving and Programming with Python", by Reema Thareja (Second Edition, 2019, OXFORD University Press)

Books for Reference:

1. "Problem Solving and Python Programming", by Mr. Ashok NamdevKamthane and Mr. Amit Ashok kamthane (McGraw Hill Education (India) Private Limited).
2. "Python Programming", by Ch. Sathyanarayana, M. Radhika Mani, B. N. Jagadesh, Universities Press (INDIA) Private Ltd.