Undergraduate Department of Mathematics

Program for B.Sc. Degree in Mathematics - CBCS -2015-16

Sem	Part	Course Code	Course Title	Hr/wk	Cr.	Marks
1	I	XXX xxxx	TAM/FRE/HIN	3	2	30
1	II	ENG xxxx	Conversational Skills	3	2	30
1	III M	MAT 1511	Classical Algebra	5	5	75
1	III M	MAT 1411	Analytical Geometry -3D	4	4	60
1	III M	MAT 1413	Differential Calculus	4	4	60
1	III S	MAT 1421	Programming in C	5	4	60
1	IV LS	XXX xxxx	Life Skill - I	3	2	30
1	IV NME	XXX xxxx	Non-major Elective - I	3	2	30
			Total	**30**	**25**	**375**
2	I	XXX xxxx	TAM/FRE/HIN	3	2	30
2	II	ENG xxxx	Reading & Writing Skills	3	2	30
2	III M	MAT 1512	Algebra- I	5	5	75
2	III M	MAT 1412	Analysis -I	4	4	60
2	III M	MAT 1414	Integral Calculus	4	4	60
2	III S	MAT 1422	Object Oriented Programming in C++	5	4	60
2	IV LS	XXX xxxx	Life Skill - II	3	2	30
2	IV NME	XXX xxxx	Non-major Elective - II	3	2	30
2	V	XXX xxxx	Ext. Activity NCA/NCN/ NSS/PED/SLP		1	15
			Total	**30**	**26**	**390**
3	I	XXX xxxx	TAM/FRE/HIN	3	2	30
3	II	ENG xxxx	Study Skills	3	2	30
3	III M	MAT 2511	Algebra -II	5	5	75
3	III M	MAT 2513	Analysis -II	5	5	75
3	III M	MAT 2515	Differential Equations	5	5	75
3	III M	MAT 2411	Statistics- I	4	4	60
3	III S	PHY xxxx	Physics for Mathematics -I	5	4	60
			Total	**30**	**27**	**405**
4	I	XXX xxxx	TAM/FRE/HIN	3	2	30
4	II	ENG xxxx	Career Skills	3	2	30
4	III M	MAT 2512	Algebra- III	5	5	75
4	III M	MAT 2514	Analysis- III	5	5	75
4	III M	MAT 2516	Vector Calculus & Trigonometry	5	5	75
4	III M	MAT 2412	Statistics- II	4	4	60
4	III S	PHY xxxx	Physics for Mathematics - II	5	4	60
4	V	XXX xxxx	Ext. Activity NCA/NCN NSS/PED/SLP		1	15
			Total	**30**	**28**	**420**

Sem	Part	Course Code	Course Title	Hr/wk	Cr.	Marks
5	III M	MAT 3611	Mechanics	6	6	90
5	III M	MAT 3613	Graph Theory	6	6	90
5	III M	MAT 3615	Operations Research- I	6	6	90
5	III M	MAT 3511	Combinatorics	5	5	75
5	IV LS	XXX xxxx	Life Skill- III	3	2	30
5	IV	MAT 3200	Environmental Studies	4	2	30
			Total	**30**	**27**	**405**
6	III M	MAT 3612	Number Theory	6	6	90
6	III M	MAT 3614	Complex Analysis	6	6	90
6	III M	MAT 3616	Fuzzy Mathematics	6	6	90
6	III M	MAT 3512	Operations Research- II	5	5	75
6	IV LS	XXX xxxx	Life Skill - IV	3	2	30
6	IV	VAL xxxx	Value Education	4	2	30
Total				**30**	**27**	**405**

Courses offered to Non-major Students by the Department of Mathematics (UG)

Supportive

Sem	Part	Course Code	Course Title	Hr/wk	Cr.	Marks
1	IIIS	MAT 1431	Maths for Physics-I	**5**	**4**	**60**
2	IIIS	MAT 1433	Maths for Economics (ECE & ECO)	**5**	**4**	**60**
2	IIIS	MAT 1432	Maths for Physics-II	**5**	**4**	**60**
2	IIIS	MAT 1434	Fundamentals of Computer Applications (ECE & ECO)	**5**	**4**	**60**
3	III	MAT 2431	Maths for Chemistry - I	5	4	60
3	III	MAT 2433	Business Statistics (COM)	5	4	60
4	III	MAT 2432	Maths for Chemistry - II	5	4	60
4	III	MAT 2434	Business Mathematics (COM)	5	4	60

Non-Major Elective

Sem	Part	Course Code	Course Title	Hr/wk	Cr.	Marks
1	IV	MAT 1221	Arithmetic & Mathematical Logic	3	2	30
2	IV	MAT 1222	Recreational Mathematics	3	2	30

Life Skill Courses

Sem	Part	Course Code	Course Title	Hr/wk	Cr.	Marks
1	IV	MAT 1231	Mathematics for Life	3	2	30
2	IV	MAT 1232	Mathematical Reasoning	3	2	30
5	IV	MAT 3231	Mathematics for Competitive Exam.	3	2	30
6	IV	MAT 3232	Developing Quantitative Aptitude	3	2	30

MAT 2511   **ALGEBRA - II**   **5hr/ 5cr**

Objective:
    The objective of this course is to create awareness on the existing structures such as rings, fields, lattices and their relevance in the contemporary world.
    This course deals with basic ideas in Ring theory, Fields and Lattices.

Unit I: Introduction to Rings – Types of rings – Sub rings –Examples.
Unit II: Ideals – Integral domain – Quotient rings – Maximal ideal – Prime ideal – Homomorphism of rings.
Unit III: Introduction to Fields – Field of quotients – Ordered integral domain – Unique Factorization Domain – Euclidean Domain – Principal ideal domain.
Unit IV: Polynomial rings - Eisenstein Criterion.
Unit V: Lattices – Modular Lattice, Distributive lattice– Boolean algebra - Boolean ring – Boolean functions – Canonical form.

References:
1. S.Arumugam and A.Thangapandian Isaac, 2006. **Modern Algebra**, SCITECH Publications Private. Limited.
2. J.N.Sharma and A.R.Vashishtha, 1981. **Linear Algebra**, Krishna Prakasha Mandir.

MAT 2513   **ANALYSIS - II**   **5hr/ 5cr**

Objective:
    The course deals with metric spaces which is a classical extension of the real line and its properties in terms of the distance.
    The course introduces to the students, metric spaces and its properties. The properties like connectedness, completeness and compactness which are inherent in nature in the real line are extended to the metric spaces. Also properties like continuity and uniform continuity are exploited.

Unit I: Introduction to limits - Limit and continuity - Continuous Functions- Discontinuity - Types of discontinuity - Intermediate value theorem and its consequences.

Unit II: Metric spaces- Open sets- Limit point- Closed sets- Closure of a set- Properties of closure of a set- Interior of a set- Properties of interior of a set- Dense sets- Nowhere dense sets - Limits in metric spaces- Reformulation of definition of continuous functions- Baire's theorem- Uniform continuity.

Unit III: Connected metric spaces- Separated sets- Connected and Disconnected sets- Connectedness of product of connected metric spaces- Continuity and Connectedness.

Unit IV: Completeness - Totally Boundedness.

Unit V: Compact metric spaces- Continuous functions on compact metric spaces- Continuity of the inverse function - Bolzano-Weierstrass theorem.

References:
1. Arumugam Issac, 2006. **Modern Analysis**, New Gamma Publishing House.
2. Richard R.Goldberg, 2002. **Methods of Real Analysis**, New Delhi: Oxford &IBH Publishing Company Private Limited.
3. J.N.Sharma and A.R.Vasistha, 1997. **Real Analysis**, Krishna Prakashan Media (P) Limited.
4. Shanthi Narayan and M.D.Raisinghania, 2010. **Elements of Real Analysis**, Sultan Chand & Company Limited.
5. R.G.Bartle and D.R.Sherbert, 2002. **Introduction to Real Analysis**, Singapore: John Wiley and Sons(Asia) Private Limited.
6. K.A.Ross, 2004. **Elementary Analysis: The Theory of Calculus**, Undergraduate Texts in Mathematics, Springer (SIE), Indian Reprint.
7. J.M. Howie, 2007. **Real Analysis**, Springer.
8. Shirali, S. and H.L.Vasudeva, 2001. **Metric Spaces**, Springer.
9. Malik, S.C. and Savita Arora, 2001. **Mathematical Analysis**, New Age International Publishers.

MAT 2515   **DIFFERENTIAL EQUATIONS**   **5hr/ 5cr**

Objective:

The objective of this course is to enable the students to solve various types of differential equations and to apply them in various fields.

The topics covered includes formation of differential equations, solving various types of ordinary and partial differential equations, Laplace transforms and Laplace transforms as tool for solving differential equations.

Unit I: Ordinary differential equation – Non-Homogeneous equations of the first degree in x and y – First order and first degree exact equation – Integrating factors – Equations of the first order but of higher degree – Equations solvable for p, y and x and Clairaut's form.

Unit II: Linear differential equations with constant coefficients – Particular integrals – second order homogeneous equations with variable coefficients – Equations reducible to the linear homogeneous equations – Variation of parameters – Simultaneous differential equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ -nth order exact differential equations – Orthogonal trajectory.

Unit III: Partial differential equations of the first order – Derivation of partial differential equations – Classification of integrals – Lagrange's method of solving linear Partial differential equations – Standard forms – Equations reducible to the standard forms.

Unit IV: Laplace transforms – Developing the theory to use it as a tool - Laplace transforms of periodic functions – Some general theorems – Evaluation of integrals – Inverse Laplace transform.

Unit V: Solving ordinary differential equation with constant coefficients - variable coefficients and simultaneous linear equation using Laplace transform.

References:
1. S.Narayanan and T.K.Manickavachagom Pillay, 1996. **Calculus III**, S.Viswanathan Private Limited.
2. S.Narayanan and T.K.Manickavachagom Pillay, 1996. **Differential Equations**, S.Viswanathan Private Limited.
3. S.Arumugam and A.Thangapandian Isaac, 2002. **Differential Equations**, New Gamma Publishing House.

MAT 2411   **STATISTICS - I**   **4hr/ 4cr**

Objective:

The objective of the course is to enable the students to understand the theoretical background of statistics as a student of Mathematics.

The course essentially deals with the probability distribution theory which is the basis of statistics. The topics covered includes Correlation and Regression and curve fitting.

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

Unit II: Mathematical expectation and generating functions – Moment generating function- Chebyche's inequality- Law of large numbers.

Unit III: Theoretical Discrete and continuous distributions- Binomial, Poisson, Normal, Gamma, Exponential , Rectangular, Uniform distributions- Standard properties- Central limit theorem.

Unit IV: Correlation and Regression.

Unit V: Method of least squares – Curve fitting- linear, polynomial, exponential and logrithimic.

References:
1. S.C.Gupta and V.K.Kapoor, 2001. **Mathematical Statistics**, Sultan Chand and Sons.
2. S.Arumugam and A.Thangapandian.Isaac, 2003. **Statistics**, New Gamma Publications Private Limited.
3. Manmohan Gupta, 2001. **Statistics**, Sultan Chand and Sons.

MAT 2512   **ALGEBRA - III**   **5hr/ 5cr**

Objective:

The objective of this course is to enable the students to understand the basic ideas of vector spaces are as algebraic structure, linear transformations and their relations to matrices are also dealt with.

The topics covered in this course are vector spaces, inner product space, linear transformations, matrix of linear transformation.

Unit I: Vector space – Subspace – Quotient space.

Unit II: Spanning set – Linear independent set- Basis –Dimension.

Unit III: Linear transformations - Rank and Nullity of a linear transformation – Matrices - linear transformations – Vector space of linear transformations.

Unit IV: Inner product space –Properties – norm and distance- Schwartz inequality, triangle inequality.

Unit V: Orthogonal elements – Orthonormal set – Gram-Schmidt orthogonalization process – orthogonal complement

References:
1. J.N.Sharma and A.R.Vashishtha, 2002. **Linear Algebra**, Krishna Prakasha Mandir.
2. S.Arumugam and A.Thangapandian Isaac, 2006. **Modern Algebra**, SCITECH Publications Private Limited.

MAT 2514   **ANALYSIS - III**   **5hr/ 5cr**

Objective:
        The first two semesters of the degree programme introduced calculus which includes differentiation and integration where integration was treated as the reverse process of differentiation. However, the Riemannian definition of integration gave a twist to the way it is looked at. Students are introduced to integration as a limit of summation by Riemann integration. The Riemann integrability of a function is looked at in detail. The necessary and sufficient condition for Riemann integrability is the central theme of this course.
        Sequence of functions and their limits are introduced (pointwise limit and uniform limit). The ramifications of uniform convergence and their ramifications on integrability, differentiability and continuity are dealt in depth.

Unit I: Riemann Integration - Riemann Integrable Functions - properties of the Riemann integral- Characterization theorem on Reimann integrable functions .

Unit II: Derivatives - chain rule - Darboux's theorem - Rolle's Theorem - Law of the mean – The Fundamental theorem of calculus -Substitution theorem and application - improper integrals.

Unit III: Taylor's theorem with Lagrange and Cauchy form of remainders- Taylor series- Maclaurin series - convex functions.

Unit IV: Pointwise and uniform convergence of sequence of functions - uniform convergence and Continuity - uniform convergence and differentiation - uniform convergence and integration -Cauchy criterion for uniform convergence.

Unit V: Series of functions - convergence and uniform convergence of series of functions – Weierstrass M-Test - Dini's theorem for series - differentiation and integration of series of functions- power series - radius of convergence.

References:
1. Richard R.Goldberg, 2002. **Methods of Real Analysis**, New Delhi: Oxford & IBH Publishing Company Private Limited.
2. J.N.Sharma and A.R.Vasistha, 1997. **Real Analysis**, Krishna Prakashan Media (P) Ltd.
3. R.G.Bartle and D.R.Sherbert, 2002. **Introduction to Real Analysis**, Singapore: John Wiley and Sons (Asia) Private. Limited.
4. K.A.Ross, 2004. **Elementary Analysis: The Theory of Calculus**, Undergraduate Texts in Mathematics, Springer (SIE), Indian Reprint.
5. J.M. Howie, 2007. **Real Analysis**, Springer.
6. J.V. Deshpande, 1999. **Mathematical Analysis and Applications**, Narosa Publishing House.
7. Torence Tao, 2000. **Analysis I**, TRIM 37, Hindustan Book Agency.

MAT 2516   **VECTOR CALCULUS & TRIGONOMETRY**   **5hr/ 5cr**

Objective:

This is a foundational course for any student aspiring to complete B.Sc degree in mathematics. The applicability of the subject is enormous in nature. The first unit is primarily devoted for the basics on vectors. Trigonometry is an inevitable part of any branch of science, Demovire's theorem and its applications are exploited..

Unit I: Introduction to vectors- dot product and cross product of vectors- product of three and four vectors- geometrical interpretation of dot and cross product and their related aspects- volume of parallelopiped- tetrahedron-vector equation(lines, circles etc.,) algebraic equations and geometrical interpretations- problems related to aforesaid aspects on vectors.

Unit II: Limit of a vector function- continuity- differentiation of vectors- Taylor's theorem for vector functions- Partial derivatives- differentiability of vector functions- related problems- Definition of gradient, divergent and curl with physical interpretation- curvilinear coordinates- cylindrical and spherical.

Unit III: Vector integration- indefinite integrals- definite integral- line, surface and volume integrals- Green's theorem in plane – Green's theorem in space- Stoke's and Gauss theorems- problems related to the verification of these theorems- vector integrations.

Unit IV: Demovire's theorem- geometrical interpretation- simplification of trigonometric function- expansion of trigonometric functions.

Unit V: Hyperbolic functions- logarithmic functions- trigonometric summation of series.

References:

1. M. D. Raisinghania, 1998. **Vector Calculus**, S.Chand Company Limited.
2. Narayanan and Manichavasagam Pillai, 2002. **Vector algebra and analysis**, M. S. Viswanathan Private Limited.
3. Dipak chatterjee, 2003. **Vector Analysis**, New Delhi: Prentice Hall of India.
4. Narayanan and Manichavasagam Pillai, 2002. **Trigonometry**, M. S. Viswanathan Private Limited.
5. Arumugam and Thangapandi Issac, 2003. **Trigonometry**, New Gamma Publication.
6. A.Chandra Babu and C.R. Seshan, 2006. **New Engineering Mathematics, Volume – II**, Chennai: Narosa Publising House.

MAT 2412   **STATISTICS - II**   **4hr/ 4cr**

Objective:

        This is the second segment of a sequential course as a tool for solving problems in real life.

        The aim of this course is to enable the students to understand statistics. The course deals with analysis of variance- analysis of time series and statistical quality control.

Unit I: Sampling and Large sample tests.

Unit II: Small sampling tests using t- F- and Chi-square distributions.

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

Unit IV: Analysis of time series – components of time series – measurement of trend – seasonal variations.

Unit V: Analysis of variance – one way- two way classification -Latin square design.

References:
1. SC. Gupta and V.K. Kapoor, 2001. **Mathematical Statistics**, Sultan Chand & Sons.
2. S. Arumugam and A. Thangapandian Isaac, 2003. **Statistics**, New Gamma Publications Private Limited.
3. S.P. Gupta, 2001. **Statistical Methods**, Sultan Chand and Sons.
4. Manmohan Gupta, 2001. **Statistics**, Sultan Chand & Sons.

<u>**Supportive:**</u>
MAT 2431   **MATHS FOR CHEMISTRY - I**   **5hr/4cr**

Objective:

        To introduce the basic concepts of various areas in Mathematics required to study chemistry.

        This course deals with matrices, eigen values, eigen vectors, sets, functions, groups, rings, fields, sampling, and numerical methods.

Unit I: Matrices – elementary transformations – diagonalization – inverse – rank

Unit II: Solving homogeneous and non-homogeneous equations – Cayley-Hamilton theorem - Eigen values and Eigen vectors.

Unit III: Sets – relations – functions – types of functions – groups – examples and simple problems, rings & fields with examples.

Unit IV: Sampling theory – Large and small sample tests for mean – normal, t-test, chi-square test.

Unit V: Numerical methods – solution of algebraic equations – Interpolation - Newton's and Lagrange's methods – Numerical differentiation &integration.

References:
1. M.L. Khanna, 2001. **Matrices**, Meerut: Jai Prakash Nath & Company.
2. S. Arumugam & A. Thangapandian Issac, 1998. **Modern Algebra**, SCITECH Publications.
3. S.C.Gupta & V.K. Kapoor, 1995. **Elements of Mathematical Statistics**, Sultan Chand & Sons.
4. S.S.Sastry, 2000. **Introductory methods of Numerical Analysis**, Prentice Hall of India.

MAT 2433   **BUSINESS STATISTICS**   **5hr/4cr**

Objective:
        To enable the students to use the tools in statistic solve the problems in business studies and commerce.
        This course deals with measures of central tendency, correlation, regression, probability theory, and sampling theory.

Unit I: Measures of central tendency – measures of dispersion.

Unit II: Correlation – correlation coefficients – rank correlation – regression – regression coefficients.

Unit III: Probability function – addition and multiplication theorems on probability – conditional probability – Baye's formula and theorem.

Unit IV: Type of sampling- parameters & statistic – statistical hypothesis – null and alternative hypothesis – types of errors- large samples based on normal area table – test of significance of small samples – t-test and, F-test and Chi-square test for population variance and goodness of fit.

Unit V: Analysis of variance – one way and two way classification – Latin square design.

References:

1. S.C Gupta & V.K. Kapoor, 1995. **Elements of Mathematical Statistics**, Sultan Chand Company.
2. S.Arumugam & A.Thangapandian Issac, 2004. **Statistics**, New Gamma publishing House.

MAT 2432   **MATHS FOR CHEMISTRY -II**   **5hr/4cr**

Objective:
        To reinforce and enhance the mathematical tools introduced in MAT2431. Differential equations as a mathematical model for solving problems in chemistry is the central theme of the course.
        This course deals with differentiation, integration, differential equations and Laplace transform.

Unit I: Differentiation – successive differentiation – meaning of derivative- maxima and minima.

Unit II: Partial differentiation – errors and approximation- maxima and minima.

Unit III: Integration – Methods of integration – Some standard formulae-Integration by parts – definite integral –   reduction formula.

Unit IV: Formation of differential equations –growth, decay and chemical reactions- Solving first and second order differential equations.

Unit V: Laplace transforms – Inverse transforms-solving linear differential equations – variation of parameters.

References:
1. D.N. Hirst, 1993. **Mathematics for Chemistry**, Macmillan Press Limited.
2. Sankaranarayanan & J.A. Mangaladoss, 1980. **Differential Equations and its Applications**, Palayamkottai: Suja Publishing House.
3. S.Narayanan & T.K.ManickavachagomPillay, 2002. **Calculus, Volume I & II**, S.Viswanathan Private Limited.
4. S.Narayanan & T.K.ManickavachagomPillay, 1996. **Differential Equations**, S.Viswanathan Private Limited.

MAT 2434   **BUSINESS MATHEMATICS**   **5hr/4cr**

Objective:
        To introduce various concepts of mathematics required for commerce.
        This course deals with differentiation, integration, matrices, transportation and assignment problem.

Unit I :   Differential calculus: idea of limit- continuity- average concept and marginal concept- differential coefficient- standard forms rules for differentiation- higher order derivatives – increasing and decreasing functions- criteria for maxima and minima applications.

Unit II: Integral calculus: standard forms rules for integration- definite integral- integration by substitution – integration by parts- applications.

Unit III: Matrices – types of matrix – consistency of a matrix – rank of matrix- solving system of Homogeneous and non- homogeneous equation.

Unit IV: Transportation problems: methods of finding IBFS-u-v method- unbalanced problems - Assignment problems.

Unit V: Game theory– pure and mixed strategies –solution of 2x2 games- dominance rule- graphical solution of 2xn and mx2 games.

References:

1. Jeyaram & Arumugam, 1986. **Mathematics: An Introduction**.
2. V.Sundaresan and SD Jeyaseelan, 2003. **An introduction to Business Mathematics**, Sultan Chand & Company.
3. M.L. Khanna, 2001. **Matrices**, Meerut: Jai Prakash Nath & Company.
4. S. Narayanan & T.K. Manickavachagom Pillay, 2002. **Calculus, Volume I & II**, S.Viswanathan Private Limited.
5. S. Arumugam & A. Thangapandian Isaac,2002. **Differential Equations with Applications**, New Gamma Publishing House.

DEPARTMENT OF MATHEMATICS
Program for B.Sc. Degree in Mathematics
(w.e.f 2015-2016)

Sem	Part	Course Code	Course Title	Hr/ wk	Cr.	Marks
1	I	XXX xxxx	TAM/FRE/HIN	3	2	30
1	II	ENG 1202	Conversational Skills	3	2	30
1	III C	MAT 1511	Classical Algebra	5	5	75
1	III C	MAT 1411	Analytical Geometry -3D	4	4	60
1	III C	MAT 1413	Differential Calculus	4	4	60
1	III S	MAT 1421	Programming in C	5	4	60

1	IV LS	XXX xxxx	Life Skill - I	3	2	30
1	IV NME	XXX xxxx	Non-major Elective - I	3	2	30
			Total	**30**	**25**	**375**
2	I	XXX xxxx	TAM/FRE/HIN	3	2	30
2	II	ENG xxxx	Reading & Writing Skills	3	2	30
2	III C	MAT 1512	Algebra- I	5	5	75
2	III C	MAT 1412	Analysis -I	4	4	60
2	III C	MAT 1414	Integral Calculus	4	4	60
2	III S	MAT 1422	Object Oriented Programming in C++	5	4	60
2	IV LS	XXX xxxx	Life Skill - II	3	2	30
2	IV NME	XXX xxxx	Non-major Elective - II	3	2	30
2	V	XXX xxxx	Ext. Activity NCA/NCN/ NSS/PED/SLP		1	15
				30	**26**	**390**

Total

Sem	Part	Course Code	Course Title	Hr/wk	Cr.	Marks
3	I	XXX xxxx	TAM/FRE/HIN	3	2	30
3	II	ENG 2201	Study Skills	3	2	30
3	III C	MAT 2511	Algebra -II	5	5	75
3	III C	MAT 2513	Analysis -II	5	5	75
3	III C	MAT 2515	Differential Equations	5	5	75
3	III C	MAT 2411	Statistics- I	4	4	60
3	III S	PHY xxxx	Physics for Mathematics -I	5	4	60
			Total	**30**	**27**	**405**
4	I	XXX xxxx	TAM/FRE/HIN	3	2	30
4	II	ENG 2202	Career Skills	3	2	30
4	III C	MAT 2512	Algebra- III	5	5	75
4	III C	MAT 2514	Analysis- III	5	5	75
4	III C	MAT 2516	Vector Calculus & Trigonometry	5	5	75
4	III C	MAT 2412	Statistics- II	4	4	60
4	III S	PHY xxxx	Physics for Mathematics - II	5	4	60
4	V	XXX xxxx	Ext. Activity NCA/NCN NSS/PED/SLP		1	15
			Total	**30**	**28**	**420**

Sem	Part	Course Code	Course Title	Hr/wk	Cr.	Marks
5	III C	MAT 3611	Mechanics	6	6	90
5	III C	MAT 3613	Graph Theory	6	6	90
5	III C	MAT 3615	Operations Research- I	6	6	90
5	III C	MAT 3511	Combinatorics	5	5	75
5	IV LS	XXX xxxx	Life Skill- III	3	2	30
5	IV	MAT 3200	Environmental Studies	4	2	30
			Total	**30**	**27**	**405**
6	III C	MAT 3612	Number Theory	6	6	90
6	III C	MAT 3614	Complex Analysis	6	6	90
6	III C	MAT 3616	Operations Research- II	6	6	90
6	III C	MAT 3512	Fuzzy Mathematics	5	5	75
6	IV LS	XXX xxxx	Life Skill - IV	3	2	30
6	IV	VAL xxxx	Value Education	4	2	30
Total				**30**	**27**	**405**

Courses offered to Non-major students by the Department of Mathematics (UG)

Supportive

Sem	Part	Course Code	Course Title	Hr/wk	Cr.	Marks
1	III	MAT 1431	Maths for Physics-I	5	4	60
1	III	MAT 1433	Maths for Economics (ECE & ECO)	5	4	60
2	III	MAT 1432	Maths for Physics-II	5	4	60
2	III	MAT 1434	Fundamentals of Computer Applications (ECE & ECO)	5	4	60
3	III	MAT 2431	Maths for Chemistry - I	5	4	60
3	III	MAT 2433	Business Statistics (COM)	5	4	60
4	III	MAT 2432	Maths for Chemistry - II	5	4	60
4	III	MAT 2434	Business Mathematics (COM)	5	4	60

Non-Major Elective

Sem	Part	Course Code	Course Title	Hr/wk	Cr.	Marks
1	IV	MAT 1221	Arithmetic & Mathematical Logic	3	2	30
2	IV	MAT 1222	Recreational Mathematics	3	2	30

Life Skill Courses

Sem	Part	Course Code	Course Title	Hr/wk	Cr.	Marks
1	IV	MAT 1231	Mathematics for Life	3	2	30
2	IV	MAT 1232	Mathematical Reasoning	3	2	30
5	IV	MAT 3231	Mathematics for Competitive Exam.	3	2	30
6	IV	MAT 3232	Developing Quantitative Aptitude	3	2	30

MAT 3611   **MECHANICS**   **6 h/6Cr**

Objectives:

The course mainly deals with two major areas of applied mathematics namely Statics and dynamics. Statics is the branch of mechanics that is concerned with the analysis of loads (force and torque, or "moment") acting on physical systems that do not experience an acceleration (a=0), but rather, are in static equilibrium with their environment. Whereas the dynamics is a branch of applied mathematics (specifically classical mechanics) concerned with the study of forces and torques and their effect on motion. Brief introduction to central forces to the learners becomes essential as we live in the era of satellites, missiles and space explorations.

On successful completion of the course the student will be able to

develop mathematical models for statical and dynamical systems.
appreciate the tools that were developed and apply in the relevant context.
convert mathematical conclusions in to physical realities.
inculcate the scientific temper among the learner.
appreciate the contemporary scientific developments.

Unit I: Introduction – Forces acting at a point – Lami's theorem – Components of force – Parallel forces and moments – Moment of a force.

Unit II: Couples– Equilibrium of three forces acting on a rigid body.

Unit III: Coplanar forces – Friction.

Unit IV: Collision of elastic bodies – Principles of conservation of momentum– Direct impact– Oblique impact.

Unit V: Motion under the action of central forces– Law of inverse squares–Moment of inertia.

References:

Venkatraman. M.K, Statics, Agasthiar publications, 2002.
Venkatraman. M.K, Dynamics, Agasthiar publications, 2002.
Loney. S.L, Dynamics, Mac Millan India Edition, 1998.
Rajeshwari. I, Mechanics, Sarah's publications, 2016.
Vasistha and Agarwal, Dynamics of a particle, Krishna prakash mandir, Meeret, 2001.

MAT 3613 **GRAPH THEORY** **6 h/6Cr**

Objectives:

A graph is a symbolic representation of a network and of its connectivity. It implies an abstraction of the reality so it can be simplified as a set of linked nodes.

Graph theory is a branch of mathematics concerned about how networks can be encoded and their properties measured. It has been enriched in the last decades by growing influences from studies of social and complex networks. The origins of graph theory can be traced to Leonhard Euler who devised in 1735 a problem that came to be known as the "Seven Bridges of Konigsberg".

On successful completion of the course the student will be able to

demonstrate knowledge of the syllabus material
write precise and accurate mathematical definitions of objects in graph theory
use mathematical definitions to identify and construct examples and to distinguish examples from non-examples
validate and critically assess a mathematical proof
use a combination of theoretical knowledge and independent mathematical thinking in creative investigation of questions in graph theory
construct mathematical proofs
write about graph theory in a coherent and technically accurate manner.
hone the ability to communicate mathematics.

Unit I: Graphs– Sub graphs– Isomorphism and degrees – Degree sequence – Walks and connected graphs – Cycles in graphs – Cut vertices and cut edges – Connectedness – Ramsay number – Matrices associated with the graph – Operations on graphs.

Unit II: Eulerian graphs – Hamiltonian graphs –Properties.

Unit III: Bipartite graph – Trees.

Unit IV: Colouring – Vertex colouring – Edge colouring – Five colour theorem and Four colour conjecture – Chromatic number and chromatic polynomials.

Unit V: Independence number – Covering number – Planar graph–Dual graph of planar graph –Directed Graph.

References:

Choudum .S.A., A First Course In Graph Theory, McMillan India Ltd, 1987.
Arumugam. S and Ramachandran. S, Invitation to Graph Theory, New Gamma Publishing House, 1996
John Clarke & Derek Allan Holton, A first Look at Graph Theory, World Scientific Publishing Co. Ltd., 1995.
Murugan. M, Graph Theory, Muthali Publications, 2000.

MAT 3615   **OPERATIONS RESEARCH – I**   **6 h/6Cr**

Objectives:

Operations research- I and II are the courses that deal with the application of advanced analytical methods to help make better decisions. It was initially used in military operations to obtain better solutions which would otherwise give bad solutions. In the recent years it is adopted to management sciences and decision making. This course aims to introduce students to use quantitative methods and techniques for effective decisions– making; model formulation and applications that are used in solving real life problems.

On successful completion of the course the student will be able to

- convert real life problems into mathematical models by making use of inequalities
- use Mathematical tools to solve problems in the analytical form and will be able to interpret in the common man's language
- understand the limitations of solving by graphical method and will appreciate the simplex method
- appreciate the two-phase method or Big-M method, an alternate for overcoming the problem of surplus variable
- appreciate the nexus between the dual problem and its primal
- able to build and solve transportation and assignment problems, and interpret such solutions.
- appreciate the theory of game as it is ever prevalent in every environment.
- hone the ability to do reality checks on calculations.

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

Unit II: The Simplex method – Introduction – Simplex method – Big M method – Two phase Method.

Unit III: Duality in Linear Programming – Concept of duality – Formulation of dual linear problem – Formulation of primal-dual pairs – Dual simplex method – Revised simplex method.

Unit IV: The Transportation Problem - Introduction- Mathematical formulation- Loops in a transportation table- Finding IBFS- moving towards optimality – Degeneracy – Unbalanced transportation problems. The Assignment problem – Introduction – Hungarian method - Variations of the Assignment problem – Multiple optimal solutions – Maximization case - Travelling salesman problem –Unbalanced assignment problem- Restrictions.

Unit V: Introduction to theory of Games – Saddle Point – Graphical solution for 2 x m, n x 2 – Dominance property – Solution of game by linear programming method.

References:

Kantiswarup, Gupta P.K. & Manmohan, Operations Research, Sultan Chand & Sons, 2010.

Hadley.G, Linear Programming, Narosa Book Distributors Private Ltd. ,1963.

Taha.H.A. Operations Research – An Introduction (8th Edition) Prentice Hall of India, New Delhi. 2007

Bronson.R, Operations Research 2nd Edition, Schaum's Outline Series, 1997.

Sharma.J.K. Operations Research, Theory and applications, Macmillan, New Delhi, 2003.

Wagener.H.M., Principles of Operations Research 2nd Edition, Prentice – Hall of India, 1975

Hillier.F.S and Lieberman.G.J. Operations Research, CBS Publishers and Distributors, New Delhi. 1998

Goel. B.S. and Mittal, S.K. Operations Research, Pragati Prakashan, Meerut, 2000

Kapoor. V.K., Operations Research (Quantitative techniques for Management) 9th Edition, Sultan Chand & Sons. 2014.

Sharma S.D., Operations Research, 11th Edition, Kedarnath, Ramnath Company, 2002.

Vohra N.D., Quantitative Techniques in Management 4th Edition, Tata McGraw Hill co. 2009.

Aditham B. Rao, Operations Research, Jaico Publishing House, Mumbai, 2008.

MAT 3511   **COMBINATORICS**   **5 h/5Cr**

Objectives:

Combinatorics is a branch of mathematics concerning the study of finite or countable discrete structures. Aspects of combinatorics include counting the structures of a given kind and size (enumerative combinatorics), deciding when certain criteria can be met, and constructing and analyzing objects meeting the criteria. Many combinatorial questions have historically been considered in isolation, giving an ad hoc solution to a problem arising in some mathematical context. In the later twentieth century, however, powerful and general theoretical methods were developed, making combinatorics into an independent branch of mathematics in its own right. Combinatorics is used frequently in computer science to obtain formulas and estimates in the analysis of algorithms.

On successful completion of the course the student will be able to

apply algorithms taught in the course

understand the fundamental combinatorial structures that naturally appear in various other fields of mathematics and computer science

use these structures to represent mathematical and applied questions

use the combinatorial tools that are used to analyze such structures

know how to prove the existence or non-existence of the object, compute the number of such objects, and understand their underlying structure

use generating functions to solve a variety of combinatorial problems.

Unit I: Two basic principles – Simple arrangement and selections with or without repetition – Distributions – Binomial coefficients.

Unit II: Generating functions - Calculating coefficients of generating functions – Exponential generating function – Summation method – Partitions.

Unit III: Recurrence relations – Divide and conquer relations – Dearrrangement – Solution of linear recurrence relation.

Unit IV: Fibonacci number - Stirling number of first and second kind – Catalan number– Ménage number.

Unit V: Inclusion and Exclusion principle – Pigeon hole principle – Ramsey theorem.

References:

Tucker A.W., Applied Combinatorics, Wiley, 2000.
Cohen D., Combinatorics, Wiley, 1978.
Hall M., Combinatorial Mathematics, McGraw Hill, 1968.
Liu C.L., Introduction to Combinatorial Mathematics, McGraw-Hill, Newyork, 1994
Ryser H.J., Combinatorial Mathematics, Carus Mathematical monograph, 1965.
Krishnamurthy, Combinatorics, PHI, 1998.
Balakrishnan V.K., Combinatorics, Schaum's outline series, Tata McGraw Hill, 2005

MAT 3612   **NUMBER THEORY**   **6 h/6Cr**

Objectives:

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

On successful completion of the course the student will be able to

state fundamental results in number theory and prove rigorously mathematical statements concerning prime numbers and modular arithmetic

determine greatest common divisors by prime factorizations or Euclid's algorithm

solve linear Diophantine equations and linear congruences

describe properties of common arithmetical functions, including the Euler
phi function
apply methods and techniques of number theory to a range of applications
hone the ability to do reality checks on calculations.

Unit I: Divisibility– Euclidean algorithm – Primes – Fundamental theorem of arithmetic.

Unit II: Congruences – Fermat, Euler and Wilson theorem – Lagrange theorem –
Chinese remainder theorem – Solution of congruences.

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.

References:

Andrews. G. E, Number theory, Hindustan Publishing Corporation, 1994.

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

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

Niven. I and Zuckerman.H.S, An introduction to the theory of numbers,
Wiley eastern, 2015.

Narayanan. K.S and Manicavachagom Pillay. T.K, Algebra, Vol. I, S. Viswanathan
(Printers and Publishers) Pvt. Ltd., 1982.

MAT 3614   **COMPLEX ANALYSIS**   **6 h/6Cr**

Objectives:

Complex analysis, traditionally known as the theory of functions of a complex
variable, is the branch of mathematical analysis that investigates functions of complex
numbers. It is useful in many branches of mathematics, including algebraic geometry, number
theory, analytic combinatorics, applied mathematics; as well as in physics, including
hydrodynamics and thermodynamics and also in engineering fields such as nuclear,
aerospace, mechanical and electrical engineering.

On successful completion of the course the student will be able to

understand how complex numbers provide a satisfying extension of the real numbers;
appreciate how throwing problems into a more general context may enlighten one
about a specific context (e.g. solving real integrals by doing complex integration;

Taylor series of a complex variable illuminating the relationship between real function that seem unrelated -- e.g. exponentials and trig functions);

learn techniques of complex analysis that make practical problems easy (e.g. graphical rotation and scaling as an example of complex multiplication);

continue to develop proof techniques;

appreciate how mathematics is used in design (e.g. conformal mapping);

unlearn (if ever learned) the notion that mathematics is all about getting "the right answer";

hone the ability to do reality checks on calculations.

hone the ability to communicate mathematics.

Unit I: Geometry of complex numbers – Elementary transformations – Bilinear transformations – Cross Ratio – Fixed points of bilinear transformation.

Unit II: Analytic function – Differentiability – The Cauchy Riemann equation – Conformal mappings.

Unit III: Definite Integral – Cauchy's Theorem – Cauchy's Integral formula – Cauchy's Inequality – Morera's theorem – Liouville's theorem and fundamental theorem of Algebra – Maximum modulus theorem.

Unit IV: Taylor's and Laurent's theorem – Zeros of an analytic function.

Unit V: Singularities – Cauchy Residue theorem – Arguments Principle – Rouche's theorem – Contour Integration.

References:

Arumugam.S, Thangapandi Issac.A , Somasundaram. A**,** Complex Analysis , SCITECH publications private limited, 2007.

Shanti Narayanan, Complex Analysis, S. Chand & Co, 1999.

Duraipandian.P, Lakshmi Duraipandian and Muhilan.D**,** Complex Analysis, Emerald Publishers, 1994.

Ponnuswamy.S, Foundations of Complex Analysis, Narosa Publishing House, 2004.

Karunakaran.V , Complex Analysis, Narosa Publishing House, 2006.

MAT 3616   **OPERATIONS RESEARCH - II**   **6 h/6Cr**

Objectives:

Student will be able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type. To build and solve Transportation Models and Assignment Models. To design new simple models, like CPM to improve decision-making and develop critical thinking and objective analysis of decision problems.

On successful completion of the course the student will be able to

> convert real life problems into mathematical models by making use of inequalities communicate effectively and to function well on multi-disciplinary teams.

> appreciate post optimal analysis/sensitivity of the optimal solution for small changes in the initial parameters

> design new simple models, like: PERT, CPM to improve decision –making and develop critical thinking and objective analysis of decision problems.

> describe the scope of project planning, and use appropriate techniques to represent and analyse projects with a view to managing resources, minimising costs, and coping with uncertainty.

> solid understanding of the many ways applied mathematics can be used to extract data information and for making decisions.

> learn and understand the types of Inventories and objectives of Inventory Control. This would help them to understand the major reasons for holding inventories and also to differentiate between independent and dependent demand.

> recognise the basic types of queuing model, derive and calculate steady state system performance characteristics for these types.

> get an understanding of the factors and restrictions involved in building and using models for planning and management problems.

Unit I: Introduction to sensitivity Analysis – Changes in the cost vector, requirement vector – Coefficient matrix – Addition and deletion of variables - related problems.

Unit II: Introduction to Integer programming – Gomary's all-IPP Method – construction of Gomary's cut – fractional cut method-all Integer and mixed Integer - related problems.

Unit III: Network Scheduling by PERT/CPM- Introduction – Network and Basic components – Rules of network construction – Time calculations in networks – Critical Path Method (CPM)- PERT:PERT calculations - Negative float and Negative slack – advantages of network (PERT/CPM)

Unit IV: Inventory Control- Introduction – Reasons for carrying inventory – Types of inventory – The inventory decisions – Economic Order Quantity- Four EOQ models – EOQ problem with price breaks- Multi item deterministic problem.

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

References:

Kantiswarup, Gupta P.K. & Manmohan, Operations Research, Sultan Chand & Sons, 2010.
G. Hadley, Linear Programming, Narosa Book Distributors Private Ltd. ,1963.

Taha, H.A. Operations Research – An Introduction (8th Edition) Prentice Hall of India, New Delhi. 2007

Bronson R, Operations Research 2nd Edition, Schaum's Outline Series, 1997.

Sharma, J.K. Operations Research, Theory and applications, Macmillan, New Delhi, 2003.

Wagener H.M., Principles of Operations Research 2nd Edition, Prentice – Hall of India, 1975

Hillier, F.S and Lieberman, G. J. Operations Research, CBS Publishers and Distributors, New Delhi. 1998

Goel, B.S. and Mittal, S.K. Operations Research, Pragati Prakashan, Meerut. 2000

Kapoor V.K., Operations Research (Quantitative techniques for Management) 9th Edition, Sultan Chand & Sons. 2014.

Sharma S.D., Operations Research, 11th Edition, Kedarnath, Ramnath Company, 2002.

Vohra N.D., Quantitative Techniques in Management 4th Edition, Tata McGraw Hill co. 2009.

Aditham B. Rao, Operations Research, Jaico Publishing House, Mumbai, 2008.

MAT 3512	FUZZY MATHEMATICS	5 h/5Cr

Objectives:

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

On successful completion of the course the student will be able to

distinguish between the crisp set and fuzzy set concepts through the learned differences between the crisp set characteristic function and the fuzzy set membership function

draw a parallelism between crisp set operations and fuzzy set operations through the use of characteristic and membership functions respectively

define fuzzy sets using linguistic words and represent these sets by membership functions

know how to perform mapping of fuzzy sets by a function and also use the α-level sets in such instances

know fuzzy-set-related notions; such as α-level sets, convexity, normality, support, etc.

know the concept of a fuzzy number and how it is defined

understand the extension principle, its compatibility with the α-level sets and the usefulness of the principle in performing fuzzy number arithmetic operations (Additions, multiplications, etc.)
know the fuzzy relations and the properties of these relations
analyze the distinction between binary logic and fuzzy logic at the conceptual.

Unit I: Crisp sets and fuzzy sets– basic concepts of fuzzy set – classical and fuzzy logic.

Unit II: α-cuts – properties of α-cuts – representations of fuzzy sets – Extension principle of fuzzy sets.

Unit III: Operations on fuzzy sets – fuzzy complements – fuzzy union – fuzzy intersection.

Unit IV: Fuzzy numbers – Arithmetic operation on intervals – Arithmetic operation on fuzzy numbers – fuzzy equations.

Unit V: Crisp and fuzzy relations – Binary fuzzy relations – Binary relation on a single set – Equivalence and similarity relation – Fuzzy relation equation.

References:

Klir.G.J and Folger T.A, Fuzzy sets Uncertainty and information, Prentice Hall of India, 1995.
Klir G.J and Bo Yuan, Fuzzy Sets, Fuzzy Logic, Theory and Applications, Prentice Hall of India, 1997.

MAT 3200   **ENVIRONMENTAL STUDIES**   **4 h/2Cr**

Objectives:

An environmental study is a multidisciplinary academic field which systematically studies human interaction with the environment in the interests of solving complex problems. Environmental study brings together the principles of sciences, commerce/ economics and social sciences so as to solve contemporary environmental problems. It is a broad field of study that includes the natural environment, built environment, and the sets of relationships between them. The field encompasses study in basic principles of ecology and environmental science, as well as associated subjects such as ethics, geography, policy, politics, law, economics, philosophy, environmental sociology and environmental justice, planning, pollution control and natural resource management.

On successful completion of the course the student will be able to

locate and comprehend relationships between the natural, social and cultural environment
create cognitive capacity and resourcefulness to make the students curious about social phenomena, starting with the family and moving on to wider spaces

nurture the curiosity and creativity of the students particularly in relation to the natural environment (including artifacts and people)

engage the students in exploratory and hands-on activities to acquire basic cognitive and psychomotor skills through observation, classification, inference, etc.

create awareness towards environmental issues and their social responsibility as a major stakeholder in the system

appreciate the eco diversity of the sub continent and its resources

know the need for sustainable development and optimal utilization of natural resources

introduce to mathematical tools that may be used solve environmental issues

Unit I: Understanding eco-system –Food chain –Ecological pyramids – Introduction to different eco-system – Bio-geographical classification of India – Hot spots of bio-diversity – Conservation of bio-diversity.

Unit II: Introduction to Environmental Pollution – Causes and effects of air, water, noise, soil, thermal and nuclear pollution – Measures of control and management – Oil slick and its effects on the marine eco system – Global warming and climate change – Acid rain– Ozone layer depletion – Nuclear accident and holocaust.

Unit III: Energy sources – Renewable- Non renewable energy sources – Nuclear energy – Bio fuels – Non conventional energy sources – Pollution free energy.

Unit IV: Social Issues – Urbanization and pollution – Hazard identification – Air quality standards – Major pollutants and their effects in an urban environment – Permissible limits and methods of control – Environmental ethics – Environmental protection act – Environmental auditing (Air, water, wildlife protection, forest conservation acts) – Public awareness on solid waste management – House hold environment and health.

Unit V: Mathematical modeling for environmental issues –Weather/ disaster predictions – mathematical models using differential equations, linear programming and chaos theory.

References:

Erach Bharucha, Textbook of Environmental Studies, Universities Press, 2005.

Rana, essentials of ecology and Environmental science S.V.S. PHI, 2003.

Subramanian,N.S. & Sambamoorthy-A.V.S.S Ecology, Narosa publishing house, 2000.

Raman Sivakumar, Introduction to environmental science and energy, 2005.

Raman Sivakumar, Introduction to Environmental Science and Engineering, 2005

Ravikrishnan.A, Environmental Science and Engineering, Sri Krishna Hitech Publishing Company Pvt. Ltd, 2010

Arumugam.N, Kumaresan.V, Environmental studies, Saras Publication,2010.

MAT 3231   MATHEMATICS FOR COMPETITIVE EXAMINATIONS   3h/2Cr

Objectives:

This course is designed for non major students who intent to apply for various competitive examinations . Though, no new concepts in mathematics are introduced whatever the students have learnt till their secondary level are recalled. Adequate training is given so that they will overcome the fear of numbers with the required level of speed and accuracy. This will provide strategies and methods to solve problems in Mathematics section of any competitive examinations.

On successful completion of the course the student will be able to

> appreciate the techniques and tools in mathematics to solve problems in life
> read between the lines and understand the logic behind it
> increase the speed and accuracy in performing problems in competitive examinations
> improve the efficiency in dealing with numbers
> appreciate the techniques and tools in mathematics to solve problems in life

Unit I: Numbers - problems on   numbers - H.C.F and L.C.M – Divisibility –Simplification.

Unit II: Arithmetic mean - Geometric mean – Harmonic mean.

Unit III: Mathematical logic – conjunction –disjunction – negation – implications – Equivalence of statements – disjunctive and conjunctive normal forms.

Unit IV: Venn diagram – Inclusion and exclusion principle.

Unit V: Measures of standard geometric objects.

References:

> Aggarwal R.S , Quantitative Aptitude, S. Chand & company Ltd., 2006.
> Discrete Mathematics, Schaum's outline series, McGraw Hill, 1996.
> 3. Set theory and Logic,   Schaum's outline series, McGraw Hill, 1996.

MAT 3232   DEVELOPING QUANTITATIVE APTITUDE   3 h/2Cr

Objectives:

This course will enable the students to develop their quantitative skills that strengthen their edge over others in competitive examinations. This course covers the area related to problems on numbers, logical concepts, alligation and mixture.

On successful completion of the course the student will be able to
> appreciate the techniques and tools in mathematics to solve problems in life

read between the lines and understand the logic behind it
 increase the speed and accuracy in performing problems in competitive examinations
improve the efficiency in dealing with numbers
appreciate the techniques and tools in mathematics to solve problems in life

Unit I: Simple equation - simultaneous simple equations - Number of solution - Application on age –fraction – average - partnership.

Unit II: Ratio and proportion- Variation- Profit and loss.

Unit III: Time and work- Pipes and cistern-Time and distance.

Unit IV: Simple interest- Compound interest-Alligation and mixture.

Unit V: Indices - Surds - Logarithms.

References:

Aggarwal R.S.Quantitative Aptitude,S.chand & company Ltd., 2006
Sundaresan.V & Jeyaseelan.S.D, An Introduction to Business Mathematics, S.Chand & company Ltd., 2003.

DEPARTMENT OF MATHEMATICS

Program for B.Sc. Degree in Mathematics
(w.e.f. 2018-19)

Sem.	Part	Course Code	Course Title	Hr/ wk	Cr.	Marks
1	I	XXX xxxx	TAM/FRE/HIN	3	2	30
1	II	ENG xxxx	Conversational Skills	3	2	30
1	III M	MAT 1511	Classical Algebra	5	5	75
1	III M	MAT 1411	Analytical Geometry -3D	4	4	60
1	III M	MAT 1413	Differential Calculus	4	4	60
1	III S	MAT 1321	Programming in C	3	3	45
1	III S	MAT 1101	Programming in C - Lab	2	1	15
1	IV LS	XXX xxxx	Life Skill - I	3	2	30
1	IV NME	XXX xxxx	Non-major Elective - I	3	2	30
			Total	**30**	**25**	**375**

						MA 27
2	I	XXX xxxx	TAM/FRE/HIN	3	2	30	
2	II	ENG xxxx	Reading &Writing Skills	3	2	30	
2	III M	MAT 1512	Algebra- I	5	5	75	
2	III M	MAT 1412	Analysis -I	4	4	60	
2	III M	MAT 1414	Integral Calculus	4	4	60	
2	III S	MAT 1322	Objected Oriented Programming in C++	3	3	45	
2	III S	MAT 1102	C++ Lab	2	1	15	
2	IV LS	XXX xxxx	Life Skill - II	3	2	30	
2	IV NME	XXX xxxx	Non-major Elective - II	3	2	30	
2	V	XXX xxxx	Ext. Activity NCA/NCN/NSS/PED/SLP		1	15	
			Total	**30**	**26**	**390**	
3	I	XXX xxxx	TAM/FRE/HIN	3	2	30	
3	II	ENG xxxx	Study Skills	3	2	30	
3	III M	MAT 2511	Algebra -II	5	5	75	
3	III M	MAT 2513	Analysis -II	5	5	75	
3	III M	MAT 2515	Differential Equations	5	5	75	
3	III M	MAT 2411	Statistics- I	4	4	60	
3	III S	PHY xxxx	Physics for Mathematics- I	5	4	60	
			Total	**30**	**27**	**405**	

Sem	Part	Course Code	Course Title	Hr/ wk	Cr.	Marks
4	I	XXX xxxx	TAM/FRE/HIN	3	2	30
4	II	ENG xxxx	Career Skills	3	2	30
4	III M	MAT 2512	Algebra- III	5	5	75
4	III M	MAT 2514	Analysis- III	5	5	75
4	III M	MAT 2516	Vector Calculus & Trigonometry	5	5	75
4	III M	MAT 2412	Statistics- II	4	4	60
4	III S	PHY xxxx	Physics for Mathematics- II	5	4	60
4	V	XXX xxxx	Ext. Activity NCA/NCN/NSS/PED/SLP		1	15
			Total	**30**	**28**	**420**
5	III M	MAT 3611	Mechanics	6	6	90
5	III M	MAT 3613	Graph Theory	6	6	90
5	III M	MAT 3615	Operations Research- I	6	6	90
5	III M	MAT 3511	Combinatorics	5	5	75
5	IV LS	XXX xxxx	Life Skill- III	3	2	30
5	IV	MAT 3200	Environmental Studies	4	2	30
			Total	**30**	**27**	**405**
6	III M	MAT 3612	Number Theory	6	6	90
6	III M	MAT 3614	Complex Analysis	6	6	90
6	III M	MAT 3616	Operations Research-II	6	6	90
6	III M	MAT 3512	Fuzzy Mathematics	5	5	75
6	IV LS	XXX xxxx	Life Skill - IV	3	2	30
6	IV	VAL xxxx	Value Education	4	2	30
			Total	**30**	**27**	**405**

Courses offered to Non-major students by the Department of Mathematics (UG)

Supportive:

Sem.	Part	Course Code	Course Title	Hr/wk	Cr.	Marks
1	III S	MAT 1431	Maths for Physics- I	5	4	60
1	III S	MAT 1433	Maths for Economics (ECE & ECO)	5	4	60
2	III S	MAT 1432	Maths for Physics- II	5	4	60
2	III S	MAT 1334	Fundamentals of Computer Applications(ECE &ECO)	3	2	45
2	III S	MAT 1104	Fundamentals of Computer Applications- Lab	2	1	15
3	III S	MAT 2431	Maths for Chemistry- I	5	4	60
3	III S	MAT 2433	Business Statistics (COM)	5	4	60
4	III S	MAT 2432	Maths for Chemistry- II	5	4	60
4	III S	MAT 2434	Business Mathematics (COM)	5	4	60

Non-Major Elective

Sem	Part	Course Code	Course Title	Hr/wk	Cr.	Marks
1	IV	MAT 1221	Arithmetic & Mathematical Logic	3	2	30
2	IV	MAT 1222	Recreational Mathematics	3	2	30

Life Skill Courses

Sem	Part	Course Code	Course Title	Hr/wk	Cr.	Marks
1	IV	MAT 1231	Mathematics for Life	3	2	30
2	IV	MAT 1232	Mathematical Reasoning	3	2	30
5	IV	MAT 3231	Mathematics for Competitive Exam.	3	2	30
6	IV	MAT 3232	Developing Quantitative Aptitude	3	2	30

DEPARTMENT OF MATHEMATICS

Program for B.Sc. Degree in Mathematics (SF)

(w.e.f. 2018-2019)

Sem.	Part	Course Code	Course Title	Hrs/Wk	Cr.	Marks
1	I	XXX xxxx	TAM/FRE/HIN	3	2	30
1	II	ENS 1201	Conversational Skills	3	2	30
1	III M	MAS 1511	Classical Algebra	5	5	75
1	III M	MAS 1411	Analytical Geometry -3D	4	4	60
1	III M	MAS 1413	Differential Calculus	4	4	60
1	III S	PHS xxxx	Physics for Mathematics - I	5	4	60
1	IV LS	XXX xxxx	Life Skill - I	3	2	30
1	IV NME	XXX xxxx	Non-major Elective - I	3	2	30
			Total	**30**	**25**	**375**
2	I	XXX xxxx	TAM/FRE/HIN	3	2	30
2	II	ENS 1202	Reading & Writing Skills	3	2	30
2	III M	MAS 1512	Algebra- I	5	5	75
2	III M	MAS1412	Analysis -I	4	4	60
2	III M	MAS 1414	Integral Calculus	4	4	60
2	III S	PHS xxxx	Physics for Mathematics - II	5	4	60
2	IV LS	XXX xxxx	Life Skill - II	3	2	30
2	IV NME	XXX xxxx	Non-major Elective - II	3	2	30
2	V	XXX xxxx	Ext. Activity NSS/PED/SLP		1	15
			Total	**30**	**26**	**390**

Sem.	Part	Course Code	Course Title	Hrs/Wk	Cr.	Marks
3	I	XXX xxxx	TAM/FRE/HIN	3	2	30
3	II	ENS 2201	Studies Skills	3	2	30
3	III M	MAS 2511	Algebra -II	5	5	75
3	III M	MAS 2513	Analysis -II	5	5	75
3	III M	MAS 2515	Differential Equations	5	5	75
3	III M	MAS 2411	Statistics- I	4	4	60
3	III S	COS xxxx	Programming in C	5	4	60
			Total	**30**	**27**	**405**
4	I	XXX xxxx	TAM/FRE/HIN	3	2	30
4	II	ENS 2202	Career Skills	3	2	30
4	III M	MAS 2512	Algebra- III	5	5	75
4	III M	MAS 2514	Analysis- III	5	5	75
4	III M	MAS 2516	Vector Calculus & Trigonometry	5	5	75
4	III M	MAS 2412	Statistics- II	4	4	60
4	III S	COS xxxx	Programming in C++	5	4	60
4	V	XXX xxxx	Ext. Activity NSS/PED/SLP		1	15
			Total	**30**	**28**	**420**

Sem.	Part	Course Code	Course Title	Hrs/Wk	Cr.	Marks
5	III M	MAS 3611	Mechanics	6	6	90
5	III M	MAS 3613	Graph Theory	6	6	90
5	III M	MAS 3615	Operations Research- I	6	6	90
5	III M	MAS 3511	Combinatorics	5	5	75
5	IV LS	XXX xxxx	Life Skill- III	3	2	30
5	IV	MAS 3200	Environmental Studies	4	2	30
			Total	**30**	**27**	**405**
6	III M	MAS 3612	Number Theory	6	6	90
6	III M	MAS 3614	Complex Analysis	6	6	90
6	III M	MAS 3616	Operations Research- II	6	6	90
6	III M	MAS 3512	Fuzzy Mathematics	5	5	75
6	IV LS	XXX xxxx	Life Skill - IV	3	2	30
6	IV	VAL xxxx	Value Education	4	2	30
			Total	**30**	**27**	**405**

Courses offered to Non-major students by the Department of Mathematics (UG)

Supportive:

Sem.	Part	Course Code	Course Title	Hrs/Wk	Cr.	Marks
1	III	MAS 1431	Maths for Physics- I	5	4	60
1	III	MAS 1433	Discrete Mathematics (BCA)	5	4	60
1	III	MAS 1435	Maths for Chemistry - I	5	4	60
1	III	MAS1439	Business Statistics (CPA)	5	4	60
2	III	MAS 1432	Maths for Physics- II	5	4	60
2	III	MAS 1434	Discrete Mathematics (COS)	5	4	60
2	III	MAS 1436	Maths for Chemistry – II	5	4	60
2	III	MAS 1438	Statistics (BIT)	5	4	60
2	III	MAS 1440	Business Statistics(BBA)	5	4	60
2	III	MAS 1446	Business Mathematics (CPA)	5	4	60
3	III	MAS 2431	Operations Research (BIT)	5	4	60
3	III	MAS 2433	Business Statistics (CME)	5	4	60
3	III	MAS 2437	Business Statistics (CIT)	5	4	60
3	III	MAS 2439	Quantitative Techniques (BBA)	5	4	60
3	III	MAS 2475	Business Statistics (CMC)	5	4	60
3	III	MAS 2477	Numerical and Statistics Methods (COS)	5	4	60
4	III	MAS 2434	Business Mathematics (CME)	5	4	60
4	III	MAS 2438	Business Mathematics (CIT)	5	4	60
4	III	MAS 2440	Operations Research (BCA)	5	4	60
4	III	MAS 2454	Biostatistics (BCH)	5	4	60
4	III	MAS 2466	Business Mathematics (CMC)	5	4	60
4	III	MAS 2472	Biostatistics (MIC)	5	4	60

Non-Major Elective:

Sem.	Part	Course Code	Course Title	Hrs/Wk	Cr.	Marks
1	IV	MAS 1221	Arithmetic & Mathematical Logic	3	2	30
2	IV	MAS 1222	Recreational Mathematics	3	2	30

Life Skill Courses:

Sem.	Part	Course Code	Course Title	Hrs/Wk	Cr.	Marks
1	IV	MAS 1231	Mathematics for Life	3	2	30
2	IV	MAS 1232	Mathematical Reasoning	3	2	30
5	IV	MAS 3231	Mathematics for Competitive Examinations	3	2	30
6	IV	MAS 3232	Developing Quantitative Aptitude	3	2	30

MAT 1511/MAS 1511   **CLASSICAL ALGEBRA**   **5 hrs / 5cr**

Objective:

This is a foundational course for any student aspiring to complete B.Sc., degree in Mathematics. The students are introduced to the different methods of solving polynomials with real coefficients. The second section is devoted to the relation between arithmetic mean, geometric mean and harmonic mean and their subsequent applications. The third section deals with the elementary properties of matrices and their use in solving simultaneous linear equations. The binomial, exponential and logarithmic series are introduced and is used to find out the approximate values of certain rational indices.

After the end of this course students will be able to

acquire the knowledge of basic algebra and its applications
solve simultaneous linear equation using matrices

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 – Applications to maxima and minima.

Unit IV: Binomial, Exponential and Logarithmic series – Approximations.

Unit V: Types of Matrices – Elementary transformations – Inverse of a matrix and Rank of matrix using elementary transformations – Solution of simultaneous linear equations – Eigen values and Eigen vectors - Cayley Hamilton theorem –Diagonalization.

Text Books:

Manickavachagom Pillay. T. K, Natarajan. T and Ganapathy. K. S, Algebra Vol I and II, S.Viswanathan Pvt. Ltd., 2013.
     Unit I: Vol I: Chapter 6 (sec 9-12, 15.1-15.2)
     Unit II: Vol I: Chapter 6 (Sec 15.3, 16.1-18, 24.1-24.3 and Sec 29.4- 30.1)
     Unit III: Vol II: Chapter 4 (Sec 1-6, 8-13)
     Unit IV: Vol I: Chapter 3 (Sec 1-1.2, 10, 14); Chapter 4 (Sec2, 3,5-9)
     Unit V: Vol II: Page no 114-115.
  Arumugam.S., Thangapandian Isaac .A, Modern Algebra, SciTech publications Pvt. Ltd, 1996.   .
     Unit V: Chapter 7 (sec 7.4 – 7.8)

Reference Books:

Arumugam. S, Thangapandian Isaac. A, Theory of Equations, New Gamma Publishing House, 1996.
Khanna .M. L, Matrices, S. Chand and Co., 1998.

MAT 1411 / MAS 1411   **ANALYTICAL GEOMETRY-3D**   **4hrs / 4cr**

Objective:

      This is a foundational course for any student aspiring to complete B.Sc., degree in Mathematics. Analytical geometry is a conventional mathematics course which deals with geometrical objects in their analytical form. The first two units are entirely devoted for understanding objects such as planes and lines in three dimensions. The co planarity of two straight lines or they being skew lines is dealt. The analytical form of a sphere, cone and cylinder are introduced.

 After the end of this course students will be able to

     classify and identify different problem types in analytical geometry and select suitable
     problem solving techniques.
     identify and use applicable math study skills in analytical geometry.

Unit I: Rectangular Cartesian co-ordinates – Direction ratios and Direction cosines.

Unit II: The plane- Angle between the planes- Equation of a plane through the line of intersection of two given planes- Length of the perpendicular- Equation of the planes bisecting the angle between the planes.

Unit III: Straight lines-Symmetrical form of equation of the lines- Equation of straight line passing through two given points.

Unit IV: Plane and the straight line- Co planarity of straight lines- Shortest distance between two given lines-Intersection of three planes- Volume of a tetrahedron.

Unit V: Standard equation of sphere-Results based on the properties of a sphere -Tangent plane to a sphere- Equation of a circle- Introduction to cone and cylinder.

 Text Book:
Manicavachagom pillay. T.K, and Natarajan .T, Analytical Geometry Part II 3D,
S.Viswanathan Pvt. Ltd., 2006.
    Unit I: Chapter 1
    Unit II: Chapter 2
    Unit III: Chapter 3 (Sec 1-4)
    Unit IV: Chapter 3 (Sec 5-11 except section 9)
    Unit V: Chapter 4, Chapter 5 (Cone and cylinder –Definition and related problems in
          Right circular cone and Right circular cylinder)

Reference Books:
    Durai Pandian. P, Analytical Geometry, Asia Publishing House, 1968.
    Arumugam. S, and Thangapandian Isaac.A , Analytical Geometry, New
    Gamma Publishing house, 1996.
    Qazi zameeruddin, khanna V K, Solid Geometry, Vikas publishing house pvt. Ltd 1997

MAT 1413 / MAS 1413   **DIFFERENTIAL CALCULUS**   **4hrs / 4cr**

Objective:

This is a foundational course for any student aspiring to complete B.Sc., degree in Mathematics. The calculus is the science of determining the effect of very small change. Different methods of calculating the derivative of a function and the interpretation of derivative at different circumstances are dealt in detail. The functions involving more than one variable and the rate of change with respect to one variable are attributed as partial derivative. The application of partial derivatives as a tool for engineers, scientists and social scientists are illustrated.

At the end of this course students can be able to

understand the idea of derivative. They can use derivative to explore the behavior of given function and solve extreme value problems.

compute the expression for the derivative of a function using the rules of differentiation including the power rule, product rule, and quotient rule and chain rule

differentiate exponential, logarithmic, and trigonometric and inverse trigonometric functions.

obtain expressions for higher order derivatives of a function using the rules of differentiation

Unit I: Differentiation – Standard form – Function of function rule – Hyperbolic function – Inverse function – Substitution - Logarithmic function – Transformation – Implicit function – one function with respect to other function.

Unit II: Successive differentiation, n^{th} derivatives – Leibnitz formula for n^{th} derivative of a product.

Unit III: Interpretation of derivatives - Tangent and Normals – Maxima and Minima of single variable.

Unit IV: Envelope – Curvature – Center of curvature – Radius of curvature – Evolutes and Involutes.

Unit V: Partial differentiation – Errors and approximation – Maxima and Minima for functions of two or more variables.

Text Book:

Narayanan. S. and Manickavachagom Pillay. T.K., Calculus Vol I, Viswanathan Pvt Ltd, 2013.

      Unit I: Chapter- II (Sec 3-6)
      Unit II: Chapter- III
      Unit III: Chapter -V (Sec 1) and Chapter-IX
      Unit IV: Chapter-X
      Unit V: Chapter-VIII

Reference Books:
Arumugam. S and Thangapandian Isaac. A , Calculus Vol I, New Gamma Publishing House, 2013.
Shanti Narayan and Dr. Mittal.P.K, Differential Calculus, S.Chand & company Ltd, 2005.

MAT1321   **PROGRAMMING IN C**   **3hrs / 3cr**

Objective:

This is a supportive course for all students aspiring to complete B.Sc., degree in Mathematics. This course introduces the syntax of the programming in C and develops the skills in writing programs.

On successful completion of the course the student will be able to

write programs in C related to the problems they encounter in day-to-day life and validate in the computer lab.

Unit I: Introduction to C- History- Identifiers- Keywords- Variables-Data types - Operators and Expressions - Input and Output statements.

Unit II: Conditional statements: simple if, if-else, nested if-else, else if ladder, switch and goto statement-Looping statements: while, do-while and for statements -Nesting of loops.

Unit III: Introduction to Arrays- One dimensional- Two dimensional and Multi dimensional array- Array of Characters - Strings - String functions.

Unit IV: Introduction to Modular Programming: Functions-Call by Value-Call by reference Category of functions-Nesting of functions-Recursion.

Unit V: Introduction to structures and unions- Array of structures-Array within Structures-Structures within Structures-Structures and Functions- Introduction to pointers.

Text Book:

Balagurusamy. E, Programming in ANSI C, Tata McGraw-Hill, Third Edition, 2013.
Unit I: sections 1.1-1.10; 2.2-2.14; 3.2-3.16; 4.1-4.5
Unit II: sections 5.1-5.9; 6.1-6.5
Unit III: sections 7.1-7.8; 8.1-8.8
Unit IV: sections 9.1-9.18
Unit V: sections 10.1-10.13; 11.1-11.5

Reference Books:
LesHanCock, Morris Kringer, C Primer, McGrawHill, 1997.
Y. Kanetkar, Understanding Pointers in C, 4th Edition, BPB publications, New Delhi.
D. M. Ritchie, The C programming language, Prentice Hall of India, 1977.
C. Gottfried, Programming in C, Schaum outline series, 1996.
P.Pandiyaraja, Programming in C, Vijay Nicole Imprint Private Limited, 2005.

MAT 1101 **PROGRAMMING IN C-LAB** **2hrs/1cr**

Objective:

This course is mainly concentrates on programming concepts of C and its implementation.

It makes the students to be familiar with the syntax and structure of C programming language and it enables them to write programs to solve real world problems using C concepts.

1. Programs on formatted input/output. (2h)
2. Programs using conditional statements. (3h)
3. Programs using looping statements. (3h)
4. Programs using one-dimensional array. (2h)
5. Programs using two-dimensional array. (2h)
6. Programs related to strings and string functions. (2h)
7. Programs using functions (Nesting of functions, recursion etc.) (2h)
8. Programs on structures and unions. (2h)
9. Basic programs using pointers. (1h)

MAT 1512 / MAS 1512 **ALGEBRA - I** **5hrs / 5cr**

Objective:

This is a basic course for any student aspiring to complete B.Sc., degree in Mathematics. The essence of mathematical logics and its ramifications in the study of mathematics is introduced. Basic properties of sets which are needed for the study of algebra are introduced. The students are exposed to the basic algebraic structure called group. Subsequently the properties of groups and imbedding a group in a bigger group called the group of symmetries are dealt with. The algebraic equivalence of any two groups is studied by means of isomorphism.

After completing the course, the students will be able to

write an argument using logical notation, understand the basic principles of sets and operations in sets
demonstrate an understanding of relations, functions and groups.

Unit I: Statement- Negation – Disjunction – Statement formulas and truth tables – Conditional and Bi-conditional statements – Tautologies – Equivalence of formulas – Normal forms – Theory of inference and predicate calculus.

Unit II: Introduction to set theory – Cartesian products – Relations – Properties of binary relations – Partition and covering of a set – Equivalence relations – Compatibility relation – Partial ordering – Functions – Peano axioms and mathematical induction.

Unit III: Equivalent definitions of a group – Permutation groups – Cyclic group – Cosets – Lagrange's theorem.

Unit IV: Normal subgroup – Quotient group – Cayley's theorem.

Unit V: Homomorphism – Isomorphism – Automorphism – Inner Automorphism – Fundamental theorems of homomorphism.

Text Books:

Tremblay.J.P, Manohar.R, Discrete Mathematical Structure with applications to Computer science, Tata McGraw – Hill, 2011.
> **Unit I:** Chapter 1(sec 1.1 - 1- 2.11, 1.3 - 1- 3.4, 1- 4.2 and 1-6.4)

Arumugam. S, & Thangapandian Issac. A, Modern algebra, New gamma publication House, 2013.
> **Unit II:** Chapter 1 (sec 1.0 -1.8) and Chapter 2 (sec 2.1 - 2.5)
> **Unit III:** Chapter 3(sec 3.0 - 3.8)
> **Unit IV:** Chapter 3(sec 3.9 and 3. 10)
> **Unit V:** Chapter 3(sec 3.11)

Dr. Venkataraman. M.K, Dr. Sridharan N, Chandrasekaran.N, Discrete Mathematics, The National Publication Company, 2013.
> **Unit II**: Chapter 4 (sec 2)

Reference Books:

> Vijay K. Khanna and Bhambri. S.K, A course in Abstract Algebra, 1998
> Joseph A. Gallian, Contemporary Abstract Algebra,8th Edition, Brooks/Cole Cengage Learning, 2013.
> Rao, Abstract Algebra, Vijay Nicole, 2012.

MAT 1412 / MAS 1412	ANALYSIS - I	4 hrs / 4cr

Objective:

In many ways, this course is the true gateway into the mathematics major, requiring rigorous proofs, introducing important topological concepts and laying the groundwork for Algebra and Topology.

> Students will be able to describe fundamental properties of real numbers that lead to the formal development of Real analysis.
> They can demonstrate an understanding of limits and how they are used in sequence and series.

Unit I: The Algebraic and order properties of R – Supremum and Infimum – Completeness property of R – Archimedean property – Characterization of intervals – Countable sets – Uncountable sets.

Unit II: Sequences – Limits of a sequence – Convergent sequences – Divergent sequences – Bounded sequences – Monotone sequences – Operations on convergent sequences – Operations on divergent sequences.

Unit III: Limit superior – Limit inferior – Bolzano – Weierstrass theorem - Cauchy sequences.

Unit IV: Definition of infinite series – Sequence of partial sums – Convergence and Divergence – series with negative terms -Alternating series - Conditional convergence and Absolute convergence

Unit V: Test for absolute convergence – Series whose terms form a non-increasing sequence.

Text Books:
Shanthi Narayanan & M.D Raisinghania, Elements of Real Analysis, S.Chand & Company Ltd., 2011.
Unit I: Chapter 1 (sec1.5), Chapter 2 (sec 2.2 - 2.8, 2.11)

Richard R. Goldberg, Methods of Real Analysis, Oxford & IBH publishing co. Pvt. Ltd, New Delhi, 2010.
Unit I: Chapter 1 (sec 1.5)
Unit II: Chapter 2 (sec2.1 - 2.8)
Unit III: Chapter 2 (sec 2.9, 2.10)
Unit IV: Chapter 3 (sec 3.1 - 3.4)
Unit V: Chapter 3 (sec 3.6 - 3.7)

Reference Books:
Bartle. R .G and Sherbert. D.R, Introduction to Real Analysis, John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
Ross.K.A, Elementary Analysis: The Theory of Calculus, Undergraduate Texts in Mathematics,Springer (SIE) Indian reprint, 2004.
Howie J.M, Real Analysis, Springer, 2007.
Ghorpade and Limaye, A course in Calculus and Real Analysis, Springer, 2006.
Deshpande. J.V, Mathematical Analysis and Applications, Alpha science International, 2004.

MAT1414 / MAS 1414   **INTEGRAL CALCULUS**   **4hrs / 4cr**

Objective:
This is a foundational course for any student aspiring to complete B.Sc degree in Mathematics. The concept of integration as a limit of summation is introduced. The different methods of integration dealt with. The applications of integration in physical sciences, biological sciences and social sciences are discussed. The Beta and Gamma functions in terms of integration are introduced and their properties are studied in detail.

The students should gain the wide knowledge of Integral Calculus and its applications
They can use the Fundamental Theorem of Calculus to evaluate definite integrals
They can use definite integrals to calculate the area of the region under a curve and the area of the region between two curves.

Unit I: Integration-Standard methods-Bernoulli's formula- Definite integral.

Unit II: Reduction formula- Integration as summation.

Unit III: Geometrical Applications of Integration- Area Volume and length of the curve - Evaluation of Double and Triple Integrals.

Unit IV: Changing the order of Integration – Change of Variables-Applications in Double and Triple integrals.

Unit V: Beta and Gamma functions - Recurrence formula for Gamma functions-Properties of Beta functions - Relation between Beta and Gamma functions.

Text Book:

Narayanan. S, and Manickavachagom Pillay.T.K, Calculus Vol. I and Vol. II, Viswanathan Pvt Ltd, 2002

        Unit I: Chapter 1(sec 1 to 7.4, 8, 10 – 12, 15.1)
        Unit II: Chapter 1(sec 13.1- 13.10 and 15.2 – 15.3)
        Unit III: Chapter 2(sec 1.1 – 1.4, 3, 4.1), Chapter 5(sec 2.2, 4)
        Unit IV: Chapter 5: Page no.208-213; Chapter 6(sec 2.2 – 2.4)
        Unit V: Chapter 7(Sec 2.1 – 2.3, 3 – 5).

Reference Book:

Arumugam. S and Thangapandian Isaac. A, Calculus Vol. I and Vol. II, New Gamma Publishing House, 2001.

MAT1322   OBJECT ORIENTED PROGRAMMING IN C++   3hrs / 3cr

Objective:

This is a supportive course for all students aspiring to complete B.Sc., degree in Mathematics. This course introduces the object oriented programming structure in C++ and develops the skills in writing programs.

On successful completion of the course the student will be able to

write programs in C++ related to the problems they encounter in day-to-day life and validate in the computer lab.

Unit I: Principles of OOP-Objects- Classes- Inheritance- Reusability- Polymorphism and Overloading- Tokens- Expressions- Conditional statements- Looping statements- Console I/O.

Unit II: Functions in C++ - Function prototyping- Call by reference- Return by reference- Default arguments- Constant arguments- Function overloading- Inline and Friend function.

Unit III: Classes and objects-Specifying a class-Defining member functions- Nesting of member functions- Private member functions- Private member functions- Array with a class- Static member functions- Array of objects- Constructor and Destructors.

Unit IV: Operator overloading-Overloading function- Overloading unary operators using member and friend functions- Overloading binary operators using member and friend functions.

Unit V: Type conversion- Inheritance: levels of inheritance- Multiple inheritance- Multilevel inheritance- Hierarchical inheritance, Hybrid inheritance- Virtual base classes-Introduction to files.

Text Book:
>Balagurusamy. E., Object Oriented Programming with C++, Tata McGraw-Hill, 2008.
>>**Unit I:** Sections 1.3-1.8; 2.1-2.8; 3.1-3.24
>>**Unit II:** Sections 4.1-4.11
>>**Unit III:** Sections5.3-5.18; 6.2-6.11
>>**Unit IV:** Sections 7.1-7.8
>>**Unit V:** Sections8.1-8.9; 11.1-11.6

Reference Books:
>H. Schildt, C++ complete reference, MC Graw Hill, 1995.

>R. Rajaram, Object Oriented Programming and C++, New age international publishers, New Delhi, 1998.

>A.Chandra Babu & T. Joshuva Devadass, Programming with C++, Narosha Publishing House Ltd., 2008.

>P. Pandiyaraja, Object Oriented Programming with C++, S.Viswanathan Pvt.,Ltd., 2008.

MAT 1102 OBJECT ORIENTED PROGRAMMING IN C++ LAB 2hr / 1cr

Objective:
>The objective of the course is to learn the fundamental programming concepts and methodologies which are essential to build a C++ programs.

>It enables them to write programs using these concepts and to practice them in the C++ programming language via laboratory experiences.

1. Programs using scanf and printf statements. (1h)
2. Programs using conditional statements. (2h)
3. Programs using looping statements. (2h)
4. Programs using functions (inline function, default arguments etc..) (1h)
5. Programs using the concept of function overloading. (1h)
6. Programs related to classes and objects. (2h)
7. Programs using static member function and arrays of objects. (2h)
8. Programs using the concept of friend and virtual functions. (2h)
9. Programs on Constructors and Destructors. (2h)
10. Programs on Operator overloading. (2h)
11. Programs related to Inheritance. (2h)
12. Basic programs on files. (1h)

MAT 2511 / MAS 2511   **ALGEBRA - II**   **5hrs / 5cr**

Objective:

   The objective of this course is to create awareness on the existing structures such as rings, fields, lattices and their relevance in the contemporary world. This course deals with basic ideas in Ring theory, Fields and Lattices.

After the end of the course the students will able to

   explain the fundamental concepts of advanced algebra such as groups and rings and their role in modern mathematics and applied contexts

   demonstrate accurate and efficient use of advanced algebraic techniques

   demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from advanced algebra

Unit I: Introduction to Rings – Types of rings – Sub rings – Examples.

Unit II: Ideals – Integral domain – Quotient rings – Maximal ideal – Prime ideal – Homomorphism of rings.

Unit III: Introduction to Fields – Field of quotients – Ordered integral domain – Unique Factorization Domain – Euclidean Domain – Principal ideal domain.

Unit IV: Polynomial rings - Eisenstein Criterion.

Unit V: Lattices – Modular Lattice -Distributive lattice– Boolean algebra - Boolean ring – Boolean functions – Canonical form.

Text Book:

   Arumugam. S and Thangapandian Isaac. A, Modern Algebra, SCITECH
   Publications Private Limited, 2006.

          Unit I: Chapter 4 (sec 4.1- 4.6)
          Unit II: Chapter 4 (sec 4.7- 4.10)
          Unit III: Chapter 4 (sec 4.11- 4.15)
          Unit IV: Chapter 4 (sec 4.16- 4.18)
          Unit V: Chapter 9 (sec 9.0- 9.5)

Reference Books:

   Sharma. J.N and Vashishtha. A.R, Linear Algebra, Krishna Prakasha Mandir, 1981.
   Vijay K Khanna, Bhambri.S.K, A Course in abstract algebra, Vikas publishing house
    pvt. Ltd, 2013.

MAT 2513 / MAS 2513   **ANALYSIS - II**   **5hrs / 5cr**

Objective:

      The course deals with metric spaces which is a classical extension of the real line and its properties in terms of the distance. The course introduces to the students, metric spaces and its properties. The properties like connectedness, completeness and compactness which are inherent in nature in the real line are extended to the metric spaces. Also properties like continuity and uniform continuity are exploited.

After the end of the course the students will able to

      explain the fundamental concepts of advanced analysis such as metric spaces their role in modern Mathematics and applied contexts

      demonstrate capacity for Mathematical reasoning through analyzing, proving and explaining concepts from analysis

Unit I: Introduction to limits - Limit and continuity - Continuous Functions- Discontinuity - Types of discontinuity - Intermediate value theorem and its consequences.

Unit II: Metric spaces- Open sets- Limit point- Closed sets- Closure of a set- Properties of closure of a set- Interior of a set- Properties of interior of a set- Dense sets- Nowhere dense sets - Limits in metric spaces- Reformulation of definition of continuous functions- Baire's theorem- Uniform continuity.

Unit III: Connected metric spaces- Separated sets- Connected and Disconnected sets- Connectedness of product of connected metric spaces- Continuity and Connectedness.

Unit IV: Completeness - Totally Boundedness.

Unit V: Compact metric spaces- Continuous functions on compact metric spaces- Continuity of the inverse function - Bolzano-Weierstrass theorem.

Text Books:
      Shanthi Narayan and Raisinghania.M.D, Elements of Real Analysis, Sultan Chand & Company Limited, 2010.
            Unit I: Chapter 8 (Sec 8.4-8.6, 8.11-8.14, 8.16, 8.17)

      Arumugam Issac, Modern Analysis, New Gamma Publishing House, 2006.
            Unit II: Chapter 2
            Unit III: Chapter 5
            Unit IV: Chapter 3
            Unit V: Chapter 6

Reference Books:
      Richard R. Goldberg, Methods of Real Analysis, New Delhi: Oxford &IBH Publishing Company Private Limited 2002.
      Sharma. J.N and Vasistha .A.R, Real Analysis, Krishna Prakashan Media (P) Limited, 1997.
      Bartle .R.G.and Sherbert .D.R., Introduction to Real Analysis, Singapore: John Wiley and sons (Asia) Private Limited 2002.

Ross .K.A, Elementary Analysis: The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian Reprint, 2004.

Howie .J.M, Real Analysis, Springer, 2007.

Shirali, S. and H.L.Vasudeva, Metric Spaces, Springer, 2001.

Malik, S.C. and Savita Arora, Mathematical Analysis, New Age International Publishers, 2001

MAT 2515 / MAS 2515   DIFFERENTIAL EQUATIONS   5hrs / 5cr

Objective:

The objective of this course is to enable the students to solve various types of differential equations and to apply them in various fields. The topics covered includes formation of differential equations, solving various types of ordinary and partial differential equations, Laplace transforms and Laplace transforms as tool for solving differential equations.

After the end of the course the students will able to

solve and apply linear differential equations of second order
solve linear differential equations using the Laplace transform.

Unit I: Ordinary differential equation – Non-Homogeneous equations of the first degree in x and y – Bernoulli's equation -First order and first degree exact equation – Integrating factors – Equations of the first order but of higher degree – Equations solvable for p, y and x and Clairaut's form.

Unit II: Linear differential equations with constant coefficients – Particular integrals – Second order homogeneous equations with variable coefficients – Equations reducible to the linear homogeneous equations – Variation of parameters – Simultaneous differential equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ -nth order exact differential equations – Orthogonal trajectory.

Unit III: Partial differential equations of the first order – Derivation of partial differential equations – Classification of integrals – Lagrange's method of solving linear Partial differential equations – Standard forms – Equations reducible to the standard forms.

Unit IV: Laplace transforms – Developing the theory to use it as a tool - Laplace transform of periodic functions – Some general theorems – Evaluation of integrals – Inverse Laplace transform.

Unit V: Solving ordinary differential equation with constant coefficients, variable coefficients and simultaneous linear equation using Laplace transform.

Text Books:

Narayanan. S and Manickavachagom Pillay.T.K, Calculus Vol.III, S.Viswanathan Private Limited, 2012.

       Unit I : Chapter 1 (sec 1.1 - 6.1)
       Unit II : Chapter 1 (sec 8.1), Chapter 2 (sec 1- 4 and 8-10), Chapter 3 (sec 2 – 4)
       Unit III: Chapter 4 (sec 1- 7)
       Unit IV: Chapter 5 (sec 1- 7)
       Unit V: Chapter 5(sec 8-10)

Raisinghania M. D , Ordinary and Partial Differential Equations , S. Chand and Company Ltd, New Delhi, 1997.

       Unit II: Part II- ODE, Chapter 3(sec 3.1- 3.4).

Reference Books:

Narayanan S and Manickavachagom Pillay.T.K, Differential Equations, S.Viswanathan Private Limited, 1996.
Arumugam.S and Thangapandian Isaac .A, Differential Equations, New Gamma Publishing House, 2002.

MAT 2411 / MAS 2411   **STATISTICS – I**   **4hrs / 4cr**

Objective:

    The objective of the course is to enable the students to understand the theoretical background of statistics as a student of Mathematics. The course essentially deals with the probability distribution theory which is the basis of statistics. The topics covered includes Correlation and Regression and curve fitting.

On successful completion of the course the student will be able to:

    identify discrete and continuous random variables.
    apply distribution into various problems.
    calculate the relation between the different parameters in real life.
    fit the appropriate curve.

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

Unit II: Mathematical expectation and generating functions – Moment generating function-Chebyche's inequality- Law of large numbers.

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

Unit IV: Correlation and Regression.

Unit V: Method of least squares – Curve fitting- linear, polynomial, exponential and logrithimic.

Text Books:

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

        Unit I: Chapter 12 (sec 12.1-12.3)
        Unit II: Chapter 12 (sec 12.4 -12.6)
        Unit III: Chapter 13
        Unit IV: Chapter 6(sec 6.1- 6.4)
        Unit V: Chapter 5

Gupta. S.C and Kapoor.V.K, Mathematical Statistics, Sultan Chand and Sons 2001.

        Unit 1: Chapter 5 (sec 5.5.1-5.5.4)
        Unit II: Chapter 6 (sec 6.12, 6.13, 6.13.1)
        Unit III: Chapter 8 (sec 8.1, 8.3, 8.6)

Reference Book:

1. Manmohan Gupta, Statistics, Sultan Chand and Sons, 2001.

MAT 2512 / MAS 2512	ALGEBRA - III	5hrs / 5cr

Objective:

       The objective of this course is to enable the students to understand the basic ideas of vector spaces are as algebraic structure, linear transformations and their relations to matrices are also dealt with. The topics covered in this course are vector spaces, inner product space, linear transformations and matrix of linear transformation.

After the end of the course the students will able to

   explain the fundamental concepts of advanced algebra such as vector space and their role in modern mathematics and applied contexts

   demonstrate accurate and efficient use of advanced algebraic techniques

   demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from advanced algebra

Unit I: Vector space – Subspace – Quotient space.

Unit II: Spanning set – Linear independent set- Basis – Dimension.

Unit III: Linear transformations - Rank and Nullity of a linear transformation – Matrices - Linear transformations – Vector space of linear transformations.

Unit IV: Inner product space –Properties – norm and distance- Schwartz inequality, triangle inequality.

Unit V: Orthogonal elements – Orthonormal set – Gram-Schmidt orthogonalization process – orthogonal complement.

Text Books:

Vijay K Khanna, Bhambri.S.K, A Course in Abstract algebra, Vikas publishing house pvt Ltd,2013.
  Unit I: Chapter 10 (page 392-403)
  Unit II: Chapter 10 (page 411-437)
  Unit III: Chapter 10 (page 404-410 & 453-479)

Arumugam.S. and Thangapandian Isaac. A, Modern Algebra, SCITECH Publications Private Limited, 2006.
  Unit IV: Chapter 6 (sec 6.0-6.1)
  Unit V: Chapter 6 (sec 6.2-6.3)

Reference Book:
Sharma. J.N and Vashishtha.A.R, Linear Algebra, Krishna Prakasha Mandir, 2002.

MAT 2514 / MAS 2514   **ANALYSIS - III**   **5hrs / 5cr**

Objective:

The first two semesters of the degree programme introduced calculus which includes differentiation and integration where integration was treated as the reverse process of differentiation. However, the Riemannian definition of integration gave a twist to the way it is looked at. Students are introduced to integration as a limit of summation by Riemann integration. The Riemann integrability of a function is looked at in detail. The necessary and sufficient condition for Riemann integrability is the central theme of this course. Sequence of functions and their limits are introduced (pointwise limit and uniform limit). The ramifications of uniform convergence and their ramifications on integrability, differentiability and continuity are dealt in depth.

After the end of the course the students will able to

explain the fundamental concepts of advanced analysis such as Riemann integral their role in modern mathematics and applied contexts

demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from analysis

Unit I: Riemann Integration - Riemann Integrable Functions - Properties of the Riemann integral- Characterization theorem on Reimann integrable functions.

Unit II: Derivatives - chain rule - Darboux's theorem - Rolle's Theorem - Law of the mean – The Fundamental theorem of calculus -Substitution theorem and application - improper integrals.

Unit III: Taylor's theorem with Lagrange and Cauchy form of remainders- Taylor series- Maclaurin series - convex functions.

Unit IV: Point wise and uniform convergence of sequence of functions - uniform convergence and continuity - uniform convergence and differentiation - uniform convergence and integration -Cauchy criterion for uniform convergence.

Unit V: Series of functions - convergence and uniform convergence of series of functions – Weierstrass M-Test - Dini's theorem for series - differentiation and integration of series of functions- power series - radius of convergence.

Text Books:

Richard R.Goldberg, Methods of Real Analysis, New Delhi: Oxford & IBH Publishing Company Private Limited, 2002.

> **Unit I:** Chapter 7 (Sec 7.1-7.4)
> **Unit II:** Chapter7 (Sec 7.5-7.8)
> **Unit III**: Chapter 8 (Sec 8.5)
> **Unit IV:** Chapter 9 (Sec 9.1-9.3)
> **Unit V:** Chapter 9 (Sec 9.4, 9.5)

Reference Books:

Sharma. J.N and Vasistha. A.R, Real Analysis, Krishna Prakashan Media (P) Ltd, 1997.

Bartle.R.G and Sherbert. D.R, Introduction to Real Analysis, Singapore: John Wiley and Sons (Asia) Private. Limited, 2002.

3. Ross. K.A, Elementary Analysis: The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian Reprint, 2004.

4. Howie J.M, Real Analysis, Springer, 2007.

5. Deshpande J.V, Mathematical Analysis and Applications, Narosa Publishing House, 1999.

Torence Tao, Analysis I, TRIM 37, Hindustan Book Agency, 2000.

MAT 2516 / MAS 2516 VECTOR CALCULUS & TRIGONOMETRY 5hrs / 5cr

Objective:

This is a foundational course for any student aspiring to complete B. Sc degree in mathematics. The applicability of the subject is enormous in nature. The first unit is primarily devoted for the basics on vectors. Trigonometry is an inevitable part of any branch of science, Demovire's theorem and its applications are exploited.

On successful completion of the course the student will be able to

compute derivatives and integrals of vector functions

calculate line integrals along piecewise smooth paths; interpret such quantities as work done by a force

use Green's theorem to evaluate line integrals along simple closed curves

compute the curl and the divergence of vector fields

compute surface integrals

apply Stoke's theorem to compute line integrals along the boundary of a surface

use Stoke's theorem to give a physical interpretation of the curl of a vector filed

use the unit circle to define the six trigonometric functions

Unit I: Introduction to vectors- dot product and cross product of vectors- product of three and four vectors- geometrical interpretation of dot and cross product and their related aspects- volume of parallelepiped- tetrahedron-vector equation(lines, circles etc.,) algebraic equations and geometrical interpretations- problems related to aforesaid aspects on vectors.

Unit II: Limit of a vector function- continuity- Differentiation of vectors- Taylor's theorem for vector functions- Partial derivatives- differentiability of vector functions- related problems- Definition of gradient, divergent and curl with physical interpretation- Curvilinear coordinates- cylindrical and spherical coordinates.

Unit III: Vector integration- Indefinite integrals- Definite integral- Line, surface and volume integrals- Green's theorem in plane – Green's theorem in space- Stoke's and Gauss theorems- problems related to the verification of these theorems- Vector integrations.

Unit IV: Demovire's theorem- Geometrical interpretation- Simplification of trigonometric function- Expansion of trigonometric functions.

Unit V: Hyperbolic functions- Logarithmic functions- Trigonometric summation of series.

Text Books:

Narayanan and Manichavasagom pillai, Vector algebra and analysis, M. S. Viswanathan pvt ltd, 1986.

> **Unit I:** Chapter I (sec 1-5,7,10), Chapter II(sec1-8,11-14),
>
> Chapter III (sec2,3,4.5- 4.8, 5, 6)
>
> **Unit II:** Chapter IV (sec1-12)
>
> **Unit III:** Chapter VI (sec1-7, 9, 10)

Narayanan and Manichavasagom Pillai, Trigonometry, M. S. Viswanathan pvt ltd, 1986.

> **Unit IV:** Chapter II (sec 3,5), Chapter III(sec1-5excluding 5.1)
>
> **Unit V:** Chapter IV (sec 1-2excluding 2.3), Chapter V(sec 5),
>
> Chapter VI(sec 1-3 excluding 3.1,3.2)

Reference Books:

Raisinghania M. D, Vector Calculus, S. Chand company ltd, 1998.

Dipak chatterjee, Vector Analysis, Prentice Hall of India, New Delhi, 2003.

Arumugam and Thangapandi Issac, Trigonometry, New gamma publication, 2003.

Chandra Babu. A and Seshan C.R , New Engineering mathematics, volume – II, Narosa Publishing house, Chennai, 2006.

MAT 2412 / MAS 2412 **STATISTICS - II** **4hrs / 4cr**

Objective:

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

On successful completion of the course the student will be able to

apply suitable test for samples.
calculate various index numbers.

Unit I: Sampling and Large sample tests.

Unit II: Small sampling tests using t- F- and Chi-square distributions.

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

Unit IV: Analysis of time series – components of time series – measurement of trend – seasonal variations.

Unit V: Analysis of variance – one way- two way classification -Latin square design.

Text Book:

Arumugam. S. and Thangapandian Isaac. A., Statistics, New Gamma Publications Private Limited, 2003.
> **Unit I:** Chapter 14
> **Unit II:** Chapter 15 and 16
> **Unit III:** Chapter 9
> **Unit IV:** Chapter 10
> **Unit V:** Chapter 17

Reference Books:

Gupta. S.C and Kapoor V.K, Mathematical Statistics, Sultan Chand & Sons, 2001.
Gupta S.P, Statistical Methods, Sultan Chand and Sons, 2001.
Manmohan Gupta, Statistics, Sultan Chand & Sons, 2001.

MAT 3611 / MAS 3611 **MECHANICS** **6hrs / 6cr**

Objective:

The course mainly deals with two major areas of applied mathematics namely Statics and Dynamics. Statics is the branch of mechanics that is concerned with the analysis of loads (force and torque, or "moment") acting on physical systems that do not experience an acceleration (a=0), but rather, are in static equilibrium with their environment. Whereas the dynamics is a branch of applied mathematics (specifically classical mechanics) concerned with the study of forces and torques and their effect on motion. Brief introduction to central forces to the learners becomes essential as we live in the era of satellites, missiles and space explorations.

On successful completion of the course the student will be able to

> develop mathematical models for statical and dynamical systems
> appreciate the tools that were developed and apply in the relevant context
> convert mathematical conclusions in to physical realities
> inculcate the scientific temper among the learner
> appreciate the contemporary scientific developments.

Unit I: Introduction – Forces acting at a point – Lami's theorem – Components of force – Parallel forces and moments – Moment of a force.

Unit II: Couples– Equilibrium of three forces acting on a rigid body.

Unit III: Coplanar forces – Friction.

Unit IV: Collision of elastic bodies – Principles of conservation of momentum– Direct impact– Oblique impact.

Unit V: Motion under the action of central forces– Law of inverse squares–Moment of inertia.

Text Books:

> Venkatraman. M.K, Statics, Agasthiar publications,
> 2002. **Unit I:** Chapter: 1 to 3.
> **Unit II:** Chapter: 4,5(§1 - 6)
> **Unit III:** Chapter: 6(§1-13),7 (§1 -12).

> Venkatraman. M.K, Dynamics, Agasthiar publications, 2002.
> **Unit IV:** Chapter 8: § 8.1 - 8.8.
> **Unit V:** Chapter11: §11.1 to 11.9, § 11.14, Chapter12: § 12.1 - 12.4.

Reference Books:

> Loney. S.L, Dynamics, Mac Millan India Edition, 1998.
> Rajeshwari. I, Mechanics, Sarah's publications, 2016.
> Vasistha and Agarwal, Dynamics of a particle, Krishna prakash mandir, Meeret, 2001.

MAT 3613 / MAS 3613   **GRAPH THEORY**   **6 hrs / 6cr**

Objective:

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

On successful completion of the course the student will be able to

write precise and accurate mathematical definitions of objects in graph theory

use mathematical definitions to identify and construct examples and to distinguish examples from non-examples

validate and critically assess a mathematical proof

use a combination of theoretical knowledge and independent mathematical thinking in creative investigation of questions in graph theory

construct mathematical proofs

write about graph theory in a coherent and technically accurate manner

hone the ability to communicate mathematics.

Unit I: Graphs– Sub graphs– Isomorphism and degrees – Degree sequence – Walks and connected graphs – Cycles in graphs – Cut vertices and cut edges – Connectedness – Ramsay number – Matrices associated with the graph – Operations on graphs.

Unit II: Eulerian graphs – Hamiltonian graphs –Properties.

Unit III: Bipartite graph – Trees.

Unit IV: Colouring – Vertex colouring – Edge colouring – Five colour theorem and Four colour conjecture – Chromatic number and chromatic polynomials.

Unit V: Independence number – Covering number – Planar graph–Dual graph of planar graph –Directed Graph.

Text Books:
Choudum .S.A., A First Course In Graph Theory, McMillan India Ltd, 1987.
  Unit I: Chapter 1(sec1.1-1.7), Chapter 4(sec 4.1)
  Unit II: Chapter 2(sec2.1-2.4)
  Unit III: Chapter 3(sec3.1-3.4)
  Unit IV: Chapter 6(sec6.1-6.3)
  Unit V: Chapter 5(sec5.1-5.4), Chapter 7(sec7.1-7.5)

Arumugam.S and Ramachandran.S, Invitation to Graph Theory, New Gamma Publishing House, 1996
  Unit I: Chapter 2(sec 2.5, 2.9), Chapter 3(sec 3.1-3.2)
  Unit V: Chapter 2(sec 2.6)

Reference Books:
John Clarke & Derek Allan Holton, A first Look at Graph Theory, World Scientific Publishing Co. Ltd., 1995.
Murugan. M, Graph Theory and Algorithms, Muthali publishing house, 2003.

MAT 3615 / MAS 3615   **OPERATIONS RESEARCH – I**   **6hrs / 6cr**

Objective:

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

On successful completion of the course the student will be able to

    convert real life problems into mathematical models
    to use Mathematical tools to solve problems in the analytical form
    interpret in the common man's language and to hone the ability to do reality checks on calculations.

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

Unit II: The Simplex method – Introduction – Simplex method – Big M method – Two phase Method.

Unit III: Duality in Linear Programming – Concept of duality – Formulation of dual linear problem – Formulation of primal-dual pairs – Dual simplex method – Revised simplex method.

Unit IV: The Transportation Problem - Introduction- Mathematical formulation- Loops in a transportation table- Finding IBFS- moving towards optimality – Degeneracy – Unbalanced transportation problems -The Assignment problem – Introduction – Hungarian method - Variations of the Assignment problem – Multiple optimal solutions – Maximization case - Travelling salesman problem –Unbalanced assignment problem- Restrictions.

Unit V: Introduction to theory of Games – Saddle Point – Graphical solution for 2 x m, n x 2 Dominance property – Solution of game by linear programming method.

Text Book:

Kantiswarup, Gupta P. K. & Manmohan, Operations Research, Sultan Chand & Sons,
         2010. **Unit I**: Chapter 1, 2 & 3
         Unit II: Chapter 4
         Unit III: Chapter 5, 9.1, 9.2
         Unit IV: Chapter 10, 11
         Unit V: Chapter 17

Reference Books:

        Sharma.J.K. Operations Research, Theory and applications, Macmillan, New Delhi, 2003.
        Goel. B.S. and Mittal, S.K. Operations Research, Pragati Prakashan, Meerut, 2000.
        Hadley.G, Linear Programming, Narosa Book Distributors Private Ltd.,1963.
        Taha.H.A. Operations Research – An Introduction (8th Edition) Prentice Hall of India, New Delhi, 2007.
        Bronson.R, Operations Research 2nd Edition, Schaum's Outline Series, 1997.

MAT 3511 / MAS 3511   **COMBINATORICS**   **5 hrs / 5cr**

Objective:
          Combinatorics is a branch of mathematics concerning the study of finite or countable discrete structures. Aspects of combinatorics include counting the structures of a given kind and size (enumerative combinatorics), deciding when certain criteria can be met, and constructing and analyzing objects meeting the criteria. Many combinatorial questions have historically been considered in isolation, giving an adhoc solution to a problem arising in some mathematical context. In the later twentieth century, however, powerful and general theoretical methods were developed, making combinatorics into an independent branch of mathematics in its own right. Combinatorics is used frequently in computer science to obtain formulas and estimates in the analysis of algorithms.

On successful completion of the course the student will be able to

   apply algorithms taught in the course
   understand the fundamental combinatorial structures that naturally appear in various
      other fields of mathematics and computer science
   use these structures to represent mathematical and applied questions
   use the combinatorial tools that are used to analyze such structures
   know how to prove the existence or non-existence of the object, compute the number of
      such objects, and understand their underlying structure
   use generating functions to solve a variety of combinatorial problems.

Unit I: Two basic principles – Simple arrangement and selections with or without repetition – Distributions – Binomial coefficients.

Unit II: Generating functions - Calculating coefficients of generating functions – Exponential generating function – Summation method – Partitions.

Unit III: Recurrence relations – Divide and conquer relations – Dearrrangement – Solution of linear recurrence relation.

Unit IV: Fibonacci number - Stirling number of first and second kind – Catalan number– Ménage number.

Unit V: Inclusion and Exclusion principle – Pigeon hole principle – Ramsey theorem.

Text Books:
   Tucker A.W., Applied Combinatorics, Wiley, 2011.
            Unit I: Chapter 5
            Unit II: Chapter 6
            Unit III: Chapter 7(sec 7.1 - 7.3).
            Unit V: Chapter 8(sec 8.1, 8.2 and Appendix A4).

Schaum's outline series, Combinatorics, Tata McGraw-Hill Publishing Company Ltd 2005.

Unit IV: Chapter 1(sec 1.112, 1.114, 1.132, 1.134, 1.146, 1.147, 1.148, 1.149, 1.150)

Chapter 2 (sec 2.73)

Chapter 3 (sec 3.64)

Reference Books:

Cohen D., Combinatorics, Wiley, 1978.

Hall M., Combinatorial Mathematics, McGraw Hill, 1968.

Liu C.L., Introduction to Combinatorial Mathematics, McGraw-Hill, Newyork, 1994.

Ryser H.J., Combinatorial Mathematics, Carus Mathematical monograph, 1965.

Krishnamurthy, Combinatorics, PHI, 1998.

Balakrishnan V.K., Combinatorics, Schaum's outline series, Tata McGraw Hill, 2005

MAT 3200 / MAS 3200   ENVIRONMENTAL STUDIES   4 hrs / 2cr

Objective:

An environmental study is a multidisciplinary academic field which systematically studies human interaction with the environment in the interests of solving complex problems. Environmental study brings together the principles of sciences, commerce/ economics and social sciences so as to solve contemporary environmental problems. It is a broad field of study that includes the natural environment, built environment, and the sets of relationships between them. The field encompasses study in basic principles of ecology and environmental science, as well as associated subjects such as ethics, geography, policy, politics, law, economics, philosophy, environmental sociology and environmental justice, planning, pollution control and natural resource management.

On successful completion of the course the student will be able to

locate and comprehend relationships between the natural, social and cultural environment

create cognitive capacity and resourcefulness to make the students curious about social phenomena, starting with the family and moving on to wider spaces

nurture the curiosity and creativity of the students particularly in relation to the natural environment (including artifacts and people)

engage the students in exploratory and hands-on activities to acquire basic cognitive and psychomotor skills through observation, classification, inference, etc.

create awareness towards environmental issues and their social responsibility as a major stakeholder in the system

appreciate the eco diversity of the sub continent and its resources

know the need for sustainable development and optimal utilization of natural resources

introduce to mathematical tools that may be used solve environmental issues.

Unit I: Understanding eco-system –Food chain –Ecological pyramids – Introduction to different eco-system – Bio-geographical classification of India – Hot spots of bio-diversity – Conservation of bio-diversity.

Unit II: Introduction to Environmental Pollution – Causes and effects of air, water, noise, soil, thermal and nuclear pollution – Measures of control and management – Oil sleek and its effects on the marine eco system – Global warming and climate change – Acid rain– Ozone layer depletion – Nuclear accident and holocaust.

Unit III: Energy sources – Renewable- Non renewable energy sources – Nuclear energy – Bio fuels – Non conventional energy sources – Pollution free energy.

Unit IV: Social Issues – Urbanization and pollution – Hazard identification – Air quality standards – Major pollutants and their effects in an urban environment – Permissible limits and methods of control – Environmental ethics – Environmental protection act – Environmental auditing (Air, water, wildlife protection, forest conservation acts) – Public awareness on solid waste management – House hold environment and health.

Unit V: Mathematical modeling for environmental issues –Weather/ disaster predictions – mathematical models using differential equations, linear programming and chaos theory.

Text Book:
> Erach Bharucha, Textbook of Environmental Studies, Universities Press, 2005.
> > **Unit I:** Section 3.1.1, 3.4, 3.6, 3.7, 4.2, 4.6, 4.9
> > **Unit II:** Section 5.1, 5.2, 6.6
> > **Unit III:** Section 2.2, 2.3
> > **Unit IV:** Section 6.2, 6.5, 6.9 – 6.13, 5.4
> > **Unit V:** http://math.unipa.it/~grim/Jferruccicarter.PDF

Reference Books:
> Rana, Essentials of ecology and Environmental science, S.V.S. PHI, 2003.
> Subramanian,N.S. & Sambamoorthy-A.V.S.S Ecology, Narosa publishing house, 2000.
> Dr.Raman Sivakumar, Introduction to environmental science and energy, 2005.
> Dr.Raman Sivakumar, Introduction to Environmental Science and Engineering, 2005.
> Dr.Ravikrishnan.A, Environmental Science and Engineering, Sri Krishna Hitech
> > Publishing Company Pvt. Ltd, 2010.
> Arumugam.N, Kumaresan.V, Environmental studies, Saras Publication, 2010.

MAT 3612 / MAS 3612   **NUMBER THEORY**   **6 hrs / 6cr**

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

On successful completion of the course the student will be able to

        state fundamental results in number theory and prove rigorously mathematical statements concerning prime numbers and modular arithmetic
        determine greatest common divisors by prime factorizations or euclid's algorithm
        solve linear diophantine equations and linear congruences
        describe properties of common arithmetical functions, including the euler phi function
        apply methods and techniques of number theory to a range of applications
        hone the ability to do reality checks on calculations.

Unit I: Divisibility– Euclidean algorithm – Primes – Fundamental theorem of arithmetic.

Unit II: Congruences – Fermat, Euler and Wilson theorem – Lagrange theorem – Chinese remainder theorem – Solution of congruences.

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.

Text Book:
        Burton. D. M, Elementary Number theory, Universal book stall, 2012.
                Unit I: Chapter 2 (sec2.1-2.4), Chapter 3(sec3.1)
                Unit II: Chapter 2(sec 2.5), Chapter 4(sec4.2-4.4), Chapter 5(sec 5.2-5.3)
                Unit III: Chapter 9 (sec 9.1-9.3)
                Unit IV: Chapter 6 (sec6.1-6.3), Chapter 7(sec 7.2-7.4)
                Unit V: Chapter 11(sec11.2-11.4), Chapter 12(sec12.1)

Reference Books:
Andrews. G. E, Number theory, Hindustan Publishing Corporation, 1994.
Apostol. T. M, Introduction to analytic number theory, Narosa publishing house,1998.
Niven. I and Zuckerman.H.S, An introduction to the theory of numbers, Wiley eastern, 2015.
Narayanan. S and Manicavachagom Pillay. T.K, Algebra, Vol. I, S. Viswanathan printers and publishers, 2012.

MAT 3614 / MAS 3614   COMPLEX ANALYSIS   6 hrs / 6cr

Objective:

Complex analysis, traditionally known as the theory of functions of a complex variable, is the branch of mathematical analysis that investigates functions of complex numbers. It is useful in many branches of mathematics, including algebraic geometry, number theory, analytic combinatorics, applied mathematics; as well as in physics, including hydrodynamics and thermodynamics and also in engineering fields such as nuclear, aerospace, mechanical and electrical engineering.

On successful completion of the course the student will be able to

   understand how complex numbers provide a satisfying extension of the real numbers
   appreciate how throwing problems into a more general context may enlighten one about
      a specific context (e.g. solving real integrals by doing complex integration; taylor
      series of a complex variable illuminating the relationship between real function that
      seem unrelated -- e.g. exponentials and trig functions)
   learn techniques of complex analysis that make practical problems easy (e.g.
      graphical rotation and scaling as an example of complex multiplication)
   continue to develop proof techniques
   appreciate how mathematics is used in design (e.g. conformal mapping)
   unlearn (if ever learned) the notion that mathematics is all about getting "the right
      answer"
   hone the ability to do reality checks on calculations
   hone the ability to communicate mathematics

Unit I: Geometry of complex numbers – Elementary transformations – Bilinear transformations – Cross Ratio – Fixed points of bilinear transformation.

Unit II: Analytic function – Differentiability – The Cauchy Riemann equation – Conformal mappings.

Unit III: Definite Integral – Cauchy's Theorem – Cauchy's Integral formula – Cauchy's inequality – Morera's theorem – Liouville's theorem and fundamental theorem of Algebra – Maximum modulus theorem.

Unit IV: Taylor's and Laurent's theorem – Zeros of an analytic function.

Unit V: Singularities – Cauchy Residue theorem – Arguments principle – Rouche's theorem – Contour Integration.

Text Book:

Arumugam.S, Thangapandi Issac.A, Somasundaram. A**,** Complex
Analysis, SCITECH publications private limited, 2007.
        Unit I: Chapter 1(sec 1.5 - 1.7) and Chapter 3(sec 3.1 - 3.4).
        Unit II: Chapter 2
        Unit III: Chapter 6
        Unit IV: Chapter 7(sec 7.1 - 7.3).
        Unit V: Chapter 7 sec 7.4   Chapter 8: (sec 8.1, 8.2, 8.3(type 1 & type 2)).

Reference Books:

Shanti Narayanan, Complex Analysis, S. Chand & Co, 1999.
Duraipandian.P, Lakshmi Duraipandian and Muhilan.D, Complex Analysis,
Emerald Publishers, 1994.
Ponnuswamy.S, Foundations of Complex Analysis, Narosa Publishing House, 2004.
Karunakaran.V , Complex Analysis, Narosa Publishing House, 2006.

MAT 3616 / MAS 3616   OPERATIONS RESEARCH - II   6hrs / 6cr

Objective:

      Student will be able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type. To build and solve Transportation Models and Assignment Models. To design new simple models, like CPM to improve decision-making and develop critical thinking and objective analysis of decision problems.

On successful completion of the course the student will be able to

      convert real life problems into mathematical models by making use of inequalities
      appreciate post optimal analysis/sensitivity of the optimal solution for small changes in the initial parameters
      design new simple models, like: pert, cpm to improve decision –making and develop critical thinking and objective analysis of decision problems
      learn and understand the types of inventories and objectives of inventory control. this would help them to understand the major reasons for holding inventories and also to differentiate between independent and dependent demand
      recognize the basic types of queuing model, derive and calculate steady state system performance characteristics for these types.

Unit I: Introduction to sensitivity Analysis – Changes in the cost vector, requirement vector – Coefficient matrix – Addition and deletion of variables - related problems.

Unit II: Introduction to Integer programming – Gomary's all - IPP Method – construction of Gomary's cut – fractional cut method-all Integer and mixed Integer related problems.

Unit III: Network Scheduling by PERT/CPM- Introduction – Network and Basic components – Rules of network construction – Time calculations in networks – Critical Path Method (CPM)- PERT:PERT calculations - Negative float and Negative slack – advantages of network (PERT/CPM).

Unit IV: Inventory Control- Introduction – Reasons for carrying inventory – Types of inventory – The inventory decisions – Economic Order Quantity- Four EOQ models – EOQ problem with price breaks- Multi item deterministic problem.

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

Text book:
 Kantiswarup, Gupta P.K. & Manmohan, Operations Research, Sultan Chand & Sons, 2004.
> **Unit I:** Chapter 6 (sec 6.1 – 6.5 (except addition & deletion of a constraint)).
> **Unit II:** Chapter 7(sec 7.1 – 7.5).
> **Unit III:** Chapter 21
> **Unit IV:** Chapter 19 (sec 19.1-19.9).
> **Unit V:** Chapter 20 (sec 20.1 – 20.8 (Model I, III, V, VII)).

Reference Books:

Hadley. G, Linear Programming, Narosa Book Distributors Private Ltd., 1963.

Taha, H.A. Operations Research – An Introduction (8th Edition) Prentice Hall of India, New Delhi, 2007.

Bronson R, Operations Research 2nd Edition, Schaum's Outline Series, 1997.

Sharma, J.K. Operations Research, Theory and applications, Macmillan, New Delhi, 2003.

Sundaresan.V, Ganesan. K, Resource management Techniques, AR publications, 2009.

MAT 3512 / MAS 3512 **FUZZY MATHEMATICS** **5hrs / 5cr**

Objective:

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

On successful completion of the course the student will be able to

distinguish between the crisp set and fuzzy set concepts through the learned differences between the crisp set characteristic function and the fuzzy set membership function

draw a parallelism between crisp set operations and fuzzy set operations through the use of characteristic and membership functions respectively

define fuzzy sets using linguistic words and represent these sets by membership functions

know how to perform mapping of fuzzy sets by a function and also use the α-level sets in such instances

know fuzzy-set-related notions; such as α-level sets, convexity, normality, support, etc.

know the concept of a fuzzy number and how it is defined

understand the extension principle, its compatibility with the α-level sets and the usefulness of the principle in performing fuzzy number arithmetic operations (additions, multiplications, etc.)

know the fuzzy relations and the properties of these relations

analyze the distinction between binary logic and fuzzy logic at the conceptual.

Unit I: Crisp sets and fuzzy sets– Basic concepts of fuzzy set – Classical and fuzzy logic.

Unit II: -cuts – Properties of -cuts – Representations of fuzzy sets – Extension principle of fuzzy sets.

Unit III: Operations on fuzzy sets – Fuzzy complements – Fuzzy union – Fuzzy intersection.

Unit IV: Fuzzy numbers – Arithmetic operation on intervals – Arithmetic operation on fuzzy numbers – fuzzy equations.

Unit V: Crisp and fuzzy relations – Binary fuzzy relations – Binary relation on a single set – Equivalence and similarity relation – Fuzzy relation equation.

Text Books:
Klir.G.J and Folger T.A, Fuzzy sets Uncertainty and information, Prentice Hall of India, 1995.
      Unit I: Section 1.1 – 1.6.
      Unit III: Section 2.1 – 2.5.
      Unit V: Section 3.1– 3.5 & 3.8.
Klir G.J and Bo Yuan, Fuzzy Sets, Fuzzy Logic, Theory and Applications, Prentice Hall of India, 1997.
      Unit II: Sections 2.1 – 2.3.
      Unit IV: Section 4.1(Introduction), 4.3 – 4.4(Problems only)& 4.6.

Reference Book:
H.J.Zimmermann, Fuzzy Set Theory and Its Applications, Kluwer Academic Publishers, 2001.

MAT 1431 / MAS 1431   MATHS FOR PHYSICS- I   5hrs / 4cr

Objective:
     This course develops among the students, the mathematical skills required to study physics. The course deals with vectors, solutions of linear equations, Eigen value, Eigen vectors, complex numbers, series expansion and complex integration.

On successful completion of the course, the students will be able to

      compute the dot product of vectors, lengths of vectors, and angles between vectors
      compute the cross product of vectors and interpret it geometrically
      determine the equations of lines and circles using vectors
      calculate line integrals along piecewise smooth paths
      use green's theorem to evaluate line integrals along simple closed curves
      compute the curl and the divergence of vector fields
      compute surface integrals
      apply stoke's theorem to compute line integrals along the boundary of a surface
      use stoke's theorem to give a physical interpretation of the curl of a vector filed
      learn techniques of complex analysis that make practical problems easy.

Unit I: Vector definition- dot product-cross product-unit normal vector-Vector differentiation results- vector differential operator definition- gradient- directional derivatives- divergent and curl- solenoidal and irrotational-scalar potential function- Formula involving operator ∇-operation involving ∇ twice related problems.

Unit II: Line integral- surface integral- volume integral – verification of Divergence theorem due to Gauss- Green's theorem and Curl theorem due to Stokes – General & orthogonal curvilinear coordinates- Polar coordinates- Right circular cylindrical coordinates-Spherical coordinates.

Unit III: Solution of a system of Linear equations: Homogeneous and non homogeneous problems using rank method-Eigen value problem- Coordinate transformations- Rotation in two dimensions- Rotation in three dimensions.

Unit IV: Introduction to complex numbers - Complex differentiation- Cauchy Riemann equations -Analytic functions -Harmonic equation - related problems.

Unit V: Complex integration – Cauchy's theorem and Integral formula - Residues - mth order pole- simple pole- Cauchy's residue theorem- Evaluation of definite integrals.

 Text Books:
>   1. Manickavachagom Pillay T.K, Narayanan .S, Vector Algebra and Vector
>   Analysis, S. Viswananthan pvt. Ltd, 1996.
>   **Unit I:** Chapter IV (sec 1, 2(Results), 6, 7, 8, 9.1, 10, 11, 12).
>   **Unit II:** Chapter VI (sec 2 - 7 and 9) (sec 4 -7 and 9).
>
>   Arumugam. S and Thangapandi Issac. A., Modern Algebra, Scitech publications
>   private Ltd, 2003.
>   **Unit III:** Chapter VII (sec 7.6, 7.8).
>
>   S. Arumugam & A. Thangapandi Issac, Complex Analysis, New Gamma
>   publishing House, 2001.
>   **Unit IV:** Chapter II (sec 2.5, 2.6, 2.7, 2.8).
>   **Unit V:** Chapter VI (sec 6.1, 6.2, 8.1, 8.2).

 Reference Book:
>   Khanna. M. L, Matrices, Jai Prakash Nath& Co. Meerut, 2001.

MAT1433 (ECE/ECO)   MATHEMATICS FOR ECONOMICS   5hrs / 4cr

Objective:

The course deals with quadratic equation, matrices, differentiation, integration, and differential equations.

This course introduces to the learner the quantitative techniques which can be applied in dealing with the study of economics.

Unit I: Importance of quantitative analysis – functions; linear, quadratic, nature of roots – relations between roots and coefficients – Theory of indices – index rules.

Unit II: Matrices – types of matrices - determinants – inverse of matrix – solving system of equations using Crammer's rule.

Unit III: Differentiation: successive differentiation – maxima & minima – partial differentiation – total differentiation.

Unit IV: Integration: standard forms – rules and definite integrals – area between two curves. **Unit V:** Differential equations – solving first order and second order differential equations. **Text Books:**

Mehta. B.C. & Madnani. G.M.K, Mathematics for Economists, Sultan Chand & Sons, Nineth edition, 2008.
Unit I: Sections 1.16-1.17.
Unit II: Sections 5.1-5.12; 5.13(II), 5.15.
Unit III: Sections 6.1-6.5; 6.8-6.9; 8.1-8.4; 8.7-8.8.
Unit IV: Chapter 12 & sections 13.1-13.3.
Unit V: Sections 14.1-14.7; 14.10-14.12.

Aggarwal R.S, Quantitative Aptitude, S. Chand & company Ltd., Revised Edition 2008.
Unit I: Chapter 9

Reference Books:

M.JeyaramArumugam, Mathematics – an introduction, 1985

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

Madha and Madnani, Mathematical applications in Economics, Himalaya, 2000.

MAT 1432 / MAS 1432   **MATHS FOR PHYSICS- II**   **5hrs / 4cr**

Objective:

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

On the successful completion of the course students will be able to

> distinguish between linear, nonlinear, partial and ordinary differential equations. recognize and solve a variable separable differential equation, homogeneous differential equation, exact differential equation
> construct a second solution of a differential equation from a known solution and to classify the partial differential equations
> understand the relationship between fourier series and linear time-invariant system.

Unit I: Differential equations- Order and degree – Variable separable- First order linear homogeneous equations – Non homogeneous differential equations - linear differential equation – Bernoulli's equation and exact differential equations.

Unit II: Second order differential equations – Second order differential equation with constant coefficients-Second order differential equations with variable coefficients and polynomial coefficients.

Unit III: Partial differential equations – Lagrange's method – Standard types - Equations solvable for p and q-Equations solvable for x, y and z, - Equation of the form $f_1(x, p) = f_2(y,$
   – Clairant's form – Equations reducible to standard forms – Charpit's method.

Unit IV: Fourier series – Step functions – odd and even functions- Fourier integral and its complex form - Half – range series: cosine and sine series - Properties of Fourier series-Parseval's relation.

Unit V: Introduction to Hermite and Legendre polynomials – Basic equations – Solution to Hermite differential equation and Legendre differential equation – Generating function – Rodrigues formula – Ortho normality relations – Recurrence relation and problems.

Text Books:

        Manickavachagom Pillay.T.K, Narayanan.S, Differential equations and its applications, S.Viswananthan pvt. Ltd, 2013.
> **Unit I:** Chapter I and Chapter II (Up to 6.3)
> **Unit II:** Chapter V (Up to Exercise XVI)
> **Unit III:** Chapter XII (Up to Exercise XXXIX).

Durai pandian. P, & Udhayabaskaran. S, Allied Mathematics volume II, S. Chand & company Pvt. Ltd, 2016.
> **Unit IV:** Chapter IV

   Saran, Sharma and Trivedi , Special functions, Pragati Prakashan Publications,2003.
> **Unit V:** Chapter 7(sect 7.1, 7.2) and Chapter 6(sec 6.1, 6.2 (recurrence relation only)).

MAT1334 (ECE/ECO)   FUNDAMENTALS OF COMPUTER APPLICATIONS

3hrs / 3cr

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

On successful completion of the course the student will be able to

know creating and editing documents using Word, data analysis and numeric manipulation using Excel and create and deliver presentations using Power Point.

Unit I: Physical components of computer – input – output devices – hardware and software – operating system.

Unit II: Word – creating a document – editing – move and copy text – help system – formatting text and paragraph – finding and replacing text – spelling checking – tabs – enhancing document – column and tables – graphs – mail merge.

Unit III: Data Base Management – spread sheet – MS Excel – basic commands – word processing – inserting and deleting rows and columns – formatting and printing work sheet – creating a chart – date and time – naming ranges and using statistical data.

Unit IV: Power-point – creating a presentation – power-point view, running a slide show – printing a presentation.

Unit V: Office automation – multimedia application – internet browsing

Text Book:

Taxali. R.K., PC Software for windows – Made simple, Tata Mc Graw- Hill, 1998.

Unit-I: Fundamentals of Computer Studies, Expert Solution Consults, 2010.
Microsoft office word 2007,Torben Lage Frandsen, e - publication Unit II: Chapters 8-18
Microsoft office Excel 2007,Torben Lage Frandsen, e - publication Unit III: Chapters 19-27
Microsoft office powerpoint 2007,Torben Lage Frandsen, e - publication Unit IV: Annexure B
UnitV: Fundamentals of Computer Studies, Expert Solution Consults, 2010.

Reference Books:
Alan R. Neibaner, Microsoft word for windows, Made easy, The basics and beyond, Tata Mc Graw Hill, New Delhi, 1999.

MAT 1104   FUNDAMENTALS OF COMPUTER APPLICATIONS-LAB   2hrs/1cr

Objective:

The main objective of the course is to enable the student to acquire the knowledge of Microsoft Office and internet browsing.

On the successful completion of the course students will be able to

- know the basic knowledge of the computer.

Create a bio-data using Ms-|word at least 2 pages.

Create a mail merge letter for your 5 friends

Insert the table with 5 columns and 8 rows and enter your mark details in the needed format.

Using Track Changes, Edit your document for Insert, Delete and Modify.

Open your saved document and check the spelling and grammar.

Create a Sheet with 15 sales person details and monthly Sales by person wise and total.

Insert the different type charts for your monthly wise sales amount.

Create pivot table and pivot chart from Area wise, Month wise, Person wise, Sales Amount.

Insert data from Text File and delete row/column and insert new row/column.

Create 5 Slide power point about healthy fruits.

Create a power point slide show with auto animation effects.

Create a power point auto slide show with duration and sound effects

Insert your favorite pictures with word art heading.

MAT 2431   MATHS FOR CHEMISTRY - I   5hrs /4cr

Objective:

Mathematics will allow the students to develop a sophisticated understanding of Mathematical structures and principles while gaining a wide range of skills that are attractive to employers.

This course deals with matrices, eigen values, eigen vectors, sets, functions, groups, rings, fields, sampling, and numerical methods.

Unit I: Matrices – elementary transformations – diagonalization – inverse – rank.

Unit II: Solving homogeneous and non-homogeneous equations – Cayley-Hamilton theorem - Eigen values and Eigen vectors.

Unit III: Sets – relations – functions – types of functions – groups – examples and simple problems, rings & fields with examples.

Unit IV: Sampling theory – Large and small sample tests for mean – normal, t-test, chi-square test.

Unit V: Numerical methods – solution of algebraic equations – Interpolation -Newton's and Lagrange's methods – Numerical differentiation &integration.

Text Books:
Arumugam. S & Thangapandian Issac. A., Modern Algebra, SCITECH Publications, 1998
  Unit I: Chapter 7(sec 7.1, 7.2, 7.4, 7.5)
  Unit II: Chapter 7(sec 7.6-7.8)
  Unit III: Chapter 1(sec 1.1-1.8), Chapter 2(sec 2.1, 2.2, 2.4), Chapter 3(sec 3.1),
    Chapter 4(sec4.1)
Arumugam S. & ThangapandianIssac. A, Statistics, New gamma publishing house, 2011.
  Unit IV: Chapter 14(sec 14.1-14.5 II A, B), Chapter 15(sec 15.1) ,
    Chapter 16(sec 16.1)
  3. S. S.Sastry, Introductory methods of Numerical Analysis, 3rd edition, Prentice Hall of India Pvt.ltd., 2003.
  Unit V: Chapter 2(sec.2.1-2.5), Chapter 3(sec 3.1, 3.3.1, 3.3.2, 3.6, 3.9.1),
    Chapter 5(sec 5.2, 5.4.1-5.4.3)

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

MAT 2433 / MAS 2433 BUSINESS STATISTICS (COM / CME) 5hrs / 4cr

Objective:
  This course deals with measures of central tendency, correlation, regression, probability theory, and sampling theory.

  To enable the students to use the tools in statistic solve the problems in business studies and commerce.

Unit I: Measures of central tendency – measures of dispersion.

Unit II: Correlation – Correlation coefficients – Rank correlation – Regression – Regression coefficients.

Unit III: Probability function – Addition and multiplication theorems on probability – Conditional probability – Baye's formula and theorem.

Unit IV: Types of sampling- parameters & statistic – statistical hypothesis – null and alternative hypothesis – types of errors- large samples based on normal area table – test of significance of small samples – t-test and F-test and Chi-square test for population variance and goodness of fit.

Unit V: Analysis of variance – One way and two way classification – Latin square design.

Text Book:
Arumugam.S & Thangapandian Issac. A, Statistics, New Gamma publishing House, 2013.
    Unit I : Chapters 2(except deciles & percentiles) & 3
    Unit II: Chapter 6
    Unit III: Chapter 11
    Unit IV: Chapters 14(sec14.1- 14.5(I& II)), 15 & 16(sec 16.1&16.2)
    Unit V: Chapter 17

Reference Books:
    Gupta .S.C and Kapoor.V.K, Mathematical Statistics, Sultan Chand and Sons, 2001.
    Manmohan Gupta, Statistics, Sultan Chand and Sons, 2001.

MAT 2432   **MATHS FOR CHEMISTRY - II**   **5h / 4cr**

Objective:

Mathematics will allow the students to develop a sophisticated understanding of mathematical structures and principles while gaining a wide range of skills that are attractive to employers.

To reinforce and enhance the mathematical tools introduced earlier. Differential equation as a mathematical model for solving problems in chemistry is the central theme of the course. This course deals with differentiation, integration, differential equations and Laplace transform.

Unit I: Differentiation – successive differentiation – meaning of derivative- maxima and minima.

Unit II: Partial differentiation – errors and approximation- maxima and minima.

Unit III: Integration – Methods of integration – Some standard formulae-Integration by parts – definite integral – reduction formula.

Unit IV: Formation of differential equations –growth, decay and chemical reactions- Solving first and second order differential equations.

Unit V: Laplace transforms – Inverse transforms-solving linear differential equations.

Text Books:
Narayanan. S.& Manickavachagom Pillay T.K., Calculus Vol.I, S. Viswanathan
    private limited, 2013.
      Unit I: Chapter II (sec 2.1- 2.7, 3.1-3.3, 3.4, 3.6, 3.8), Chapter III (sec 1.1- 1.6, 2.1),
        Chapter IV (sec 2.1, 2,2, 3, 4), Chapter V (sec 1.1- 1.5)
    Unit II: Chapter VIII (sec 1.1-1.3, 1.5-1.7, 2.1, 2.3, 4, 5)
Narayanan. S. & Manickavachagom Pillay. T.K., Calculus Vol. II, S. Viswanathan
    private limited, 2013.
    Unit III: Chapter I(sec 1.1-6.4, 7.3, 7.4, 11, 12, 13.1-13.5(formula only), 15.1)

Narayanan.S. & Manickavachagom Pillay. T.K., Differential Equations and its applications, S. Viswanathan private limited, 2008.
  Unit IV: Chapter I (sec 1, 3), Chapter II(sec 1, 2, 4, 6.1-6.4), Chapter III (sec 1)
          Chapter V(sec 1-4).
  Unit V: Chapter XI(sec 1, 2, 4-9)

Reference Books:

Hirst. D. N., Mathematics for Chemistry, Macmillan Press Ltd, 1993.
Sankaranarayanan & Mangaladoss. J.A., Differential Equations and its Applications, Suja Publishing House, Palayamkottai (1980)

MAT 2434 / MAS 2434   BUSINESS MATHEMATICS (COM/CME)   5hrs / 4cr

Objective:
        This course to introduce various concepts of mathematics required for commerce and it deals with differentiation, integration, matrices, transportation and assignment problem.

On the successful completion of the course students will be able to

        the student will understand how to process
        interpret information to arrive at logical conclusions to common business
        math applications
        to understand the important role math plays in all facets of the business world.

Unit I: Differential calculus: idea of limit- continuity- average concept and marginal concept- differential coefficient- standard forms rules for differentiation- higher order derivatives – increasing and decreasing functions- criteria for maxima and minima applications.

Unit II: Integral calculus: standard forms rules for integration- definite integral- integration by substitution – integration by parts- applications.

Unit III: Matrices – types of matrix – consistency of a matrix – rank of matrix-solving system of Homogeneous and non- homogeneous equation.

Unit IV: Transportation problems: methods of finding IBFS-u-v method-unbalanced problems - Assignment problems.

Unit V: Game theory– pure and mixed strategies –solution of 2x2 games- dominance rule- graphical solution of 2xn and mx2 games.

Text Books:
    1**.** Sundaresan.V and Jeyaseelan.S.D, An introduction to Business Mathematics, S. Chand & co 2003.
              Unit I: Chapter (sec 3.1 - 3.10, 3.11(from pg118), 4.3)
              Unit II: Chapter (sec 6.1 - 6.10, 6.11, 6.11.b, 6.11.c, 6.11.e)
              Unit III: Chapter (sec 8.1 - 8.6, 8.8, 8.9)

2. Sundaresan. V, Ganapathy sub. K.S & Ganesan.K, Resource Management
   Techniques, A.R Publications , 2011.

   Unit IV: Chapter 7.1 - 7.4, 8.1 - 8.5, 8.7, 8.9.
   Unit V: Chapter 16.1-16.4, 16.6, 16.7.

Reference Books:
Jeyaram & Arumugam,Mathematics an Introduction, New Gamma publishing
House, 1986.
Khanna .M.L, Matrices, Jai Prakash Nath & Co. Meerut, 2001.
Narayanan .S & Manickavachagom Pillay .T.K, Calculus, volume I & II,
S.Viswanathan private limited, 2002.
4.Arumugam .S & Thangapandian Issac. A , Differential equations with Applications,
New Gamma publishing house, 2008.

MAS 1433	DISCRETE MATHEMATICS (BCA)	5hrs / 4cr

Objective:
        The objective of this course is to inculcate the essential mathematical concepts for
computer applications and improving their logical thinking as well as to equip the students to
understand the concepts on algebraic structures, graph theory with examples.

On the successful completion of the course students will be able to

> realize that there are multiple solutions to a given problem and these solutions
> will have a real impact on people's lives
> communicate their solutions to others, including why and how a solution
> solves the problem and what assumptions were made
> successfully apply the knowledge they have gained through project experience
> encompass an appreciation for the structure of computer systems and
> the processes involved in their construction and analysis
> understand individual and collective responsibility and individual limitations
> as well as the limitations of technical tools
> understand the range of opportunities and limitations of computing
> know how to apply tools and ideas from mathematics and theoretical computer
> science to structure and solve complex problems

Unit I: Set- Subset- Cardinality of a set- Cartesian product- Relations- Functions-Matrix-
Inverse of a matrix- Solving system of equations using Crammer's rule.

Unit II: Logic- Connectives- Well formed formula- Implications- Tautology-
Valid conclusions.

Unit III: Algebraic Structure - Semi group – Monoid – Group - Abelian group - Cyclic group
Sub group - Ring - Sub ring – Vector space - Linearly independent sets - Linearly
dependent sets – Basis - Linear Transformations.

Unit IV: Combinatorics - Addition and multiplication Principle – Permutations –
Combinations - Recurrence relations.

Unit V: Graph - Sub graphs – Walk – Trail – Path – Connected – Cycle - Euler graph - Fleury's Algorithm - Hamiltonian graph - Closure of a graph - Cut vertex - Cut edge – Tree - Kruskal's and Prim's algorithms.

Text books:

Dr. Venkataraman .M.K, Dr. Sridharan.M., Chandrasekaran.M, Discrete Mathematics, National Publishing Company, 2003
 Unit I: Chapter 1(sec 1-4, 6, 9) Chapter 2(sec 1-5) Chapter 3(sec 1, 2, 5).
 Unit II: Chapter 9 (sec 1-3,5-8).

Arumugam. S & Thangapandian Issac. A, Modern Algebra, Scitech Publications, 2001.
Unit III: Chapter 3(sec 3.1 , 3.5 ,3.6) Chapter 4(sec 4.1 , 4.6
) Chapter 5: sec 5.0, 5.1 ,5.3-5.6

Alan Tucker, Applied Combinatorics, 5th edition, John Wiley & sons. Inc. 2007. **Unit IV:** Chapter 5(sec 5. 1 , 5.2) Chapter 7(sec 7.1)**.**

John Clark and Derek Allan Holton, A First Look at Graph Theory, Allied Publishers ltd, 1995.
Unit V: Chapter 1(sec 1.1, 1.3-1.6) Chapter 2(sec 2.2, 2.3, 2.6) Chapter 3(sec 3.1, 3)

Reference Books:
1. Shankerrao.G, Mathematical Foundations of computer science, I.K International publishing house pvt ltd ,2006.
2. Tremblay J.P & Manohar R, Discrete Mathematical Structures with applications computer science, Tata McGraw Hill, 1987.
   Narsingh Deo, Graph Theory with applications to engineering and computer science, Prentice Hall India, New Delhi, 1989.

MAS 1435   **MATHS FOR CHEMISTRY - I**   **5hrs / 4cr**

Objective:
        To introduce the basic concepts of various areas in Mathematics required to study chemistry. This course deals with matrices, eigen values, eigen vectors, sets, functions, groups, rings, fields, sampling, and numerical methods.

On successful completion of the course the student will be able to

        solve systems of linear equations
        to reduce the augmented matrix to row echelon form
        apply the basic techniques of matrix algebra
        find the eigen values and eigenvectors of a square matrix using the characteristic polynomial and will know how to diagonalize a matrix
        use mathematical definitions to identify and construct examples and to distinguish examples from non-examples
        ability to apply sampling methods to more general problems in statistics
         ability to analyse and interpret results of statistical sampling

solve an algebraic or transcendental equation, differential equation using an
  appropriate numerical method
approximate a function using an appropriate numerical method

Unit I: Matrices – Elementary transformations – Diagonalization – Inverse – Rank.

Unit II: Solving homogeneous and non-homogeneous equations – Cayley-Hamilton theorem - Eigen values and Eigen vectors.

Unit III: Sets – Relations – Functions – Types of functions – Groups – Examples and simple problems- Rings & fields with examples.

Unit IV: Sampling theory – Large and small sample tests for mean – normal, t-test, chi-square test.

Unit V: Numerical methods – Solution of algebraic equations – Interpolation -Newton's and Lagrange's methods – Numerical differentiation &integration.

Text Books:
  Arumugam.S & Thangapandian Issac. A, Modern Algebra, SCITECH Publications,
    1998 .
        Unit I: Chapter 7(sec 7.1, 7.2, 7.4, 7.5)
        Unit II: Chapter 7(sec 7.6-7.8)
        Unit III: Chapter 1(sec 1.1-1.8), Chapter 2(sec 2.1, 2.2, 2.4), Chapter 3(sec 3.1),
                Chapter 4(sec 4.1)

  2. Arumugam. S & Thangapandian Issac. A, Statistics, New gamma publishing house,
      July 2011.
      Unit IV: Chapter 14(sec 14.1-14.5 II A, B), Chapter 15(sec 15.1) , Chapter 16(sec 16.1)

  Sastry. S.S, Introductory methods of Numerical Analysis, 3rd edition, Prentice Hall of
      India Pvt.ltd, 2003.
      Unit V: Chapter 2(sec.2.1-2.5), Chapter 3(sec 3.1, 3.3.1, 3.3.2, 3.6, 3.9.1),
      Chapter 5(sec 5.2, 5.4.1-5.4.3)

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

MAS 1439   **BUSINESS STATISTICS (CPA)**   **5 hrs / 4cr**

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

On the successful completion of the course students will be able to

        the students will gain basic knowledge of the application of mathematics and statistics to business disciplines
        get the ability to analyse and interpret data to provide meaningful information to assist in making management decisions.

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

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

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

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

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

Text Book:
      R.S.N . Pillai and Bagavathi **,** Statistics theory and practice,S. Chand & sons, New Delhi, 2017.
              Unit I: Chapters 1, 4,5, 7 ,8
              Unit II: Chapters 9, 10
              Unit III: Chapters 12, 13.
              Unit VI: Chapter 14
              Unit V: Chapters 15, 18.

Reference Books:
      Sanchetti & Kapoor, Statistics, Sulthan Chand, New Delhi, 2013.
      Gupta .S.P, Statistical Methods , Sultan Chand & Sons, New Delhi, 2012.

MAS 1434   **DISCRETE MATHEMATICS (COS)**   **5hrs / 4 cr**

Objective:

      The objective of this course is to train the students with fundamental concepts of mathematics and to equip the students with logical thinking and analytical skills .This course deals with sets, logic, Combinatorics and automata.

On successful completion of the course, the students will be able to

- write an argument using logical notation and determine if the argument is or is not valid
- understand the basic principles of sets and operations in sets
- demonstrate an understanding of relations and functions
- to utilize mathematics and computer application to solve practical problems in mathematics.

Unit I: Logic: Connectives-Normal forms-Inference theory of calculus- Inference theory of predicate calculus.

Unit II: Set theory: Sets-Operations of sets- Relations- Functions- Boolean algebra- Lattices.

Unit III: Combinatorics: Permutations- Combinations- Recurrence Relations- Generating Functions- Principle of inclusion and exclusion- Problems.

Unit IV: Algebraic Structure: Groups - Semi Groups- Monoids – Subgroups- Normal subgroups- Lagrange's Theorem- Introduction to rings. (Definition and simple problems only).

Unit V: Automata: Alphabets- Strings- Languages- Grammar- Type 0, Type1, Type2 and Type3 Grammars- Finite automata- Regular expressions- Non- deterministic finite automata.

Text Books:

Tremblay. J.P & Manohar.R, Discrete Mathematical Structures with applications of Computer Science, Tata McGraw- Hill 1987.
        Unit I :Chapter 1(sec 1-2 - 1-2.4 ,1-2.6, 1-2.8 , 1-2.9 , 1-2.11 ,1-3.1- 1-3.4 , 1-4.2 & 1-6.4)

Tucker .A, Applied Combinatorics, John Wiley and sons, 2005.
        Unit III: Chapter 5(sec 5.1- 5.4); Chapter 6(sec 6.1, 6.2) Chapter 7 (sec 7.1).

3.   S.Arumugam and A. Thangapandian Isaac, Modern Algebra, SCITECH publications, 2006.
      Unit II: Chapter 9 (sec 9.1,9.2 ,9.3 and 9.5)
        Unit IV: Chapter 3(sec 3.1 , 3.2 , 3.5 , 3. 8 , 3. 9)

Dr. Venkataraman.M.K, Dr. Sridharan.N,Chandrasekaran.N, Discrete Mathematics , Then National Publication Company.
        Unit II: Chapter 1 (All sections except sec 9 only problems) & Chapter 2 (sec 1, 2, 5)
        Unit IV: Chapter 7 (sec 3)
        Unit V: Chapter 12(sec 3 -7 and 17)

References Books:
Schaums outline Series, Set Theory and Logic, Tata McGraw Hill, 1999.
Schaums outline Series, Boolean Algebra and switching circuits, Tata McGraw Hill, 1999.
Schaums outline Series, Discrete Mathematics, Tata McGraw Hill, 1999.
Schaums outline Series, Combinatorics, Tata McGraw Hill, 1999
J.E. Hopcroft, J.D.Ullman, Introduction to automata theory, Language and computations, Narosa publishing House, 1999.

MAS 1436 **MATHS FOR CHEMISTRY - II** **5hrs / 4cr**

Objective:
To reinforce and enhance the mathematical tools introduced earlier. Differential equation as a mathematical model for solving problems in chemistry is the central theme of the course. This course deals with differentiation, integration, differential equations and Laplace transform.

On successful completion of the course, the student will be able to:

understand the rules of differentiation
able to compute the derivatives of given functions
able to explain the relationship between the derivative of a function as a function and the notion of the derivative as the slope of the tangent line to a function at a point
understand the notion of an implicitly defined function
understand the derivative as it relates to rates of change
solve problems involving relationships between changing quantities
find the indefinite integral of elementary algebraic functions and trigonometric functions.
use the substitution rule to evaluate both definite and indefinite integrals
understand some basic definitions and terminology associated with differential equations and their solutions
use analytical methods of solution by direct integration; separation of variables; and the integrating factor method
understand exponential growth and decay
understand the laplace transform and its existence.

Unit I: Differentiation – Successive differentiation – Meaning of derivative- Maxima and minima.

Unit II: Partial differentiation – Errors and approximation- Maxima and minima.

Unit III: Integration – Methods of integration – Some standard formulae-Integration by parts – Definite integral – Reduction formula.

Unit IV: Formation of differential equations –Growth, decay and chemical reactions- Solving first and second order differential equations.

Unit V: Laplace transforms – Inverse transforms-Solving linear differential equations.

Text Books:

Narayanan. S. & Manickavachagom Pillay. T.K., Calculus Vol. I , S. Viswanathan private limited, 2013.

     Unit I: Chapter II (sec 2.1- 2.7, 3.1-3.3, 3.4, 3.6, 3.8), Chapter III (sec 1.1- 1.6, 2.1),
            Chapter IV (sec 2.1, 2, 2, 3, 4), Chapter V (sec 1.1- 1.5)
     Unit II: Chapter VIII (sec 1.1-1.3, 1.5-1.7, 2.1, 2.3, 4, 5)

Narayanan. S. & Manickavachagom Pillay.T.K, Calculus Vol. II, S. Viswanathan private limited, 2013.
     Unit III: Chapter I (sec 1.1-6.4, 7.3, 7.4, 11, 12, 13.1-13.5(formula only), 15.1)

Narayanan. S & Manickavachagom Pillay.T.K , Differential Equations and its applications, S. Viswanathan private limited, 2008.
     Unit IV: Chapter I (sec 1, 3), Chapter II (sec 1, 2, 4, 6.1-6.4), Chapter III (sec 1),
            Chapter V (sec 1-4)
     Unit V: Chapter XI (sec 1, 2, 4-9)

Reference Books:

     Hirst. D. N, Mathematics for Chemistry, Macmillan Press Ltd, 1993.
     Sankaranarayanan & Mangaladoss. J.A, Differential Equations and its Applications,
            Suja Publishing House, Palayamkottai, 1980.

MAS 1438   **STATISTICS (BIT)**   **5 hrs / 4cr**

Objective:
     The aim of this course is to enable the students to understand statistics. The course essentially deals with the probability distribution theory which is the basis of statistics. The topics covered include correlation and Regression and analysis of variance.

On successful completion of the course, the students will be able to

demonstrate the ability to apply fundamental concepts in exploratory data analysis
demonstrate an understanding of the basic concepts of probability
understand the foundations for classical inference involving confidence intervals and
     hypothesis testing.

Unit I: Measures of central tendency - Measures of dispersion

Unit II: Correlation – Correlation coefficient – Rank correlation – Regression – Regression coefficient

Unit III: Probability function – Addition and multiplication theorems on probability – Conditional probability- Baye's formula and theorem.

Unit IV: Types of sampling – Parameters and statistics –Statistical hypothesis – Null and alternative hypothesis – Types of errors –Large samples based on normal area table –Test of significance of small samples- t-test and F-test and chi square test for population variance and goodness of fit.

Unit V: Analysis of variance – One way and two way of classification –Latin square design.

Text Book:
  Arumugam.S & Thangapandian Issac .A , Statistics, New gamma publication House , 2013.

     Unit I: Chapter 2(sec 2.0 - sec 2.4), Chapter 3 (sec 3.1)
     Unit II: Chapter 6(sec 6.1 - 6.4)
     Unit III: Chapter 11
     Unit IV: Chapter 14(sec 14 .3 & 14.4), Chapter 15(sec 15.1 & 15. 2),
                Chapter 16 (sec 16.2)
     Unit V: Chapter 17(sec 17.2 to 17.3)

Reference Book:
  Gupta .S.C. & Kapoor .V.K, Elements of Mathematical statistics, S.chand co, 1995.

MAS 1440　　　　　　　　**BUSINESS STATISTICS (BBA)**　　　　　　**5hrs / 4cr**

Objectives:
       This course is designed to acquire the skills needed for decision making under uncertainties using statistical tools.

On completion of the course, the students will able to

        gain the knowledge on presentation and tabulation of data, the methods of collecting data and summarizing the data using central tendency
        acquire the knowledge on various measures of dispersion and the method of measuring it
        measure the trend or variation existing in a time series data
        acquire the knowledge of measuring the fluctuation or changes in price and quantity of goods and products using various index numbers.

Unit I: Business statistics: Introduction-definition - nature and scope-objectives-importance - functions of statistics-limitations-uses of statistics in various fields.

Unit II: Statistical survey-execution of survey-collection of data-sampling design-classification of data-tabulation-diagrammatic presentation-graphical presentation, measures of central tendency-arithmetic mean- combined mean-weighted means - median- quartile-percentile-mode- - geometric mean-harmonic mean.

Unit III: Measures of dispersion-range-quartile deviation-mean deviations-standard deviation-variance-coefficient of variation-combined standard deviation.

Unit IV: Skewness-correlation analysis-types of correlation-karl pearsons's coefficient of correlation-spearman's rank correlation-concurrent deviation-coefficient of determination.

Unit V: Regression analysis-business applications of regression analysis-index number - uses-methods of calculation of index number – analysis of time series.

Text Books:

1. Dr. Selvaraj .V.M, Business Statistics, Bhavani publications, 2011 (for theory).

    Unit I: Chapter 1(sec1 – 8)

    Unit II: Chapter 1(sec 1-9 - 1-32), Chapter 2

    Unit IV: Chapter 5(sec 5-1, 5-2), Chapter 6(sec 6-1 - 6-5, 6.7), Chapter 7(sec 7-1, 7-2)

  Arumugam, Isaac, Statistics, New gamma Publishers, 2008 (for

    problems) **Unit II :** Chapter 2

    Unit III: Chapter 3

    Unit IV: Chapter 6.1 – 6.3

    Unit V: Chapter 9.1, 9.2, Chapter 10

Reference Books:

    Pillai.R.S.N. & Bhavathi.V, Business Statistics, S. Chand Publishers, 2015.

    Gupta S.C, Kapoor.V.K, - Fundamentals of Mathematical Statistics, 10th-Edition, 2000.

MAS 1446   **BUSINESS MATHEMATICS (CPA)**   **5 hrs / 4 cr**

Objective:

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

    Students will be able to identify and use applicable math study skills in suitable problems.

Unit I: Ratios and Proportions- Simple and Compound Interest Including Application of Annuity – Variation, Indices –Laws of indices-Fractional index-Operations with power functions- Surds-Operations on surds-Rationalising factor-Number Systems and Conversions.

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

Unit III: Linear Simultaneous Equations- Quadratic Equations- Solution to quadratic equations-Nature of the roots- Inequalities.

Unit IV: Sequence and Series- Summation of series- Arithmetic progression-Sum of series in A.P- Geometric Progressions – Sum of series in G.P- Arithmetic mean-Geometric mean.

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

Text Books:

Dr. Aggarwal.R.S, Objective Arithmetic, S.Chand publishing,New
Delhi,2013. **Unit I:** Chapter 12, 21& 22

Switching and finite automata theory, Z.Kohavi,Tata MCGraw hill publishing
company,1978.

Unit I: Chapter

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

Unit I: Chapter 6
Unit II: Chapter 2, Chapter 9
Unit III: Chapter 8 (sec 8.3, 8.7- 8.11)
Unit IV: Chapter 11&12
Unit V: Chapter 17 (sec17.0-17.8, 17.10, 17.19 &17.20)

Reference Books:

Ranganath.C.K, Sampagiram.C.S. and Rajaram.Y, Business Mathematics, Himalaya
Publishing House, Mumbai, 2011.

Gupta.S.C , Business Mathematics , Sultan Chand & sons, New Delhi, 2010.

| MAS 2431 | OPERATIONS RESEARCH (BIT) | 5hrs / 4cr |

Objective:

To introduce to the students some of the quantitative techniques which are
essential for Information technology.

On successful completion of the course, the students will be able to

develop mathematical models for real life problems
get solutions using techniques in operation research.

Unit I: Introduction to operations research - Linear programming problem (L.P.P) –
Mathematical formulation – Graphical solution– Solution to L.P.P by simplex method.

Unit II: Transportation problem – Mathematical formulation – Finding initial basic feasible
solution – Northwest corner rule, least cost method and Vogel's approximation method –
Moving towards optimality – Unbalanced transportation problem.

Unit III: Assignment problem: Introduction – Mathematical formulation – Hungarian
Assignment algorithm – variations of the Assignment problem.

Unit IV: Game theory – Introduction – Two person zero sum games – Maxmin principle -
minimax principle – Saddle points – Games without saddle points – Solution of 2x2 games –
Graphical method – Dominance property.

Unit V: PERT/CPM – Introduction – Networking – Critical path analysis – Probability
considerations in PERT.

Text Book:

KantiSwarup, Gupta and Man Mohan, Operations Research, Sultan Chand and Sons 2004.

      Unit I: Chapter 1 (sec 1. 1, 1.6 & 1.7) Chapter 2 (sec 2.1, 2.2)

           Chapter 3 (sec 3.1, 3.2) Chapter 4 (sec 4.3)

      Unit II: Chapter 10 (sec 10.1, 10.9, 10. 10, 10. 14)

      Unit III: Chapter 11 (sec 11.1 - 11. 4)

      Unit IV: Chapter 17 (sec 17 .1 - 17.7)

      Unit V : Chapter 21(sec 21. 1 - 21. 6)

Reference Books:

Taha,H.A, Operations Research - An Introduction, Prentice Hall,8th Edition, 2007.

Kapoor V.K, Operations Research, Sultan chand and sons, 1997.

3 .Gupta P.K, and Man Mohan, Problems in Operations Research, Sultan chand and Sons, 2007.

4. Paneerselvam, Operations Research, Prentice Hall, 200

MAS 2437	BUSINESS STATISTICS (CIT)	5hrs / 4cr

Objective:

The purpose of this course is to develop the numerical and analytical ability with statistical tools. This course equips the students with various statistical tools which can be used in business environment.

On the successful completion of the course students will be able to

Students in introductory-level Statistics courses will know fundamental statistical concepts and some of their basic applications in science and society.

Students shall know how to organize, manage, and present data. Students shall be able to effectively communicate results of statistical analysis.

Unit I: Meaning- Scope- Importance and Limitations of Statistics- Statistically Investigation: Planning of Statistical Investigation- Census and collection of primary and secondary data- Statistical errors and approximation- Classification and Tabulation of data- Frequency distribution.

Unit II: Statistical Average: Arithmetic- geometric and Harmonic means- Mode- Median- Quartiles and Percentiles- Simple and weighted averages- Uses and limitations of different averages.

Unit III: Dispersion: Range- Quartile deviation- mean deviation and their coefficients- standard deviation- Coefficient of variation.

Unit IV: Correlation: Types of correlations- Karl person's coefficient of correlation- Spearman rank correlation- Regression- meaning- applications- equations.

Unit V: Index Numbers: Utility of index numbers- Problems in the construction of index numbers- Simple and weighted index number- Fisher's ideal index number -Time reversal test - Factor reversal test - Commodity reversal test.

Text Books:

        Dr. Selvaraj.V.M, Business Statistics, Bavani Puplications, 2011.
          Unit I: Chapter 1
       S. Arumugam, & A. Thangapandian Isaac, Statistics, New Gamma Publication
      House, 2004.
          Unit II: Chapter 2(sec 2.1, 2.2 (except Deciles), 2.3, 2.4, 2.5)
          Unit III: Chapter 3(sec 3.1)
          Unit IV: Chapter 6(sec 6.1, 6.2, 6.3, 6.4)
          Unit V: Chapter 9(sec I-A,I-B,II-A,II-B)

Reference Books:

        Gupta .S.P, Fundamentals of Statistics, Sultan Chand Publishers, New Delhi, 2007.
        Elhance .D.N, Fundamentals of Statistics, New Century Book House, 2011.
        Gupta .S.C, V. K. Kapoor, Mathematical Statistics, Sultan Chand & Sons 2001.
        Gupta.S. P, Statistical Methods, Sultan Chand & Sons, 2001.
        Dr. Vittal .P. R, Mathematical Statistics, MARGHAM Publications, 2002.

MAS 2439	**QUANTITATIVE TECHNIQUES (BBA)**	**5hrs / 4cr**

Objective:

     This course aims to equip the students with the basic mathematical and quantitative techniques that would enhance their Decision making skills both as a manager and as an entrepreneur.

On successful completion of the course the student will be able to

     understand statistical inference in relation to international business decision making
     understand the mathematical tools that are needed to solve optimization problems
     students have gain the knowledge on transportation and assignment problem.

Unit I: Basic concepts in matrix algebra – Determinant- Solving linear equations using Crammer's rule, matrix inversion method – Introduction to theory of probability.

Unit II: Concept of Linear Programming Problem : Formulation - Terminologies – Assumptions – Application and Limitations; LPP solution methods – Graphical method – Simplex method.

Unit III: Transportation Problem: Mathematical formulation – Initial basic feasible solution methods: North West corner rule – Least cost method – Vogel's approximation method – Optimality checking – Stepping stone method.

Unit IV: Assignment problem: Introduction – Mathematical Formulation – Hungarian assignment algorithm – Variations of the assignment problem.

Unit V: Game Theory: Introduction - Basic terminologies – Two person zero sum game – Games with saddle point – Games without saddle point mixed strategies – Dominance property of reducing the size of the game – solution methods.

Text Books:

Khanna M.L, Matrices, Jai Prakash Nath& Co. Meerut, 2001.
Unit I: Chapter

Arumugam. S, & Thangapandian Issac .A, Statistics, New Gamma Publication House, 2004.
Unit I: Chapter 11

Kantiswarup and Manmohan, Operations Research, Sultan Chand and sons, New Delhi,2004.
Unit II: Chapter 2& Chapter 3 (sec 3.1, 3.3)
Unit III: Chapter 6 (sec 6.1, 6.2, 6.5, 6.6)
Unit IV: Chapter 7
Unit V: Chapter 9 (sec 9.1-9.7)

Reference Books:

Sundaresan.V, Ganapathy Subramanian. K.S, Ganesan.K, Resource Management Techniques, A.R.Publications, 2002

Natarajan , Balasubramani, Tamilarasi, Operations Research , Pearson Education, 2007.

Ramnath , Rohitashwa, Quantitative Techniques for Managers, Himalaya Publications, 2010.

Paneerselvam, Operations Research, Prentice Hall, 2007.

Kothari, Introduction to Operation Research, Vikas publishing House, New Delhi, 2010.

Gupta. P.K, Man Mohan, Problems in Operation Research, Sultan Chand and sons, New Delhi, 2010.

MAS 2475	BUSINESS STATISTICS (CMC)	5hrs / 4cr

Objective:

The purpose of this course is to develop the numerical and analytical ability with statistical tools.

This course equips the students with various statistical tools which can be used in business environment.

Unit I: Meaning- Scope- Importance and Limitations of Statistics- Statistically Investigation: Planning of Statistical Investigation- Census and collection of primary and secondary data- Statistical errors and approximation- Classification and Tabulation of data-Frequency distribution.

Unit II: Statistical Average: Arithmetic- geometric and harmonic means- Mode- Median-Quartiles and Percentiles- Simple and weighted averages- Uses of different averages.

Unit III: Dispersion: Range- Quartile deviation- mean deviation and their coefficients-Standard deviation- Coefficient of variation.

Unit IV: Correlation: Karl person's coefficient of correlation- Spearman's rank correlation-Concurrent deviation method- Regression equations.

Unit V: Index Numbers: Utility of index numbers- Problems in the construction of index numbers- simple and weighted index number- Base shifting Fisher's ideal index number and tests of reversibility.

Text Books:

Gupta. S.C, Kapoor.V. K, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2001.

> **Unit I** : Chapter 1(sec 1.1 - 1.4)

2. Arumugam.S & Thangapandian Issac. A,   Statistics, New Gamma Publication House, 2013.

> **Unit II:** Chapter 2 (sec 2.0 -2.4 (except deciles))
> **Unit III:** Chapter 3
> **Unit IV:** Chapter 6 (sec6.1 -6.4)
> **Unit V:** Chapter 9 (sec 9.1)

Dr. Selva Raj.V.M, Business Statistics, Bavani Publications, 2011.

> **Unit I:** Chapter 1

Reference Books:

Gupta. S.P, Fundamentals of Statistics, Sultan Chand Publishers, New Delhi, 2007.
Elhance. D.N, Fundamentals of Statistics, New Century Book House, 2011.
Gupta.S.P, Statistical Methods, Sultan Chand & Sons, 2001
4. Dr. Vittal. P. R,   Mathematical Statistics, MARGHAM Publications, 2002.

MAS 2477   NUMERICAL AND STATISTICAL METHODS (COS)   5 hrs / 4cr

Objective:

The aim of this course is to enable the students to acquire basic tools in numerical and statistical methods for solving real life problems in business, industry, agriculture and medicine.

On the successful completion of the course students will be able to

> Understand Numerical and Statistical methods preliminaries.
> Apply Statistical and Numerical methods in various computer science related projects, seminars and research.

Unit I: Solving algebraic and transcendental equations – Bisection method – Regula Falsi method- Iteration method – Newton Raphson method-Solving system of linear equations - Gauss elimination – Gauss Jordan method.

Unit II : Interpolation – Equally spaced intervals- Newton's forward and Backward – Gauss forward and Backward – Stirlings formula- Unequally spaced intervals – Lagrange method – Hermite method.

Unit III : Numerical differentiation- Newton's forward and backward formula - Stirlings formula- Numerical integration – Trapezoidal – Simpson's $1/3^{rd}$ and $3/8^{th}$ rule – Solving differential equation - Euler's method – Runge Kutta 2nd and 4th order formula.

Unit IV: Measures of central tendency – mean – median – mode – Geometric mean – Harmonic mean – Measure of Dispersion – Range – Standard deviation – Quartile Deviation .

Unit V : Probability - Conditional probability - Probability distributions – Binomial – Poisson – Normal distributions - Correlation – Correlation coefficients – Rank Correlation.

Text Books:
>   Sastry S.S , Introductory method of Numerical Analysis, Prentice Hill of India,
>   2000 **Unit I:** Chapter 2(sec 2.1- 2.5) Chapter 5(sec 5.3.2)
>   **Unit II:** Chapter 3 (sec 3.6, 3.7.1, 3.7.2, 3.9.1, 3.9.2)
>   **Unit III:** Chapter 4(sec4.2, 4.4 (4.4.1, 4.4.2)) , Chapter 6 (sec 6.4,6.5)
>   Arumugam. S and Thangapandian Issac. A, Statistics, New Gamma puplishing
>   House, 2004.
>   **Unit IV :** Chapter 2(sec 2.1,2,2,(only Median)2.3,2.4) , Chapter 3 (sec 3.1)
>   **Unit V:** Chapter 11 (sec 11.1, 11.2), Chapter 13 (sec 13.1, 13.2, 13.3) Chapter 6
>   (Sec 6.1, 6.2)

Reference Books:
>   1**.** Jain.M.K, Jain.R.K &,Iyengar.S.R.K , Numerical methods for scientific &
>   engineering, New Age international, 1995.
>   Venkataraman. M.K, Numerical methods for science and engineering,
>   National Publishing company, 1999.

MAS 2438   **BUSINESS MATHEMATICS (CIT)**   **5hrs / 4cr**

Objective:
>   This course is designed to explore the techniques in mathematics and statistics
> which can be used in environment and managerial skills.

On the successful completion of the course students will be able to

>   apply mathematical concepts and principles to perform computations.
>   apply mathematics to solve problems.
>   communicate mathematical knowledge and understanding.
>   apply technology tools to solve problems.
>   perform abstract mathematical reasoning.
>   learn independently.

Unit I: Set theory: basic operations - Universe of sets - Functions - Venn diagrams.

Unit II: Matrices and Determinants-Definition of a matrix -Types of matrices- Algebra of matrices - Properties of determinants - Calculation of values of determinants upto Third order-Adjoint of a matrix- elementary row or column operations-Finding inverse of a matrix through Adjoint and elementary row and column operations- Solution of a system of linear equations (having unique solution and involving not more than three variables) using matrices- Input Output Analysis.

Unit III: Analysis of Time series- Causes of variation, components of a time series-Decomposition - additive & multiplicative models- determination of trend - Moving averages-least squares (Linear, Parabolic & Exponential trend)- Seasonal Indices - simple averages - ratio to trend- link relative methods.

Unit IV: Theory of Probability – concepts - addition & multiplication laws of probability- conditional probability- Baye's Theorem.

Unit V: Theoretical distribution – Binomial-Poisson and Normal Distributions.

Text Books:

Sancheti .D.C, and Kapoor .V.K, ,Business Mathematics ,Sultan Chand & Sons,1993.
>   **Unit I:** Chapter 2(sec 2.1-2.12,2.19- 2.24)
>   **Unit II:**Chapter 20 (sec 20.1-20.12,20.14-20.15,20.17-20.22)

Sundaresan.V, Jeyaseelan.S.D , An Introduction to Business Mathematics,2012, S.Chand, 2012.
>   **Unit II :** Chapter 8 (sec 8.7)

Arumugam. S., & A. Thangapandian Isaac, Statistics, New Gamma Publication House, 2004.
>   **Unit III :** Chapter 10 (sec 10.1,10.2,10.3)
>   **Unit IV :** Chapter 11 (sec 11.1,11.2)
>   **Unit V :** Chapter 13 (sec 13.1,13.2,13.3)

Reference Books:

1. Gupta. S.C, Kapoor. V. K, Mathematical Statistics, Sultan Chand & Sons, 2001.
2. Gupta .S P,   Statistical methods, Sultan Chand & Sons, 2001.

MAS 2440   **OPERATIONS RESEARCH (BCA)**   **5hrs / 4cr**

Objective:

To introduce to certain quantitative techniques in operations research will enhance the analytical ability of the students.

After completing the course, the students will be able to

> convert real life problems into mathematical models, to use Mathematical tools to solve problems in the analytical form and will be able to interpret in the common man's language and to hone the ability to do reality checks on calculations.
> design new simple models, like: PERT, CPM to improve decision –making and develop critical thinking and objective analysis of decision problems.

Unit I: Linear programming problem (L.P.P) – Mathematical formulation – Graphical solution – General L.P.P – Standard form – Canonical form – Solution to L.P.P by simplex method.

Unit II: Transportation problem – Mathematical formulation – Finding initial basic feasible solution – Northwest corner rule, least cost method and Vogel's approximation method – Moving towards optimality – Unbalanced transportation problem.

Unit III: Assignment problem – Mathematical formulation – Hungarian algorithm – Unbalanced assignment problem – Special cases – Travelling salesman problem.

Unit IV: Game theory – Introduction – Two person zero sum games – Maxmin, minimax principle – Saddle points – Games without saddle points – Solution of 2x2 games –Graphical method – Dominance property.

Unit V: Networking – Network and Basic components – Rule of network construction – Time calculations – Float or slack values – Critical path – CPM & PERT.

Text Book:

Kantiswarup, Gupta and ManMohan, Operations Research, Sultan Chand and Sons, 2004.
> **Unit I:** Chapter 2(sec 2.2), Chapter 3(sec 3.1,3.2,3.4,3.5), Chapter 4(sec 4.3)
> **Unit II:** Chapter 10(sec 10.1, 10.2, 10.9, 10.10, 10.14)
> **Unit III:** Chapter 11(sec 11.1, 11.2, 11.3, 11.4, 11.6)
> **Unit IV:** Chapter 17: 17.1 -17.7
> **Unit V:** Chapter 21: 21.1 -21.7.

Reference Books :
> Kapoor.V.K , Operations Research, Sultan chand and sons , 1997.
> Gupta. P.K and ManMohan, Problems in Operation Research, Sultan Chand and Sons, 2010.
> Arumugam. S & Thangapandian Isaac.A, Operations Research, New Gamma Publishing house, 2003.
> Sundaresan.V, Ganapathy Subramanian. K.S, Ganesan. K, Resource Management Techniques, A.R.Publications, 2002.

MAS 2454   **BIOSTATISTICS (BCH)**   **5hrs / 4cr**

Objective:

The main objective of the course is to inculcate the students with statistical skills needed to deal with contemporary nature of biological and clinical experiments. It also acquaints students with basic concepts of data collection and sampling methods.

On successful completion of the course the student will be able to

> identify the probability distribution
> apply the methods of distribution in various experimental problems

Unit I: Definition of statistics- Characteristics of statistics- Statistical Methods- Uses of statistics in Biology- Data types- Collection of data- Classification- Tabulation- Diagrammatic representation.

Unit II: Statistical tools-measures of central tendency-mean, median and mode, Harmonic mean, Geometric mean-measures of dispersion-mean deviation-standard deviation-coefficient of variation.

Unit III: Correlation: Types of correlation- Karl Pearson's co-efficient of correlation- Rank correlation- Regression lines.

Unit IV: Probability: Introduction-Basic definitions –Simple problems- Theoretical distribution- Binomial-Poisson-Normal distributions and applications.

Unit V: Sampling-Hypothesis- t-test- F-test-chi square test for goodness of fit-ANOVA-Definition- Classification-one criteria and two criteria - Simple problems- Overview of research methodology.

Text book:

Palanichamy.S & Manoharan, Statistical Methods for Biologists, Palani Paramount publications, 1990.

Unit I: Chapters 1, Chapter 2 (sec 2.1, 2.3, 2.4)
Unit II: Chapters 3, Chapter 4 (sec 4.1 – 4.4)
Unit III: Chapters 6 (sec 6.1, 6.2, 7.1, 7.2)
Unit IV: Chapters 8, 9
Unit V: Chapters 10, 11, 12.

Reference Books:

Arumugam Isaac .S, Statistics, New gamma Publishers, 2008.
Dr. Pranab kumar banarjee, Introduction to Biostatistics, S.Chand & company Ltd, 2011
Elhance, D.N and Agarwal, Fundamentals of Statistics, Kitab Mahal Ahamedabad, 2003.

MAS 2466	**BUSINESS MATHEMATICS (CMC)**	**5hrs / 4cr**

Objective:

This course is designed to explore the techniques in mathematics and statistics which can be used in environment and managerial skills.

On successful completion of the course the student will be able to

understand the basic principles of sets
demonstrate an understanding of the basic concepts of probability.

Unit I: Set theory: basic operations - universe of sets - functions - Venn diagrams.

Unit II: Matrices and Determinants- Definition of a matrix- Types of matrices-Algebra of matrices-Properties of determinants- Calculation of values of determinants up to Third order-adjoint of a matrix- elementary row or column operations-Finding inverse of a matrix through adjoint and elementary row and column operations- Solution of a system of linear equations (having unique solution and involving not more than three variables) using matrices- Input Output Analysis.

Unit III: Analysis of Time series- Causes of variation, components of a time series-Decomposition - additive & multiplicative models, determination of trend - Moving averages-least squares (Linear, Parabolic & Exponential trend)- Seasonal Indices - simple averages - ratio to trend- link relative methods.

Unit IV: Theory of Probability: concepts- addition & multiplication laws of probability-Conditional probability- Baye's theorem.

Unit V: Theoretical distribution - Binomial, Poisson distribution - Test of significance - Chi-square test, T-tests.

Text Books :

1. Sanchetti Kapoor, Business Mathematics, Sultan Chand & Sons, New Delhi, 2009.
   Unit I: Chapter 2 (sec 2.0 -2.20)
   Unit II: Chapter 20 (sec 20.0 - 20.24)

V. Sundaresan , S . D . Jeyaseelan, An Introduction to Busines mathematics,
S. Chand, 2013.
   Unit II: Chapter 8 (sec 8.7)

S. Arumugam, & A. Thangapandian Isaac, Statistics, New Gamma Publication
House, 2013.
   Unit III: Chapter 10
   Unit IV: Chapter 11
   Unit V: Chapter 13 (sec 13.1 & 13.2), Chapter 15 (sec 15.1)and
            Chapter 16(sec 16.1 & 16.2)

Reference Books:

Gupta. S.C, Kapoor. V. K, Mathematical Statistics, Sultan Chand & Sons, 2001.
Gupta. S.P , Statistical methods, Sultan Chand & Sons, 2001.

MAS 2472	BIOSTATISTICS (MIC)	5hrs / 4cr

Objective:

To introduce to the students the basic techniques in statistics, will enhance their ability to validate their experimental results.

The course deals with the fundamentals of biostatistics, sampling methods, data types and presentation, measures of central tendencies and dispersion, distribution patterns and various tests of inferential statistics.

Unit I: Definition of statistics- Characteristics of statistics- Uses of statistics in Biology- Data types- Collection of data- Classification- Tabulation- Diagrammatic representation.

Unit II: Measures of central tendencies: Mean and its types- Arithmetic mean, Geometric mean, Harmonic mean. Median, Mode, Measures of Dispersion: Range, Quartile deviation, Mean deviation, Standard deviation, Co-efficient of standard deviation, Standard error, Variance.

Unit III: Correlation Analysis: Types of correlation- Karl Pearson's co-efficient of correlation-Rank correlation- Regression lines.

Unit IV: Sampling: Types of sampling- Parameters and statistic- Null and alternate hypothesis- Test of significance of small samples-T-test, F-test and chi-square test for goodness of fit.

Unit V: Analysis of variance- One-way and two way classification- Latin square design.

Text Books:

Palanichamy.S & Manoharan, Statistical Methods for Biologists, Palani Paramount Publications, 1990.
Unit I: Chapter 1(sec1.1-1.7), Chapter 2(sec2.1-2.4)
Unit II: Chapter 3, Chapter 4(sec 4.1- 4.4)
Unit III: Chapter 7(sec7.1-7.2(coefficient of correlation and rank correlation))
Unit VI: Chapter 10(sec 10.1-10.3 and 10.6) ,Chapter 11
Unit V: Chapter 12

2. Arumugam. S & Thangapandian Issac. A, Statistics, New Gamma publishing

Gupta, Statistical Methods, S.Chand&co, 2001.
Subatra.R. & Ms. Shrividya .R, Probability and statistics, Tech-Max publications, 2006.
Pranab kumar banarjee, Introduction to Biostatistics, S.Chand & company ltd.2011
Elhance, D.N and Agarwal, Fundamentals of Statistics, Kitab Mahal Ahamedabad, 2003.

MAT 1221 / MAS 1221   ARITHMETIC AND MATHEMATICAL LOGIC

3 hrs / 2cr

Objective:

The course is intended for the students who are not majoring in mathematics as a non-major elective. The basic algebraic concepts including the principle of mathematical induction are introduced. The basic structure in mathematics called set is introduced by means of real life examples. The idea of truth table and its consequence in resolving situations in which the truth value is either true or false is studied at length.

After the successful completion of the course, students will be able to

identify and use applicable math study skills in suitable problems.
it develops logical skills and arithmetic ability.

Unit I: Odd man out series - Percentage - Profit and Loss – Discount - Data interpretation.

Unit II: Mean – Median – Mode.

Unit III: Operations on set – Algebra of sets – Finite and Infinite set – Principles of Mathematical Induction.

Unit IV: Truth tables – Disjunction – Conjunction – Implication.

Unit V: Laws of Logic – Tautology – Contradiction – Conjunctive and Disconjunctive Normal forms.

Text Books:

Aggarwal. R. S , Quantitative Aptitude , S . Chand and Company Ltd, 2014.
Unit I: Sec I : 35 ,10 ,11, 32 and Sec II : 36 ,37

Arumugam. S & Thangapandian Issac. A, Statistics, New gamma publication House, 2013
Unit II: Sec 2.1 – 2.3 simple problems

Venkatraman .M.K, Discrete Mathematics, The normal publishing company, 2000.
Unit III: Chapter 1 (sec 1.1 – 1.6) and chapter 4 (sec 4.2)
Unit IV: Chapter 9 (sec 9.1 -9.3)
Unit V: Chapter 9 (9.6 – 9.8   and 9.12)

Reference Books:

Stoll. R.S, Set Theory and Logic , Eureka publishing House , 1997.
Tremblay .J.P, Manohar. R, Discrete Mathematical Structure with applications to Computer science, Tata Mc-Graw -Hill, 2011.
Seymour Lipschutz , Schaum's theory and problemsof set theory , Mc-Graw-Hill, 1964.

MAT 1222 / MAS 1222   RECREATIONAL MATHEMATICS   3hrs / 2cr

Objective:

The course is intended for the students who are not majoring in mathematics as a non-major elective. Mathematics is called the Queen of sciences. It is sometimes perceived as incomprehensible. Mathematics can be fun is the theme of this course.

 This course enables the students to

appreciate the recreational value in mathematics through interesting games fallacies and paradoxes.

Unit I: Magic squares – Definition – History – Creation of magic square- Odd order (2m+1)-Single even order(2(2m+1))– Double even order (4m) .

Unit II: Fallacies- Paradoxes.

Unit III: Multiplication rules – Divisibility rules.

Unit 1V: Combinatorics – Rule of sum – Rule of product – Combination – Permutations – Basic level problems.

Unit V: Recurrence relations – Tower of Hanoi problem – Fibonacci numbers – Related results.

Text Books:

Rouse ball,H.S.M.Coxter, Mathematical Recreations and essays 13th edition,Dover Publications, 2003.
    Unit I: Chapter 7(page no 193-199)

Maxwell. E.A, Fallacies in mathematics,Cambridge University press , 1969.
    Unit II: Chapter 1& 6

Jagadguru swami Sri Bharathi Krisna tirthaji maharaja, Vedic mathematics, Banarsidass publishers,Delhi 2006.
    Unit III: Chapter 2 & 3

Balakrishnan.V.K, Schaum's outline of combinatorics,Tata Mc Graw-Hill publishing company Limited,Delhi 1995.
    Unit IV: Chapter 1 (Basic level problems)
    Unit V: Chapter 3 (Basic level problems)

Reference Books:
Tucker A.W, Applied Combinatorics, John & Sons Wiley, 2000.
Cohen D, Combinatorics, Wiley, 1978.

MAT 1231 / MAS 1231   MATHEMATICS FOR LIFE   3hrs / 2cr

Objective:
    The course is introduced to all the first year students as a life skill course. This course attempts to show what mathematics is, how it has developed from man's efforts to understand and model nature, how the mathematical approach to real problem can be accomplished, to what extent mathematics has modeled on civilization and culture. The topics covered in this course are history of calendar, puzzles, and moon, sun and Mathematical models in nature.

    The course aims at enabling the students to acquire mathematical knowledge for technical proficiency.

Unit I: History and types of calendar- Various number bases subsist in the history-Number puzzles and Logical puzzles.

Unit II: Speed arithmetic-Complementation rule - Product near the base 10^k- Division-Square root.

Unit III: Konigsberg bridge problem- Jordan curve-Planarity-Map coloring.

Unit IV: Synodic month- Sidereal month - Relation between synodic and sidereal month-Elongation of Moon- Phase formula.

Unit V: Lunar eclipse- Types and condition for its occurrence-Partial and total Solar eclipse-Condition for the occurrence of solar eclipse.

Text books:

      Kumaravel and Mrs. Kumaravel, Astronomy, Shri Vishnu arts, Sivakasi,2004.
          Unit I: Chapter 7(Sec 3).
          Unit IV: Chapter 12.
          Unit V: Chapter13.
    2. Glover. J. T,   Vedic Mathematics, MothilalBanarsidass publishers, 1995.
          Unit II: Chapters: 2,3,4,5.
      Arumugam.S. and Ramachandran.S ,Invitation to Graph Theory,
      SciTech Publications (India) Pvt. Ltd., 2004.
          Unit III: Pages: 1-10, 73-82, 85-98.

Reference Books:

    Galbraith.P, Blurn.W, Booker.G, and Ian D. Hurtles, Mathematical models, Harwood
        publisher, Chichester, 1993.
    Arthur berry, Astronomy, Dover publication, 1991.
    George J. Summer, The great book of puzzles and teasers, Jaico publishing house.
    John Clarke & Derek Allan Holton, A first look at Graph Theory, World Scientific
        Publishing Co. Ltd., 1995.

MAT 1232 / MAS 1232   **MATHEMATICAL REASONING**   **3hrs / 2cr**

Objective:

       The course is introduced to all the first year students as a life skill course. This course aims at developing logical thinking and mathematical reasoning. The science of coding and decoding is a hallmark in this era of communication and networking. A logical deduction is an important tool for any sequential programming which is an essence of the present electronic era.

The course enables the students to

          understand this process and ultimately enables them to crack the unknown
          enable the students to gain the knowledge about any problem that involves
          logical deduction by several methods like cause and effect reasoning

Unit I: Blood relation- Deciphering jumbled up descriptions, Relation puzzle and coded relations.

Unit II: Coding and Decoding- Letter decoding, direct letter coding, Number/symbol coding- Matrix coding- Substitution- Deciphering message word codes- Deciphering number and symbol codes for messages- Jumbled coding.

Unit III: Puzzle test: Classification type- Seating/placing arrangements-Comparison type- Sequential order of things- Selection based on given conditions-Family based puzzles.

Unit IV: Logical deduction- Arguments- Assumptions- Courses of Actions- Conclusions.

Unit V: Deriving conclusions from passages- Theme deduction - Cause and effect reasoning.

Text Book:

Aggarwal. R.S, A Modern Approach to verbal & non-verbal reasoning, S.chand& company Ltd., 2006.

Unit I: section 1: 5

Unit II: section 1: 4

Unit III: section 1: 6

Unit IV: section 2: 1, 2,3,4,5

Unit V: section 2: 6, 7,8

Reference Books:

Aggarwal. R.S, A Modern Approach to verbal reasoning, S.chand& company Ltd., 2006.

Aggarwal. R.S, A Modern Approach to non-verbal reasoning, S.chand& company Ltd., 2006.

Aggarwal. R.S, A Modern Approach to logical reasoning, S.chand& company Ltd., 2006.

MAT 3231 / MAS 3231 MATHEMATICS FOR COMPETITIVE EXAMINATIONS

3 hrs/2cr

Objective:

This course is designed for non major students who intent to apply for various competitive examinations. Though, no new concepts in mathematics are introduced whatever the students have learnt till their secondary level are recalled. Adequate training is given so that they will overcome the fear of numbers with the required level of speed and accuracy. This will provide strategies and methods to solve problems in Mathematics section of any competitive examinations.

On successful completion of the course the student will be able to

appreciate the techniques and tools in mathematics to solve problems in life
read between the lines and understand the logic behind it
 increase the speed and accuracy in performing problems in competitive examinations
improve the efficiency in dealing with numbers
appreciate the techniques and tools in mathematics to solve problems in life.

Unit I: Numbers   - problems on numbers - H.C.F and L.C.M – Divisibility –Simplification.

Unit II: Arithmetic mean - Geometric mean – Harmonic mean.

Unit III: Mathematical logic – conjunction –disjunction – negation – implications – Equivalence of statements – disjunctive and conjunctive normal forms.

Unit IV: Venn diagram – Inclusion and exclusion principle.

Unit V: Measures of standard geometric objects.

Text Books:

    Aggarwal R.S , Quantitative Aptitude, S. Chand & company Ltd., Revised edition, 2008.
        Unit I: Chapters 1,2&4
        Unit II: Chapter 6
        Unit V: Chapters 24 &25
    Discrete Mathematics, Schaum's outline series, McGraw Hill, 1992.

    Set theory and Related Topics, Schaum's outline series, McGraw Hill,Second Edition 1998.
        Unit IV: Chapter 1

Reference Books:

    Arumugam. S, & Thangapandian Issac .A, Statistics, New gamma publication House, 2013.
    Tremblay J.P, Manohar R, Discrete Mathematical Structure with applications to computer science, Tata McGraw - Hill, 2011.

MAT 3232 / MAS 3232   DEVELOPING QUANTITATIVE APTITUDE   3 hrs / 2cr

Objective:

    This course will enable the students to develop their quantitative skills that strengthen their edge over others in competitive examinations.

On successful completion of the course the student will be able to

    appreciate the techniques and tools in mathematics to solve problems in life
    increase the speed and accuracy in performing problems in competitive examinations
        and to improve the efficiency in dealing with numbers

Unit I: Simplification - Simultaneous simple equations – Problems on numbers- Problems on ages –Decimal fractions – Average - Partnership.

Unit II: Ratio and proportion- Variation- Profit and loss.

Unit III: Time and work- Pipes and cistern-Time and distance.

Unit IV: Simple interest- Compound interest- Alligation and mixture.

Unit V: Indices - Surds - Logarithms.

Text Book:

    Aggarwal R.S. Quantitative Aptitude, S.chand & company Ltd.,
        2006 **Unit I:** Chapters 4, 7, 8, 3,6,13
        Unit II: Chapters 11, 12, 14
        Unit III: Chapters 15, 16, 17
        Unit IV: Chapters 21, 22, 20
        Unit V: Chapters 9, 23

Reference Books:

    Sundaresan.V & Jeyaseelan.S.D, An Introduction to Business Mathematics, S.Chand & company Ltd., 2003.
    Elango, Business Mathematics, S.Chand & company Ltd., 2001.

Undergraduate Department of Mathematics

w.e.f. 2020-2021

Course offered to Non-major students as Supportive by the Department of Mathematics (UG)

Sem	Part	Course Code	Course Title	Hrs/Wk	Credits	Marks
1	III	MAS 1472	Theory of Probability	5	4	60

Value Added Courses

Sem	Course Code	Course Title	Hrs/Wk	Credits
1	MAT 121V	Mathematics for Competitive Examinations	2	2
3	MAT221V	Introduction to Astronomy	2	2
5	MAT321V	Hacks and Tips for Joint Admission Test - I	2	2
6	MAT322V	Hacks and Tips for Joint Admission Test - II	2	2

MAS 1472   *Theory of Probability*   *5Hrs/4Cr*

The aim of the course is to enable the students to understand the elementary concepts in probability as a measure of uncertainty and apply wherever there is a need in the field of data science. It also intends to introduce to the learner the concept of random variables and its ramifications in data science.

On successful completion of the course the student will be able to
   i.   illustrate with examples the basic concepts in probability
   ii.   identify and classify one dimensional discrete and continuous random variables
   iii. identify and classify two dimensional random variables and apply while dealing with conditional distribution function.
   iv.   demonstrate the ability to apply the theoretical discrete distributions inexploratorydata analysis
   v.   determinethe ability to apply the theoretical continuous distributions inexploratorydata analysis.

Unit 1: Introduction: Sample space – Classical Probability – Empirical Probability – Axiomatic approach to Probability - Random Experiment and Event – Laws of Probability – Conditional Probability - Baye's Theorem.   **(15 hrs)**

Unit 2: One dimensional random variable: Random Variable-Discrete and continuous distribution function-Probability density function.   **(15 hrs)**

Unit 3: Two dimensional random variables: Discrete and continuous joint probability distribution function – Conditional Distribution Function.   **(15 hrs)**

Unit 4: Discrete Distributions: Binomial, Poissonand Geometric distributions.   **(15 hrs)**

Unit 5: Continuous Distributions: Rectangular, Normal and Gamma distributions. **(15 hrs)**

Textbook:
   1. Gupta.S. C and Kapoor. V. K, Mathematical Statistics, Sultan Chand and Sons, 2001.

      Unit 1: Chapter 4 (sec 4.1, 4.3, 4.5 – 4.8)
      Unit 2: Chapter 5 (sec 5.1 – 5.4.3)
      Unit 3: Chapter 5 (sec 5.5 – 5.5.5)
      Unit 4: Chapter 7(sec 7.2 – 7.2.2, 7.2.4 – 7.2.6, 7.3 – 7.3.5, 7.5, 7.5.2, 7.5.3)
      Unit 5: Chapter 8 (sec 8.1 – 8.1.2, 8.1.4, 8.2 – 8.2.7, 8.3, 8.3.1)

References:
   1. Pillai Bagavathi R.S.N, Statistics Theory and Practice, Eighth Edition, Sultan Chand and Company Ltd., New Delhi, 2017.
   2. Rohatgi. V.K and Saleh. E, An Introduction to Probability and Statistics, Third Edition, John Wiley and Sons Inc., New Jersey, 2015.
   3. Arumugam S and Thangapandian Isaac A, Statistics, New Gamma Publications Pvt. Ltd., 2003.

Mapping of Course Outcomes with Bloom's Taxonomy

	K1	K2	K3	K4	K5	K6
CO1		2	3			
CO2	1		3			
CO3	1		3			
CO4				4		6
CO5			3			6

Mean: 3.2

MAT121V   **Mathematics for Competitive Examinations**   **2Hrs/2Cr**

   This course is designed for students who intent to apply for various competitive examinations. It enables the students to develop their quantitative skills which would strengthen their edge over others in competitive examinations. Adequate training is given so that they will overcome the fear of numbers with the required level of speed and accuracy. This will provide strategies and methods to solve problems in Mathematics section of any competitive examinations.

On successful completion of the course the student will be able to:
   i.   exhibit the efficacy in dealing with number system and simplification.
   ii. demonstrate the use of mathematical logic as a tool for solving problems using profit and loss, ration and proportion and blood relation
   iii. solve problems involving simple and compound interest, convert time and work, time and distance into mathematical equations and solve.
   iv. formulate problems connected with age, numbers, sequence and ranking as simultaneous equations and solve.
   v.   solve problems involving statement & argument, statement & assumptions and statement & conclusion.

Unit 1: Number system and simplification – Average – Percentage –Series   **(6 hrs)**

Unit 2: Profit and loss - Ratio and Proportion - Blood relation   **(6 hrs)**

Unit 3: Simple and compound interest - Time, Speed and Distance - Time and Work   **(6 hrs)**

Unit 4: Problem solving – Age and Numbers - Time sequence, number and ranking test   **(6 hrs)**

Unit 5: Statement & Argument - Statement & Assumptions - Statement & conclusion   **(6 hrs)**

References:
1. Aggarwal. R. S, A Modern Approach to verbal & non-verbal reasoning, S Chand & company Ltd., 2006.
2. Aggarwal. R. S, A Modern Approach to verbal reasoning, S. Chand & company Ltd., 2006.
3. Aggarwal. R. S, A Modern Approach to non-verbal reasoning, S. Chand & company, Ltd., 2006.
4. Aggarwal. R.S, A Modern Approach to logical reasoning, S. Chand & company Ltd., 2006.

Mapping of Course Outcomes with Bloom's Taxonomy

	K1	K2	K3	K4	K5	K6
CO1		2	3	4		
CO2			3	4	5	
CO3			3	4	5	
CO4			3	4	5	
CO5		2	3	4		

Mean: 3.6

MAT 221V   *Introduction to Astronomy*   *2Hrs/2Cr*

         The course will concentrate on the celestial objects, various techniques used to fix an object in the sky, and the various parameters that help one to measure the distance of a star. The course also contains the laws governing the celestial bodies discovered by Keplar and Newton. The various phenomenon like eclipses and the waxing and waning of the moon, and the properties of different planets in the solar system, the development of calendar, and the astronomical instruments one uses to measure the celestial bodies are covered in the syllabus.

At the end of the course, the student will be able to
    i.   understand the celestial coordinates system.
    ii.   understand and appreciate the relative significance of the Earth with reference to celestial objects.
   iii.   understand the moon as the natural satellite of the Earth and its motion from the perspective of a person on the Earth.
   iv.   understand the Sun and its periodic motions.
    v.   understand the history of Evolution of Calendar.

Unit 1: Celestial Spheres: Celestial coordinates, Diurnal motion.   **(6 hrs)**

Unit 2: The Earth: Zones of earth: Terrestrial Latitudes and Longitudes- Dip of Horizon
Twilight.   **(6 hrs)**

Unit 3: The Moon: Relation between sidereal and synodic months- Elongation-Phase of
moon- Path of the moon with respect to the sun.   **(6 hrs)**

Unit 4: Eclipses: Solar eclipse- Lunar eclipse-Ecliptic limits- Synodic period of the nodes
of lunar orbit.   **(6 hrs)**

Unit 5: Time: Equation of time- Seasons- Calendar- Conversion of time.   **(6 hrs)**

References:
1. Kumaravelu S, SusheelaKumaravelu, Astronomy, SK Publishers, 2007.
2. Michael Zeilik, Astronomy The Evolving Universe- John Wiley & sons, 1988
3. George O.Abell, David Morrison, Sidney C. Wolff- Exploration of the Universe- Saunders College Publishing,1987.

Mapping of Course Outcomes with Bloom's Taxonomy

	K1	K2	K3	K4	K5	K6
CO1		2				
CO2				4		
CO3			3			
CO4				4		
CO5					5	

Mean: 3.6

MAT321V   *Hacks and Tips for Joint Admission Test - I*   *2Hrs/2Cr*

This is a preparatory course for any student of Mathematics aspiring to pursue postgraduate programs, integrated Ph.D. Programs at IISc, IITs and other premier institutions. This course aims at recalling the cherished concepts which are core for Mathematics learning and apply in tricky situations and predict the right answer in the given environment.

At the end of the course, students will be
  i.   reinforced with the concepts learnt in functions of a real variable and trained to tackle problems by applying and analyzing with the tools acquired.
  ii. reinforced with the concepts learnt in Functions of multi Real Variables and trained to tackle problems by applying and analyzing with the tools developed.
  iii. reinforced with the concepts learnt in Integral Calculus and trained to tackle problems with the knowledge they have gained.
  iv. reinforced with the concepts learnt in Vector Calculus and trained to tackle problems with the skills and techniques they have learnt.
  v.   reinforced with the concepts learnt in Differential Equations and trained to tackle problems with the methods and procedures had been exposed to.

Unit 1: Functions of a Real Variable: Limit, continuity, intermediate value property, differentiation, Rolle's Theorem, mean value theorem, L'Hospital rule, Taylor's theorem, maxima and minima. **(6 hrs)**

Unit 2: Functions of Two or Three Real Variables: Limit, continuity, partial derivatives, differentiability, maxima and minima. **(5 hrs)**

Unit 3: Integral Calculus: Integration as the inverse process of differentiation, definite integrals and their properties, fundamental theorem of calculus. Double and triple integrals, change of order of integration, calculating surface areas and volumes using double integrals, calculating volumes using triple integrals. **(7hrs)**

Unit 4: Vector Calculus: Scalar and vector fields, gradient, divergence, curl, line integrals, surface integrals, Green, Stokes and Gauss theorems. **(6 hrs)**

Unit 5: Differential Equations: Ordinary differential equations of the first order of the form $y'=f(x,y)$, Bernoulli's equation, exact differential equations, integrating factor, orthogonal trajectories, homogeneous differential equations, variable separable equations, linear differential equations of second order with constant coefficients, method of variation of parameters, Cauchy- Euler equation. **(6 hrs)**

References:

1. Apostol T. M, Calculus, Volume I, 2nd. Edition, Wiley India, 2007.
2. Apostol T. M, Calculus, Volume II, 2nd. Edition, Wiley India, 2007.

Mapping of Course Outcomes with Bloom's Taxonomy

	K1	K2	K3	K4	K5	K6
CO1			3	4	5	
CO2			3	4	5	
CO3			3	4	5	
CO4		2	3	4		
CO5		2	3	4		

Mean: 3.6

MAT 322V   *Hacks and Tips for Joint Admission Test - II*   *2Hrs/2Cr*

This is a foundational course for any student aspiring to pursue postgraduate programs, integrated Ph.D. Programmes at IITs and IISc. This course is designed to provide opportunities to the students to develop academic talent to crack the national level entrance exams for higher studies.

At the end of the course, students will be
   i.   reinforced with the concepts learnt in Group Theory and trained to tackle problems with the knowledge they have gained.
   ii.   reinforced with the concepts learnt in Sequences of Real Numbers and trained to tackle problems with the tools and tricks acquired
   iii. reinforced with the concepts learnt in Series of Real Numbers and trained to tackle problems with the knowledge they have gained.
   iv.   reinforced with the concepts learnt in Real Analysis and trained to tackle problems with the methods and knowledge they have gained.
   v.   reinforced with the concepts learnt in Linear Algebra and trained to tackle problems with the methods and procedures they have been exposed to.

Unit 1: Group Theory: Groups, subgroups, Abelian groups, non-Abelian groups, cyclic groups, permutation groups, normal subgroups, Lagrange's Theorem for finite groups, group homomorphisms and basic concepts of quotient groups.   **(6 hrs)**

Unit 2: **Sequences of Real Numbers.** Sequence of real numbers, convergence of sequences, bounded and monotone sequences, convergence criteria for sequences of real numbers, Cauchy sequences, subsequences, Bolzano-Weierstrass theorem.   **(6 hrs)**

Unit 3: Series of Real Numbers. Series of real numbers, absolute convergence, tests of convergence for series of positive terms – comparison test, ratio test, root test; Leibniz test for convergence of alternating series.   **(6 hrs)**

Unit 4: Real Analysis: Interior points, limit points, open sets, closed sets, bounded sets, connected sets, compact sets, completeness of R. Power series (of real variable), Taylor's series, radius and interval of convergence, term-wise differentiation and integration of power series.

(6 hrs)

Unit 5: Linear Algebra: Finite dimensional vector spaces, linear independence of vectors, basis, dimension, linear transformations, matrix representation, range space, null space, rank-nullity theorem. Rank and inverse of a matrix, determinant, solutions of systems of linear equations, consistency conditions, eigenvalues and eigenvectors for matrices, Cayley-Hamiltontheorem.

(6 hrs)

References:
   1. Gallian J. A, Contemporary Abstract Algebra, 9th Edition, Cengage, 2017.
   2. Bartle R. G. and Sherbert D. R, Introduction to Real Analysis,4th Edition Wiley India, 2018.
   3. Strang G, Linear Algebra and its Applications, 4th Edition, Brooks/Cole, 2006

4. Dummit D. S. and FooteR. M, Abstract Algebra, John Wiley & Sons, 2001.
5. Richard. R Goldberg, Methods of Real Analysis, Oxford & IBH Publishing Co. Pvt. Ltd., 2011.
6. KumerasanS,Linear Algebra: A Geometric approach, PHI, 2004.
7. Seymour Lipschitz, Anton H, Vasishtha A.R, Linear Algebra, Schaum's Outline Series, 2017.

Mapping of Course Outcomes with Bloom's Taxonomy

	K1	K2	K3	K4	K5	K6
CO1			3	4	5	
CO2			3	4	5	
CO3			3	4	5	
CO4			3	4	5	
CO5		2	3	4		

Mean: 3.8