DEPARTMENT OF MATHEMATICS
U.G. PROGRAMME

SYLLABUS

Effective from the Academic Year 2003-04

LOYOLA COLLEGE

CHENNAI - 600 034

MT 1500 - ALGEBRA,ANALYTICAL GEOMETRY, CALCULUS AND TRIGONOMETRY-PAPER-I

Semester : I **Credit** **: 4**
Category : MC **No. of Hours / Week : 6**

Objectives: 1. To introduce basics in mathematics
           2. To improve analytical skills

Unit 1: The nth derivative - Leibnitz theorem and applications - subtangent and subnormal in cartesian and polar coordinates - slope of a curve and angle of intersection of curves in polar coordinates.

Unit 2: Lagrange's method of undetermined multipliers - application to maxima and minima - radius of curvature in cartesian, polar and parametric forms - p-r equations - centre of curvature - evolute.

Unit 3: Theory of equations - relation between roots and coefficients - sum of the rth powers of roots - irrational roots and imaginary roots - reciprocal equations - transformations - Horner's method.

Unit 4: Expansion of sin $n\theta$, cos $n\theta$ and tan $n\theta$ - conversion of $\sin^n\theta$ and $\cos^n\theta$ in terms of sines/cosines of multiples of θ - power series for $\sin\theta$, $\cos\theta$ and $\tan\theta$ - hyperbolic functions - summation of trigonometrical series - series in Binomial, Exponential and Logarithmic form.

Unit 5: Conics - pole and polar - chord in terms of midpoint - pair of tangents - conjugate diameters for ellipse - asymptotes of hyperbola - rectangular hyperbola - polar equations of a conic.

Text Books:

1. Narayanan, S. and Manickavachagam Pillai, T.K., *Calculus,* Vol.I, S.Viswanathan Printers & Publishers,1996.

2. Manickavachagam Pillai, T.K, Natarajan,T. and Ganapathy,K.S. *Algebra*,Vol I, S.Viswanathan Printers & Publishers,1994.

3. Narayanan, S. *Trigonometry*, S.Viswanathan Printers & Publishers,1995.

4. Manickavachagam Pillai, T.K, Natarajan,T. and Ganapathy,K.S. *Analytical Geometry*, S.Viswanathan Printers & Publishers,1996.

Reference Books:

1. Shanthi Narayanan, *Differential Calculus*, S.Chand & Co., 1964.

2. Vittal, *Trigonometry,* Margham Publications, 1988.

3. Duraipandian, P., *Trigonometry*, Emerald Publishers, 1984.

4. Duraipandian, P., *Coordinate Geometry*, Emerald Publishers, 1984.

MT 2500 - ALGEBRA,ANALYTICAL GEOMETRY, CALCULUS - PAPER-II

Semester	: II	Credit	:	4
Category	: MC	No. of Hours / Week	:	6

Objectives: 1. To introduce basics in mathematics
                     2. To improve analytical skills

Unit 1: Methods of Integration - Integration by parts - Bernoulli's formula - properties of defintite integrals - reduction formulae - area, volume, arc length and surface area in polar coordinates.

Unit 2: Ordinary differential equations - solutions of first order and first degree equations - exact equations - second order differential equations with constant and variable coeficients - method of variation of parameters.

Unit 3: Convergence and divergence of series - comparison test - ratio test - Cauchy's root test - Raabe's test.

Unit 4: Binomial, Exponential and Logarithmic series together with their proofs - application to summation.

Unit 5: 3D Geometry, Planes - Straight lines - Spheres.

Text Books:

1. Narayanan, S. and Manickavachagam Pillai, T.K., *Calculus,* Vol.II, S.Viswanathan Printers & Publishers,1996.

2. Manickavachagam Pillai, T.K, Natarajan,T. and Ganapathy,K.S. *Algebra,*Vol I and Vol II, S.Viswanathan Printers & Publishers,1994.

3. Manickavachagam Pillai, T.K, Natarajan,T. and Ganapathy,K.S. *Analytical Geometry*, S.Viswanathan Printers & Publishers,1996.

Reference Books:

1.   Shanthi Narayanan, *Integral Calculus*, S.Chand & Co., 1964.

2.   Duraipandian, P., *Coordinate Geometry*, Emerald Publishers, 1984.

CH 2100 - GENERAL CHEMISTRY-I

Semester :	**II**	**Credit**	**:**	**3**
Category :	**AR**	**No. of Hours / Week**	**:**	**4**

Objectives :

To get a good exposure to the basic concepts of chemistry to enable them to pursue careers related to chemistry.

Unit 1. Inorganic Chemistry

1.1 Transition elements

a) Transition Electronic structure and position in the periodic table.

b) General properties: variable valency, colour, magnetic properties and catalytic role

1.2 Coordination compounds

a) IUPAC Nomenclature of mononuclear complexes, Types of ligands including EDTA.
b) Theories: Werner's theory based on conductivity, Precipitation and isomerism (geometrical and optical) in square planar and octahedral complexes. Sidgwick's theory and EAN Principle, Pauling's Theory, explanation of shapes and magnetic nature.
c) Use of coordination compounds in qualitative analysis (Cu^{2+}/NH_3) and quantitative analysis (Ni^{2+}/DMG), Hardness of water using EDTA.
d) Mention of biologically active compounds: Haemoglobin, Chlorophyll.

Unit 2.   Organic Chemistry

2.1 Electronic displacement effects:

a) Inductive, resonance and steric effects.
b) Their effect on K_a and K_b on organic acids and bases.

5

2.2 Organic reaction mechanisms:

a) S_N1 bd S_N2 reaction of alkyl halides : mechanism only
b) Aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation.

2.3 Isomerisms:

a) Geometrical isomerism: molecules of alkene ofstructure R-CH=CH-R
b) Optical isomerism: compounds with one and two adjacent chiral carbons
c) Conformational isomerisms of ethane, n-butane and cyclohexane.

Unit 3.   Physical Chemistry

3.1 Solutions:

a) Types and examples of solutions: gas in liquid and liquid in liquid (totally miscible, partially miscible and immiscible liquid pairs)
b) Henry's and Raoult's laws, ideal and real solutions, deviation from ideal behaviour. Vapour-Pressure composition diagram for a totally miscible binary liquid system obeying Raoult's laws.
c) Partially miscible liquid system (Phenol-water)

3.2 Phase Rule:

a) Definition of phase, component and degree of freedom, Phase rule (statement only).
b) Application of phase rule to a one component system (water) and simple eutectic system (Pb-Ag)
c) Determination of pH (glass electrod)

3.3 Kinetics and catalysis:

a) Rate expression for I and II order, methods of determining order of a reaction, order and moleccularity.
b) Catalysis : homogeneous and heterogeneous, catalyst used in Contact and Haber's processes.
c) Concept of energy of activation and Arrhenius equation.

3.4 Photochemistry:

a) Comparison between thermal and photochemical reactions

b) Grotthus-Drapper's law, Einstein's law, quantum yield, photosensitisation

c) Beer-Lambert's law. Estimation of copper and nickel by spectrophotocalorimetry.

Unit 4.   Bio-Organic Chemistry   (7 hours)

4.1 Nucleic acids:

a) Structure of DNA and RNA, Hydrogen bonding.
b) Replication of DNA. Types of RNA
c) Genetic Engineering: Mention of applications and possible risks.

4.2 Hormones :

a) Thyroxine, adrenaline and sex hormones (structure and functions only)
b) Mention of ACTH, cortisone, prostaglandins, and oxytocin.

Unit 5.   Industrial Chemistry (9 hours)

5.1 High Polymers:

a) Classification: Natural and synthetic, step growth and chain growth polymers.
b) Natural rubber : Composition, cis-structure, elasticity, manufacture and uses of synthetic rubber (neoprene, Buna-S), Vulcanization of rubber.
c) Plastic : Manufacture and uses of PVC, Bakelite, acrylates, PET, PUF, Polystyrene.

5.2 Corrosion :

a) Causes of corrosion of metals, Electrochemical mechanism.
b) Prevention: Galvanization, electroplating and cathodic protection.

Reference Text Book :

1. C.N.R. Rao, University General Chemistry, Macmillan Co., India Ltd, 1973.
2. M.J. Sienko and R.A. Plane, Chemistry – Principles and properties, nternational Student Edition. 1995.
3. R. Gopalan, S. Sundaram, Allied Chemistry, Sultan Chand and Sons (1995).

Reference Books :

1. G.C. Hill, J.S. Holman, Chemistry in Context, ELBS, 1998

2. W.R. Kneen, M.J.W. Rogers, P. Simpson, Chemistry – Facts, patterns and principles, ELBS., 1999.

3.   Bruce H. Mahan, University Chemistry, 3rd edition, Addition-Wesley Publishing Company, 1977.

CH 2101 - CHEMISTRY PRACTICAL FOR GENERAL CHEMISTRY

Semester	: II	Credit	:	1
Category	: AR	No. of Hours / Week	:	2

Objectives :

To enable the students to understand better the concepts of organic analysis and appreciate better the applications of organic chemistry towards biological systems.

Practicals:

Organic Analysis:

a) Identification of acidic, basic, phenolic and neutral organic substances

b) Detection of N, S and halogens

c) Test for aliphatic and aromatic nature of substances.

d) Test for saturation and unsaturation.

e) Identification of functional groups

   i)   Carboxylic acid
   ii) Phenols
   iii) Aldehydes
   iv) Ketones
   v)   Esters
   vi) Carbohydrates
   vii) Primary amines
   viii) Amides

Text Books :

1.   N.S. Gnanapragasam and G. Ramamurthy, Organic chemistry – Lab manual, S. Viswanathan Co. Pvt. Ltd., 1998.

2.   J.N. Gurtu and R. Kapoor, Advanced Experimental Chemistry(Organic), S. Chand and Co., 1987.

8

MT 3500 - ALGEBRA,CALCULUS AND VECTOR ANALYSIS - PAPER-III

Semester : III   **Credit**   :   4
Category : AR   **No. of Hours / Week** :   6

Objectives: 1. To introduce basics in mathematics
              2. To improve analytical skills

Unit 1: Multiple integrals-change of order of integration-change of variables-Jacobian-Beta and Gamma integrals and their properties.

Unit 2: Partial differential equations-4 standard types-Lagranges's equation $Pp + Qq = R$- Charpits method.

Unit 3: Differentiation of vectors-gradient-divergence and curl-line integrals-verification of Gauss theorem, Green's theorem and Stokes theorem.

Unit 4: Laplace transform of standard functions and periodic functions-inverse transform-application to solutions of second order differential equations.

Unit 5: Theory of numbers-Euler's function $\phi(N)$-highest power of a prime contained in n!-congruences-Fermat's theorem-Wilson's theorem-inequalities-geometric and arithmetic means-Weirstrass inequality-Cauchy's inequality.

Text Books:

1. Narayanan, S. and Manickavachagam Pillai, T.K., *Calculus,* Vol.II, S.Viswanathan Printers & Publishers,1996.

2. Manickavachagam Pillai, T.K, Natarajan,T. and Ganapathy,K.S. *Algebra*,Vol II, S.Viswanathan Printers & Publishers,1994.

3. Narayanan, S. *Vector Analysis*, S.Viswanathan Printers & Publishers,1995.

Reference Books:

1. Shanthi Narayanan, *Integral Calculus*, S.Chand & Co., 1964.

2. Duraipandian, P., *Vector Analysis*, Emerald Publishers, 1984.

3. Viswanathan,K. and Selvaraj,S., *Vector Analysis*, Emerald Publishers, 1988.

MT 3020 - COMPUTER PROGRAMMING IN " C "

Semester :	III	**Credit**	:	1
Category :	AR	**No. of Hours / Week**	:	3

Objectives : 1.To improve logical thinking and better understanding of programming techniques

2.To learn a language that is well suited for both systems software and business packages.

Unit 1: Character set-constants-variables-data types-arithmetic, relational and logical operators-assignment operators-increment and decrement operators-conditional operators-arithmetic expressions .

Unit 2: Input and output operators-decision making-branching and looping(8 hrs).

Unit 3: Arrays-handling of character strings.

Unit 4: User defined functions-structures.

Unit 5: Pointers-file management in C.

Text Book:

Balagurusamy, E., *Programming in ANSI C*, 2nd edition,Tata McGraw Hill Publishing Co.,1997.

Reference Books:

1.Kernington & Richia,*C Programming Language*, second edition,Prentice Hall,1988.

2.Rajaraman, V., *Computer Programming in C*, Prentice Hall of India, New Delhi, 1996.

3.Byron S. Gottfried, *Programming with C,* Schaum outline series,Tata McGraw Hill Publishing Co.,1993.

PH 3100 - PHYSICS FOR MATHEMATICS

Semester :	I	Credit	:	2
Category :	AR	No. of Hours / Week	:	4

Unit 1.   Mechanics:

a) **SHM :** Formula for acceleration, velocity, displacement - Graphs of kinetic and potential energy Oscillations in spring - mass system - Potential and Kinetic energy exchanges Springs in series and parallel -Simple pendulum - Oscillation of liquid in U - tube.

b) **Rotational dynamics:** Moment of inertia - torque and angular acceleration - Rotational kinetic energy - Work done in rotation - Angular momentum - Conservation of angular momentum and applications Rolling motion down inclined plane.

Unit 2.   Gravitation

a) **Classical Theory of Gravitation :** Kepler's laws, Newton's law of gravitation - G and measurement Earth -Moon system - Weightless - Earth satellites - Parking orbit - Earth density - Mass of Sun Gravitation potential -Velocity of escape - Satellite potential and kinetic energy.

b) **Einstein's theory of gravitation :** Introduction - the principle of equivalence - experimental tests of general theory of relativity - gravitational red shift - bending of light - perihelion of mercury.

Unit 3.   Properties of Matter

a) **Elastic properties :** Elastic limit - Hooke's law - modulii of elasticity - Poison ratio - relation between q,n,k - force in a bar due to contraction or expansion - energy stored in a wire - rigidity modulus torsion in a wire -static torsion and torsional oscillations method.

Viscosity and surface tension : Newton's formula - Stokes' formula - Poiseuille's flow - Molecular theory of surface tension - Excess pressure over a curved surface - Spherical and cylindrical drops - Surface energy - Capillary rise . -Quincke's method for Mercury.

Unit 4.   Classical Mechanics and Relativity

a) **Lagrangian formulation :** Genaralised coordinates - Holonomic and Nonholonomic constraints Lagranges's equations - simple applications

- Atwood's machine. - simple pendulum.

b) Special theory of relativity: Galilean transformations -Michelson -Morley experiment Interpretation of results - Postulates of theory of relativity - Lorentz transformation equations - Length contraction - Time dilation - transformation of velocity -Variation of mass with velocity - Mass - energy relation.

Unit 5.   Mechanical waves

a) Sound waves : Pitch - loudness - quality - intensity of sound - beats and applications - Doppler principle in sound -Doppler red shift

b) Waves in pipes and strings : Stationary waves - node and antinodes - waves in pipes - displacement - pressure -fundamental, overtones - end correction -speed of sound in pipes - transverse vibrations in strings - fundamental and overtones - sonometer - longitudinal waves in strings.

Books for Study:

Advanced Level Physics: M. Nelkon and P. Parker - Arnold Publishers - 6th Edition.

Elements of Properties of Matter: D.S. Mathur

Mechanics: M.Narayanamurthy and N. Nagarathnam.

Introduction to Special theory of relativity: Robert Resnik.

MT 4500 - MODERN ALGEBRA

Semester :	IV	Credit	:	4
Category :	MC	No. of Hours / Week	:	6

Objectives: 1. To introduce and develop abstract concepts

2. To understand the subject as tool applicable to almost all other branches of Science, Engineering and Technology

Unit 1: Equivalence relations-the integers-binary operations-partially ordered sets-groups-examples-properties of groups-subgroups.

Unit 2: Cyclic groups-Lagrange's theorem-normal subgroups-quotient groups .

Unit 3: Homomorphisms-isomorphism theorems- automorphisms-

permutation groups.

Unit 4: Rings-examples-some special classes of rings-subrings-fields and subfields-ideals-quotient rings-homomorphisms.

Unit 5: Maximal ideals-prime ideals-characteristic of an integral domain-Euclidean rings-unique factorization theorem-Gaussian integers.

Text Books:

1. Santiago, M.L., *Modern Algebra*, Tata McGraw-Hill Publishing Co., 2001, Chapters 1-4 except the sections 2.3 and 2.12.

Reference Books:

1. Herstein,I.N.,*Topics in Algebra,* 4th edition, Vikas Publishing House Pvt. Ltd.,1991.

2. John B.Fraleigh, *A first course in Abstract Algebra*, 2nd edition ,Addison Wesley Publishing Co., 1975.

3. Arumugam S., Franklin John and Issac, *Modern Algebra*, Gamma Publishing house, Palayamkottai, 1979.

MT 4501 - MECHANICS-I

Semester : IV   Credit   :   4
Category : MC   No. of Hours / Week :   6

Objectives: To enable the learner to apply the principles of Mechanics in daily life.

Unit 1: Forces acting on a particle-concurrent forces-equilibrium of forces acting at a point-parallelogram law of forces-triangle law of forces-Lami's theorem-polygon of forces .

Unit 2: Moment of a force about a point and a line-Theorems on moments-resultant of like and unlike parallel forces-couples-reduction of a force and couple in a plane to a single force-laws of friction-equilibrium of a particle on a rough inclined plane.

Unit 3:Kinematics-motion of a point-velocity and acceleration-composition of velocities-relative velocity-motion in a straight line under uniform

acceleration and variable acceleration-vertical motion under gravity (articles 1.8, 1.9, 1.10, 1.11).

Unit 4: Newton's laws of motion-conservation of linear momentum-motion of a particle on a rough horizontal and inclined plane under the action of a constant force-motion in a resisting medium with resistance varying as (1)velocity (2)(velocity)^2 (articles 2.1, 2.5, 2.8, 2.9, 2.10,4.2, 4.3, 4.4) .

Unit 5: Projectiles-trajectory-ranges on horizontal and inclined planes-enveloping parabola-impact of elastic bodies-impact of two smooth spheres (direct and oblique)-loss of kinetic energy (articles 5.2, 5.3, 5.6, 5.7, 7.2, 7.7).

Text Book:

Naik,K.V. and Kasi,M.S.,*Statics and Dynamics*,Emerald Publishers,1992.

Reference Books:

1.   Narayanan,S.,*Statics and Dynamics*,Rochouse & Sons Pvt.,Ltd.

2.   Venkataraman,M.K.,*Statics and Dynamics,*1982.

MT 5500 - MECHANICS–II

Semester :	V	Credit	:	4
Category :	MC	No. of Hours / Week	:	6

Objectives: 1.   To give the students a practical knowledge of the mechanics; its uses and application in day to day life.

Unit 1: Center of gravity:

Center of gravity of areas – surfaces and volumes of solids of revolution – conditions of equilibrium

Unit 2: Virtual work:

Virtual work – simple problems – equilibrium of strings and chains – common catenary – suspension bridge.

Unit 3: Simple Harmonic Motion.

S.H.M. and its application – particle attached to an elastic string – composition of two S.H.M.'s –Simple pendulum – tangential and normal

14

velocity and acceleration of a particle along a curve. Art. 8.1, 8.2, 8.3, 8.4, 9.2, 9.3.

Unit 4: Central forces:

Velocity and acceleration of a particle in polar coordinates – circular – elliptic – parabolic and Hyperbolic orbits. Problems in finding law of force – equation to the orbit – inverse square law. Art: 10.1 to 10.6, 10.11.

Unit 5: Rigid dynamics:

M.I. of standard regular bodies – Theorems of parallel and perpendicular axes – motion of rigid body about a fixed axis – D'Alemberts principle – K.E. and angular momentum of a rigid body rotating about horizontal axis – compound pendulum – length of S.E.P. – Sphere rolling down the inclined plane. Art: 11.3, 11.4, 11.12, 12.1 to 12.5.

Text Book:

Statics, Dynamics by K.V. Naik and M.S.Kasi, Emerald publishers, 133, Anna Salai,Chennai-2, 1992.

Reference Books:

1. Statics, Dynamics by S.Narayanan, Rochouse& Sons pvt. Ltd.,Chennai-1.

2. Statics, Dynamics by Dr.M.K.Venkataraman; Agasthiar Book Depot, Nandhi Koil street,Teppakulam, Trichi-2.

MT 5501 - REAL ANALYSIS

Semester :	**V**	**Credit**	**:**	**4**
Category :	**MC**	**No. of Hours / Week**	**:**	**6**

Objectives: 1. The primary objective of teaching Real Analysis is to make the students think logically and objectively.

2. The secondary objective is to impart rigorous mathematical training.

Unit 1:Ordered field – upper bounds – lower bounds – maximum element – minimum element – supremum- infemum – order completeness of the real line – the Cauchy-Schwarz inequality – Minkowski's inequality – similar

sets – finite and infinite sets – countable and uncountable sets – uncountability of the real number system- set algebra – countable collection of countable sets.

Unit 2: Metric spaces (Definition and some examples only) – Euclidean space R^n – Open balls and open sets in R^n – Closed sets – adherent points – accumulation points – The Bolzano –Weierstrass theorem for R only – The Heine- Borel covering theorem – Compactness in R^n.

Unit 3: Convergent sequences in a Metric space – Cauchy sequences – complete Metric spaces- limit of a function- continuous function – examples of continuous functions – continuity and inverse images of open or closed sets – functions continuous on compact sets- intermediate value theorem for continuous functions – uniform continuity – discontinuities of real valued functions- monotonic functions.

Unit 4: Definition of derivative – derivatives and continuity – one sided derivatives and infinite derivatives – Roll's theorem – the Mean value theorem for derivatives – intermediate value theorem for derivatives – Taylor's formula with remainder - MaClaurin's series – Properties of monotonic functions – functions of bounded variation – total varitation on [a,x] as a function of x – functions of bounded variation expressed as a difference of increasing functions.

Unit 5: Notation – the defenition of the Riemann Stieltjes integral – linear properties – integration by parts – reduction to a Riemann integral – Convergent and divergent sequences – limit superior – limit inferior of a real valued sequence – monotonic sequences of real numbers.

Text Book:

Real Analysis by K.Viswanatha Naik, Emerald Publishers.

Reference:

1. A first course in Mathematical Analysis by D.Somasundaram – B.Choudhary, Narosha publishing House, New Delhi.

2. Mathematical Analysis by Tom M.Apostol, Addison Wesley publishing company, California

3. Methods of Real Analysis by Richard R.Goldberg, Oxford and IBH publishing Co.Pvt.,Ltd., New Delhi.

MT 5502 - LINEAR ALGEBRA

Semester : V   **Credit**   **:   4**
Category : MC   **No. of Hours / Week :   6**

Objectives:

    1. To study vector spaces as an abstract algebraic system and establish some of the properties of such systems.

    2.   To appreciate the subject which finds the widest application – in physics, chemistry, economics and in fact in almost every science and pseudo science.

Unit 1: Vector spaces, subspaces, quotient spaces, sums and direct sums, linear independence.

Unit 2: Basis and dimension, homomorphisms.

Unit 3: Inner product spaces, Algebra of linear transformations, eigen values, eigen vectors.

Unit 4: Matrix representation of linear transformations, algebra of matrices, trace and transpose

Unit 5: Rank of a matrix, linear equations, Hermitian and Unitaray transformations.

Text books:

Modern Algebra by M.L.Santiago, Arul publications,1988.

Chapters 6 and 7 excluding 6.7, 7.4 and 7.8.

Reference:

1.Topics in Algebra by I.N.Herstein, Fourth edition, Vikas Publishing House pvt. Ltd.

2.Modern Algebra by Dr.S.Arumugam, Franklin John & Issac. Gamma publishing House,1979, Palayamkottai.

MT 5503 - ASTRONOMY

Semester :	V	**Credit**	:	**4**
Category :	MC	**No. of Hours / Week**	:	**6**

Objectives: 1.   To introduce the students to space science.

2.   To familiarize the student with the important features of the planets, sun , moon and stellar universe.

Unit 1: Spherical trigonometric formulae (without proof) – systems of coordinates – diurnal motion of the sun and stars – sidereal day – sidereal time – circumpolar stars – morning and evening stars – celestial diagram.

Zones of earth – variations in the durations of day and night – dip – twilight.

Unit 2 : Refraction – parallaxes – aberration of light – effect of parallax on celestial latitude and longitude.

Instruments – sextant – telescope – meridian circle – equatorial – sundial.

Unit 3 : Kepler's laws – verifications of first law – Newton's deductions – conversion of time – equation of time – seasons – calender.

Unit 4 : Moon – synodic and sidereal periods – Moon's phases – description of Moon's surface .

Eclipses – lunar and solar eclipses – different kinds of eclipses – ecliptic limits – maximum and minimum number of eclipses in a year.

Unit 5 : Solar system – elongation- phases – stationary points.

Descriptive astronomy – sun – planets – comets – constellations of stars.

Text Book:

Astronomy for degree classes by S.Kumaravelu, Mission Press, Palayamkottai.

Reference books:

1.   Astronomy for graduate & post graduate classes by Rukmani Ramachandran, Trichirapally,1968.

2.   Astronomy by G.V.Ramachandran,Mission Press,PalayamKottai.

MT 5400 - GRAPH THEORY

Semester : V		**Credit** :	**2**
Category : ES		**No. of Hours / Week** :	**3**

Objectives: 1. To translate real life situations to diagrammatic representations.

2. To develop problem solving skills and thereby solve real life problems.

Unit 1: Definition of graph and examples – incidence and degree – subgraphs – isomorphism – complement of a graph – operation on graphs.

Unit 2: Walks, trails and paths – connectedness and components – cut points and bridges – blocks.

Unit 3: Eulerian graphs – Konigsburg bridge problem – Hamiltonian graphs.

Unit 4: Trees – characteristics of trees – center of a tree.

Unit 5: Planarity – colourability – chromatic number – five-colour theorem – four-colour problem.

Text Books:

Invitation to graph theory by S.Arumugam and S.Ramachandran, New gamma publishing house, Palayamkottai, 1994.

MT 5401 - FLUID DYNAMICS

Semester : V		**Credit** :	**2**
Category : ES		**No. of Hours / Week** :	**3**

Objectives: To introduce the applied mathematics.

Unit 1: Fluid Motion – Lagrangian method – Eulerian method – Relationship between the Lagrangian and Eulerian method – steady and unsteady flows – Uniform and non-uniform flows – One, two, three dimentional flows – Axi-symmetric flow – line of flow – stream line – stream tube – stream surface-path line – streak line – velocity of a fluid particle at a point.

Local,connective and material derivatives – equation of continuity – velocity potential – irrotational flow – Boundary conditions.

Unit 2 : Euler equation of motion – Bernoulli's equation – Pitot tube – Venturi tube.

Unit 3 : Complex potential – two dimentional source – sink – doublet – Image system of source and sink.

Unit 4 : Vortex motion - vorticity vector - vortex line - vortex tube - Axi symmetric flow – stokes stream function .

Unit 5 : Aerofoil - Joukowski's transformation – Theorem of Kutta and Joukowski - lift on an aerofoil.

Text book:

1.Text book of Fluid dynamics by F.Chorlton, CBS publications 1985.

2.Fluid dynamics by Rutherford, Inter science publications,Inc-1959.

Reference:

1.Fluid dynamics – Shanti Swarup, Krishnan Prakashan Mandhir, Meerut, 1992-93.

2.Hydrodynamics by M.D.Raisinghania, S.Chand & Co. Ltd., -1995

MT 5402 - COMBINATORICS

Semester :	**V**	**Credit**	**:**	**2**
Category :	**ES**	**No. of Hours / Week**	**:**	**3**

Objectives: 1. To introduce a branch of Discrete Mathematics that deals with enumeration and existence problems.

2. To enable the students to attempt questions related to enumeration in various competitive examinations.

Unit 1: Basic Combinatorial numbers -Stirling numbers of the second kind.

Unit 2 : Generating functions and Recurrence relations - Symmetric functions.

Unit 3 : Multinomials - multinomial theorem - Inclusion and Exclusion principle.

Unit 4 : Euler Function - Permutations with forbidden positions - The 'Menage' problem -Problem of Fibonacci.

Unit 5 : Polya Theory - Necklace problem and Burnside's lemma - Cycle index of a permutation group - Polya's theorems and their immediate applications.

Text Books:

Krishnamurthy.V , Combinatorics Theory and Applications, East-West Press.

Reference Books:

1.   V.K.Balakrishnan – Theory and problems of combinatorics – Schaums outline series –

      McGraw Hill.

2. Inn Anderson – Combinatorics of finite sets – Oxford Science Publication.

3. Kenneth P. Boggart - Introductory Combinatorics- Pitman Books Ltd.

MT 5403 - SPECIAL FUNCTIONS

Semester :	V	Credit	:	2
Category :	ES	No. of Hours / Week	:	3

Objectives: 1. To learn different techniques for solving differential equations.

2. To familiarize the students to applications in other branches of Mathematics such as Quantum Mechanics, Electro-Static problems, Structure of Hydrogen atom, Nuclear Physics, etc.

Unit 1: Power series solution of Ordinary Differential equations of First and Second   Order-Properties of Power Series

Unit 2: Singular Points of Linear Second Order Differential Equations - The Method of Frobenius.

Unit 3: Bessel's Equation - Solution of Bessel's general Differential Equation- Recurrence Formula for $J_n(X)$ - Generating Function $J_n(X)$

Unit 4: Hermite's Polynomials- Orthogonal properties of Hermite's polynomials- Recurrence formula for Hermite's polynomials- Laguerre polynomials- Orthogonal properties of Laguerre polynomials.

Unit 5: Legendre's Equation -Solutions of Legendre's Equation- Definition of $P_n(X)$ and $Q_n(X)$ - Laplace Definite Integral for $P_n(X)$- Orthogonal Properties of Legendre's Polynomials- Recurrence Formula for Legendre's Polynomials - Beltrami's Result - Christoffel's Expansion.

Text Books:

1. Special Functions by J.N. Sharma and R.k.Gupta.(2.1 to 2.8, 2.10, 5.1, 5.4, 5.5, 6.1, 6.3, 6.7, 6.8, 7.1, 7.7), Krishna Prakashan Mandir -Pub.

2. Advanced Calculus of Applications by F.b. Hilder Brandt (4.1 to 4.4).

Reference Books:

1. Differential Equations and Calculus of variations by L.Els golts.

2. Differential Equations- Diwan and Agashe.

MT 6600 - COMPLEX ANALYSIS

Semester :	**VI**	**Credit**	**:**	**4**
Category :	**MS**	**No. of Hours / Week**	**:**	**6**

Objectives: To prepare the students for logical thinking

Unit 1: Definition of Complex number and the Algebra of Complex numbers – conjugation – absolute value- inequalities – Functions of a complex variable – limit – continuity – uniform continuity – analytic function – C-R equations.

Unit 2: Sequences – Series – Uniform convergence – power series – Hadamard's formula for the radius of Convergence – elementary functions-rectifiable arcs – contours – Complex line integration – Cauchy's theorem – Cauchy's integral formula for the derivatives of an analytic function – Cauchy's estimate – Morera's theorem – Liouville's theorem – Fundamental theorem of Algebra.

Unit 3: Maximum modulus principle – Schwarz Lemma – Taylor series – Laurent series – Zeros and Poles of a function – Meromorphic function.

Unit 4: The residue at a singularity – Residue theorem - The argument principle – Rouche's theorem – Contour integration.

Unit 5: Definition of Conformal mapping – Bilinear transformation – Cross ratio – the mappings from disc to disc, disc to half plane and half plane to half plane.

Text books:

1. Complex Analysis by S.Arumugam, A.Thangapandi Issac and A.Somasundaram; New Gamma Publishing House, Palayamkottai-627002.

2. Complex variables and application by R.V. Churchill.

Reference books:

1.Foundations of Complex Analysis by S.Ponnusamy; Narosa Publishing House, New Delhi.

2.Functions of a complex variable by Sharma J.N., Krishna Prakashan Mandir, Subash Bazar, Meerut- 2, U.P.

MT 6601 - APPLIED ALGEBRA

Semester :	VI	Credit		:	4
Category :	MS	No. of Hours / Week		:	6

Objectives: 1.To equip the students with mathematical tools that have applications in various fields.

2.To give a better exposure to face the competitive exams.

Unit 1: Mathematical logic

Statements and Notations, Connectives, Negation, Conjunction, Disjunction, Statement Formulae and Truth Tables, Logical Capabilities of Programming Languages, Conditional and Biconditional, Well–formed Formulae, Tautologies, Equivalence of Formulae, Duality Law.

Unit 2: Mathematical logic (contn..)

Tautological Implications, Formulas with Distinct Truth Tables, Functionally Complete Sets of Connectives, Other Connectives, Normal Forms, Disjunctive Normal Forms, Conjunctive Normal Forms, Principal Disjunctive

Normal Forms, Principal Conjunctive Normal Forms, Ordering and Uniqueness of Normal Forms.

Unit 3: Lattices

Properties of lattices, Modular and Distributive Lattices, Boolean Algebra, Basic properties, Boolean Polynomials, Ideals

Unit 4: Automata

Semiautomata and Automata, Description of Automata and examples, Semigroups, Fundamental concepts, Subsemigroups, Homomorphisms, Free semigroups, Input sequences.

Unit 5: Automata (contn..)

The Monoid of an Automaton and the Automaton of a Monoid, Composition and Decomposition, Elementary Constructions of Automata, Cascades.

Text books:

1. Discrete Mathematical Structures with applications to Computer science by J.P. Trembley, R.Manohar – McGrew Hill Book Co., second edition 1984, Chapter 1 (Sec. 1.1 to 1.2.14, 1.3.1 - 1.3.5)

2. Applied Abstract Algebra – R.Lidl and G. Pilz, Springer Verlaq 1984 Chapters 1(Sections 1 & 2), 6(Sections 1 - 6).

Reference:

Discrete and combinatorial Mathematics by Ralph P.Grimaldi, 3rd edition,

Addison –Wesley Publishing company.

MT 6602 - DATA STRUCTURES AND ALGORITHMS

Semester :	VI	Credit	:	2
Category :	MS	No. of Hours / Week	:	3

Objectives: 1. This language independent data structures enable students to design algorithms using pseudocode and then build them into programs.

2. Learn the basic techniques to collect and analyze the data in respective project.

Unit 1: Peudocode - Algorithm analysis - pseudocode examples - Abstract Data Type(ADT) - Data structure - ADT operations.

Unit 2: Searching - sequential search - sentinel search, probability search, ordered list search - Binary search.

Unit 3: Linear lists - linked lists - linked list algorithms(Create node, insert node, delete node algorithms only) –Stacks - Applications - Reversing data, Backtracking.

Unit 4: Queues - operations - Array implementation- Recursion - Examples(Factorial, Fibonacci numbers algorithms only) - Tree - Basic tree concepts - Binary tree.

Unit 5: Sorting concepts - Insertion sort - Selection sort - Heap sort - Bubble sort.

Text Books:

Richard F.Gilberg and Behrouz A.Forouzan - Data Structures A Pseudocode approach with C - Brooks/Cole Publishing Company, 2002.

(Sections 1.1 - 1.3, 2.1, 3.1 - 3.3, 4.1, 4.3, 5.1, 5.7, 6.1, 6.4, 7.1, 7.2, 11.1 - 11.4)

Reference Books:

1. Trembley and Sorenson – Data structures with applications – TMH- 3nd Edition, 1991.

2. Ellis Horowitz and Sartaj Sahani – Fundamentals of Data Structure in PASCAL – Galgotia Publ, 1996.

MT 6650 - NUMERICAL METHODS

Semester :	VI	Credit	:	4
Category :	SK	No. of Hours / Week	:	6

Objectives: To find numerical solutions to problems where the exact relationship between the variables are not known.

Unit 1: Solutions to simultaneous linear equations - Cramer's rule – Gaussian elimination – Gauss-Seidel iterative method (Application of 'C' programming to the unit is included).

Unit 2: Successive bisection method – Newton-Raphson method – Successive approximation method – Regula Falsi method.

Unit 3: Interpolation – Newton's interpolation formulae – Forward difference interpolation formula – Backward difference interpolation formula – Divided difference formula - Lagrange's interpolation formula.
(Application of 'C' programming to the unit is included).

Unit 4: Central difference – Central difference formula – Gauss interpolation formula – Stirlings formula –Bessel's formula – Everett's formula (Only application of these formulae. No proof required). Numerical differentiation.

Unit 5: Numerical integration – Trapezoidal rule – Simpson's $1/3^{rd}$ and $3/8^{th}$ rule for numerical integration.

(Application of 'C' programming is included for numerical integration). Numerical solutions of ordinary differential equations- Euler's methods with its modifications – Taylor's series method –Runge- Kutta method.

Text books:

1. Numerical Algorithms computations in Science & Engineering by E.V. Krishnamurthy & S.K.Sen. Affiliated East- West Press pvt. Ltd., New Delhi.

2. Numerical Methods by Dr.V.N.Vedamurthy, Dr.N.Ch.S.N.Iyengar; Vikas Publishing house pvt. Ltd.,576, Masjid Road, Jangpura, New Delhi – 110014.

MT 6651 - OPERATIONS RESEARCH

Semester : VI	Credit	:	4
Category : SK	No. of Hours / Week	:	6

Objectives: To provide a scientific basis to the decision makers for obtaining optimal solution.

Unit 1: Linear programming – Graphical solution – Simplex algorithm – Dual and primal techniques – Dual simplex method.

Sections: 2.1.1, 3.1 to 3.5 (Application of 'C' programming to the unit is included).

Unit 2: Transportation and assignment problem.
Sections: 6.1 to 6.3. (Application of 'C' programming to the unit is included).

Unit 3: Theory of Games – Optimal solutions of two persons zero-sum games – Mixed strategies – Solutions by graphical method – Solutions of mxn games by graphical method – Dominance principle.

Sections: 12.4.1 to 12.4.4.

Unit 4: Network Analysis – Network definitions – Shortest - route problem – Minimal spanning tree problem –Maximal flow problem – Project scheduling by PERT-CPM.

 Sections: 8.1 to 8.4, 13.1 to 13.4.1.

Unit 5: Inventory models: Introduction – Deterministic models- single item static models with and without shortages- Single item static model with single price break- Quantity discounts.

Sections: 4.3, 14.3.1,14.3.2.

Text books:

1.Operations Research. An Introduction. Fifth edition by Hamdy A. Taha Prentice – hall of India private Ltd., New Delhi – 110001.

2.Operations Research by B.S.Goel and S.K.Mittal. Pragati Prakashan Meerut.

Reference Books:

1. An Introduction to Operational Research; Third revised and enlarged edition by C.R.Kothari Vikas Publishing house pvt. Ltd.

2. Introduction to Operational Research by Frederick S.Hillier and Gerald J.Lieberman, Holden-Day, Inc., 500 Sansome street, San Francisco, California.

3. Operation Reseaarch Twelfth Edition by Kanti Swarup P.K. Gupta, Manmohan - Sultan Chand and Sons, New Delhi