ANNAMALAI UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF MATHEMATICS
M.Sc. MATHEMATICS
FIVE YEAR INTEGRATED DEGREE PROGRAMME (CBS)
(ON CAMPUS)
(2014 – 2015)
Regulations for students admitted from 2014 – 2015

Common to all Departments of Studies in the Faculty of Science

Mathematics, Statistics, Physics, Chemistry, Botany, Zoology, Earth Sciences, Bio Chemistry.

Master's Programme

A Master's Programme consists of a number of courses, in M.Sc. A Master's programme consists of a set of compulsory courses and Language Papers.

The entire course carries credit system. The number and distribution of credits for the courses will be decided by the respective faculties.

A Course is divided into two Semesters, Odd Semester and Even Semester.

Credits

The term credit is used to describe the quantum of syllabus for various programmes in terms and hours of study. It indicates differential weightage given according to the contents and duration of the courses in the Curriculum design.

The minimum credit requirement for the award of the Degree of Five Years Master's Programme shall be 225.

Courses

Each course may consist of Lectures/ Tutorials/ Laboratory work/ Seminar/ Project work/ Practical training report/ Viva voce etc.

Normally, in each of the courses, credits will be assigned on the basis of the Lectures/ Tutorials/ Laboratory work and other form of learning in a 18 week scheme schedule.

Eligibility for Admission

Candidates for admission to the first year of the Five Year Integrated M.Sc. Degree Course shall be required to have passed the final examination of the plus 2 Higher Secondary Course or Equivalent thereto with a minimum of 50% aggregate under academic stream with the following subjects as in Appendix - A, conducted by the Board of Secondary Education, Tamilnadu Government or an examination of any other authority accepted by the Syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time.

Grading System

The term Grading system indicates a 10 point scale of evaluation of the performance of students in terms of marks, grade points, letter grade and class.

Course Duration

The duration for completion of a Five Year Integrated M.Sc. Programme in any course is Ten Semesters.

Student Counselors

To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counselor for those students throughout their period of study.

Attendance

Every teaching faculty handling a course shall be responsible for the maintenance of Attendance Register for candidates who have registered for the course.

The instructor of the course must intimate the Head of the Department at least Seven Calender days before the last instruction day in the semester about the particulars of all students who have secured an attendance of less than 80%.

A candidate who has attendance less than 80% shall not be permitted to sit for the End-Semester Examination in the course in which the shortage exists.

However, it shall be open to the authorities to grant exemption to a candidate who has failed to obtain the prescribed 80% attendance for valid reasons on payment of a condonation fee and such exemptions should not under any circumstances be granted for attendance below 70%.

Examination

There will be two sessional assessments and one End-Semester Examination during each semester.

Sessional Test - I will be held during Sixth Week for the syllabi covered till then.

Sessional Test - I will be combination of a variety of tools such as class test, assignment and paper presentation that would be suitable to the course. This requires an element of openness. The students are to be informed in advance about the nature of assessment and the procedures. However, the tests are compulsory. Test-I may be for one hour duration. The pattern of question paper will be decided by the respective Faculty. Sessional Test-I will carry 12.5% of marks of the entire course.

Sessional Test - II will be conducted with a variety of assessment tools. It will also have an element of openness. The student are to be informed in advance about nature of assessment and the procedures. However the tests are compulsory. Test II may be for two hours duration. The pattern of question paper will be decided by the respective Faculty. Sessional Test - II will carry 12.5% of marks of the entire course.

There will be one End Semester Examination of 3 hours duration in each course.

The end semester Examination will cover all the syllabus of the course for 75% of marks.

Evaluation

Evaluation will be done by a continuous basis. Evaluation may be Objective Type Questions, Quiz, Short Answers, Essays or a combination of these, but at the End Semester it has to be a Written Examination.

The performance of students in each course is evaluated in terms of percentage of marks (PM) with a provision for conversion of Grade point (GP). The sum total performance in each semester will be rated by GPA while the continuous performance from the 2nd Semester onwards will be marked by OGPA.

Marks and Grading

A student cannot repeat the assessment of Sessional Test - I and Sessional Test - II. However, if for any compulsive reason the student could not attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department.

A minimum of 50% marks in each course is prescribed for a pass. A student has to secure 50% minimum in the End Semester Examinations.

If a candidate who has not secured a minimum of 50% of marks in a course shall be deemed to have failed in that course.

The student can repeat the End Semester Examination when it is offered next in the subsequent Odd/Even Semesters till the regulations are in force. However, a candidate cannot move to the next odd/even semester if he/she has more than six papers as arrears at any point of time.

A candidate who has secured a minimum of 50% marks in all courses prescribed in the programme and earned a minimum of the credits will be considered to have passed the Master's Programme.

Grading

A ten point rating is used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Master's Programme.

Marks	Grade point	Letter grade	Class
90+	10	S	Exemplary
85-89	9.0	D++	Distinction
80-84	8.5	D+	Distinction
75-79	8.0	D	Distinction
70-74	7.5	A++	First Class
65-69	7.0	A+	First Class
60-64	6.5	A	First Class
55-59	6.0	B	Second Class
50-54	5.5	C	Second Class
49 or Less		F	Fail

The Successful candidates in the Core Subjects are classified as follows.

I-Class 60% marks and above in over all percentage of marks (OPM)

II-Class 50-59% marks in over all percentage of marks.

Candidates who obtain 75% and above but below 90% of marks (OPM) shall be deemed to have passed the examination in First Class (Distinction) provided he/she passes all the courses prescribed for the programme at the first appearance.

Candidates who obtain 90% and above (OPM) shall be deemed to have passed the examination in First Class (Exemplary) provided he/she passes all the courses prescribed for the programme at the first appearance.

Candidates who obtain highest marks in all examinations at the first appearance alone considered for ranking.

For the Internal Assessment Evaluation the break up marks shall be as follows:

Test (7.5+7.5)   : 15 Marks
Assignment   : 05 Marks
Case study/Seminar/Short Answers etc.   : 05 Marks
Total   : 25 Marks

Course-Wise Letter Grades

The percentage of marks obtained by a candidate in a course will be indicated in a letter grade.

A Student is considered to have completed a course successfully and earned the credits if he/she secures over all grades other than F. A letter grade F in any course implies a failure in that course. A course successfully completed cannot be repeated for the purpose of improving the Grade Point.

The F Grade once awarded stays in the grade card of the student and is not deleted even when he/she completes the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the Odd/Even semester in which the candidate has appeared for clearance of the arrears.

If a student secures F grade in the Project Work/ Field Work/ Practical Work/ Dissertation, either he/she shall improve it and resubmit it if it involves only rewriting incorporating the clarification of the evaluators or he/she can re-register and carry out the same in the subsequent semesters for evaluation.

Transitory Regulations

Wherever there had been change of syllabi, examinations based on the existing syllabus will be conducted for three consecutive times after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the recommendations of the Head of the Department concerned.

APPENDIX-A

M. Sc. (Mathematics)	:	A Pass in H.Sc. (10+2 level) and Equivalent thereto with a minimum of 50% aggregate under academic stream with the following subject's viz. Mathematics, Physics & Chemistry.

SCHEME FOR TEN SEMESTERS
Total Credits: upto Six semesters 135; For all the Ten semesters 225

Code	Title of the paper	Hours	Credit	Internal Marks	External Marks	Total
FIRST SEMESTER						
ITAC 11	Language I (Paper - I)	3	3	25	75	100
IENC 12	Language II (Paper – I)	3	3	25	75	100
ICEC 13	Civics	3	3	25	75	100
APHT 01	Ancillary-I – Physics	4	4	25	75	100
IMAT 15	Classical Algebra and Matrices	5	5	25	75	100
	Total	18	18			
SECOND SEMESTER						
ITAC 21	Language I (Paper – II)	3	3	25	75	100
IENC 22	Language II (Paper – II)	3	3	25	75	100
ICEC 23	Computer Applications – I	3	3	25	75	100
ACHT 02	Ancillary-II – Chemistry	4	4	25	75	100
IMAT 25	Trigonometry	5	5	25	75	100
IMAT 26	Vector Analysis and Fourier Series	5	5	25	75	100
	Total	23	23			
THIRD SEMESTER						
ITAC 31	Language I (Paper – III)	3	3	25	75	100
IENC 32	Language II (Paper – III)	3	3	25	75	100
ICEC 33	Computer Applications – II	3	3	25	75	100
AEST 03	Ancillary- III – Environmental Science	4	4	25	75	100
IMAT 35	Analytical Geometry	5	5	25	75	100
	Total	18	18			
FOURTH SEMESTER						
ITAC 41	Language I (Paper – IV)	3	3	25	75	100
IENC 42	Language II (Paper – IV)	3	3	25	75	100
ACOT 04	Ancillary- IV – Principles of Accounting	4	4	25	75	100
IMAT 44	Statics	5	5	25	75	100
IMAT 45	Mathematics for Competitive Examinations	5	5	25	75	100
IMAT 46	Calculus	5	5	25	75	100
	Total	25	25			
FIFTH SEMESTER						
IMAT 51	Real Analysis – I	5	5	25	75	100
IMAT 52	Differential Equations and Applications	5	5	25	75	100
IMAT 53	Dynamics	5	5	25	75	100
IMAT 54	Programming Language C	5	5	25	75	100
IMAT 55	Numerical Methods	5	5	25	75	100
	Total	25	25			
SIXTH SEMESTER						
IMAT 61	Real Analysis – II	5	5	25	75	100
IMAT 62	Complex Analysis	5	5	25	75	100
IMAT 63	Basic Algebra	5	5	25	75	100
IMAT 64	Discrete Mathematics	5	5	25	75	100
IMAT 65	Optimization Techniques and Tutorial	6	6	25	75	100
	Total	26	26			

	SEVENTH SEMESTER					
IMAT 71	Abstract Algebra	5	5	25	75	100
IMAT 72	Advanced Real Analysis	5	5	25	75	100
IMAT 73	Advanced Differential Equations	5	5	25	75	100
IMAT 74	Programming Language C++	4	4	25	75	100
IPHO 75	Optional 1 - Classical Mechanics and Special Theory of Relativity	4	4	25	75	100
	Total	23	23			
	EIGHT SEMESTER					
IMAT 81	Advanced Algebra	5	5	25	75	100
IMAT 82	Measure Theory and Integration	5	5	25	75	100
IMAT 83	Advanced Complex Analysis	5	5	25	75	100
IMAT 84	Soft Skills	5	5	25	75	100
IMAP 85	Computer Practical – I	6	2	40	60	100
OIMAT 86	Optional 2 - Mathematical Statistics	4	4	25	75	100
	Total	30	26			
	NINTH SEMESTER					
IMAT 91	Topology	5	5	25	75	100
IMAT 92	Graph Theory	5	5	25	75	100
IMAT 93	Differential Geometry	5	5	25	75	100
IMAT 94	Probability Theory	4	4	25	75	100
IMAP 95	Computer Practical – II	6	2	40	60	100
OMPY 96	Optional 3 –Comparative Religion	4	4	25	75	100
	Total	29	26			
	TENTH SEMESTER					
IMAT 101	Functional Analysis	4	4	25	75	100
IMAT 102	Stochastic Processes	4	4	25	75	100
IMAT 103	Algebraic Number Theory	4	4	25	75	100
OIMAT 104A OIMAT 104B	Optional 4 Students to choose one from the following 1. Fluid Dynamics 2. Fuzzy sets and their Applications	4	4	25	75	100
	Total	16	16			

Subject	Total Numbers of Courses	Total Credits
Language	8	24
Optional + Soft Skills	5	20
Co-curricular	2	7
Ancillary	4	16
Computer Course	2	6
Core Subjects	32	152
Total	**53**	**225**

SYLLABUS
PART – I: Language
ITAC 11 – Tamil (Option)

PART-I: Language
ITAC 11 - Hindi (Option)

PART-I: Language
ITAC 11 - French (Option)
PART-II: ENGLISH
IENC 12 - BASIC ENGLISH SKILLS

ICEC 13 CIVICS

Ancillary-I – APHT 01 Physics

Objective: This paper highlights the various topics of Physics to make the students aware of the important concepts.

Unit - I: Mechanics
 Centre of gravity – Definition - General formula for the determination of centre of gravity of a hollow hemisphere, solid hemisphere and solid cone.

 Floatation
 Laws of floatation - Stability of floating bodies - Metacentre - Determination of metacentric height of   a ship.

Unit - II: Relativity
 Introduction - Definition of Relativity - Special theory and general theory of relativity - Newtonian relativity - Frame of reference - Galilean transformation equations - Derivation-The Michelson - Morley experiment - Explanations of negative result - Lorentz transformation equations - Derivation - Length contraction -Time dilation - Addition of velocity - Variation of mass with velocity - Mass - Energy equivalence.

Unit- III: Solid State Physics
 Elements of crystallography - Different features of crystals - Symmetry operation-Symmetry elements - Space lattices - lattice constants - Miller indices - Reciprocal lattices-Crystal structures of Diamond and NaCl.

Superconductors
 Nature and occurrence - Meissner effect - Type I and Type II superconductors - superconducting magnet - Applications of superconductors.

Unit- IV: Nuclear physics
 Properties of nucleus (size, mass, binding energy, spin and parity) - Particle detectors - G.M.Counter - Wilson cloud chamber - Bubble chamber.

Nuclear models
 Liquid drop model - Shell model.

Nuclear Energy
 Nuclear fission - Fusion - Self sustained fission reaction - Nuclear fission in stars – Carbon - Nitrogen cycle - Proton - Proton cycle - Thermonuclear reaction - Nuclear reactor.

Unit- V: Digital Electronics:
 Decimal, Binary, Octal and hexadecimal number systems and their mutual conversions - Basic logic gates - OR, AND and NOT - Universal gates - NOR and NAND - Boolean algebra - Demorgan's theorem - Verification using truth table.

Text Books and References
1. Mechanics, DS.Mathur, S.Chand and Co., 2006.
2. Modern Physics, Murugasen, S.Chand and Co., 2008

3. Solid state Physics, SL.Gupta, V.Kumar; Kedarnath and Ramnath and Co.,1970.
4. Elements of Nuclear Physics, M.L.Pandya and P.R.S.Yadav Kadanath, 1993.
5. Modern Digital Electronics, RP.Jain, Tata McGraw Hill, 2006.

<h1 style="text-align:center">IMAT 15 CLASSICAL ALGEBRA AND MATRICES</h1>

Objectives: In this Course students are exposed to topics like Theory of Equations, Summation of Series, Matrices and Elementary Number Theory. The stress is on the development of problem solving skills.

Unit-I: Theory of Equations

Polynomial Equations - Symmetric Functions of roots in terms of Coefficients - Sum of   r-th powers of roots - Reciprocal Equations - Transformation of Equations.

Unit-II: Theory of Equations (Contd...)

Descartes Rule of Signs - Approximate Solutions of Polynomials by Horner's method - Newton - Raphson method of Solution of a Cubic Polynomial.

Unit-III: Summation of Series

Summation of series using Binomial - Exponential and Logarithmic series (Theorems without proofs) - Approximation using Binomial & Exponential series.

Unit-IV: Elementary Number Theory

Prime Number - Composite Number - Decomposition of a Composite Number as a Product of Primes uniquely (without proof) - Divisors of a Positive Integer - Congruence Modulo n - Euler Function (without Proof) - Highest Power of a Prime Number p contained in n! - Fermat's and Wilson's Theorems (statements only) - simple problems.

Unit-V: Matrices

Symmetric - Skew symmetric, - Hermitian - Skew Hermitian - Orthogonal and Unitary Matrices - Cayley-Hamilton Theorem (without proof) - Eigen Values - Eigen Vectors–Similar Matrices - Diagonalisation of a Matrix.

Text Book:

Content and treatment as in the book "Mathematics for B.Sc. Vol-I, II, III & IV" by P. Kandasamy, K. Thilagavathy, S.Chand & Company Ltd., New Delhi-55 (2004)

Reference Books:

1. T.K. Manicavachagom Pillay, T.Natarajan and K.S.Ganapathy. (2004) Algebra, Volume I & II, S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai.
2. S. Arumugam (2003) Algebra. New Gamma Publishing House, Palayamkottai.
3. A. Singaravelu (2003) Algebra and Trigonometry, Vol.-I & II Meenakshi Agency, Chennai.
4. S. Sudha (1998) Algebra and Trigonometry. Emerald Publishes, Chennai. B.Sc. Mathematics: Syllabus (CBCS).

<h2 style="text-align:center">PART – II: Language
ITAC 21 – Tamil (Option)</h2>

<h2 style="text-align:center">PART-I: Language
ITAC 21 - Hindi (Option)</h2>

<h2 style="text-align:center">PART-I: Language
ITAC 21 - French (Option)</h2>

<h2 style="text-align:center">PART-II: ENGLISH
IENC 22 - Technical and Communicative English</h2>

<h1 style="text-align:center">ICEC 23   COMPUTER APPLICATIONS - I</h1>

UNIT - I

Introduction to Computers, Applications of Computers, Concepts of Data and Information, A Typical Computer System-Memory Concepts, History of Computers, Types of Computers.

Input-Output Devices, Data Storage Devices, Software, The Definition, The Role of Software, Housekeeping.

UNIT - II

The Computer internals, Typical PC Configuration, Booting, Virus, Anti-Virus, Vaccine, Versions of Software.

Operating System, Definition, classification, Basics of MSDOS, Introduction to Windows Operating System,Features of Windows OS, Desktop and Desktop Icons, Starting Programs, Browsing and Managing Windows Explorer , Setting ,Taskbars and Creating Shortcuts.

UNIT - III

Introduction to Internet, Client Server Basics, e-mail, Telnet and Archie, FTP - Gopher, Jughead and Veronica, WAIS and World Wide Web. Fundamentals of HTML, TCP/IP and E-commerce.

UNIT - IV

Issues involved in Web Site Management, Addressing, Designing Web Sites with Front Page.

UNIT - V

Multimedia, Concept, Requirements, Applications and Future, Hardware and Software Requirements for Multimedia Development and Delivery Platforms, Multimedia Methodologies, Fundamentals and Use of Hypertext, Hypermedia, Sound, Images, Animation, Video.

Using Multimedia, Multimedia Interface, Planning and Development of Multimedia Projects.

REFERENCE BOOKS
1. Ron Mansfield, Obsorne, Windows 95 for Busy People, McGraw Hill.
2. Ron White, How computers work, BPB.
3. Christian Crumlish - The ABCs of the Internet.
4. Alexis Leon & Mathews Leon – "Internet in a nutshell" Leon Press, Chennai and Vikas Publishing House, New Delhi.
5. Tay Vaughan - Multimedia Making it work, Osborne, Tata McGraw Hill, 1996.
6. Computer Fundamentals and Windows with Internet Technology by Krishnan, Scitech Publications (India) Pvt. Ltd., Chennai.
7. Windows and MS - OFFICE 2000 with Database Concepts, by Krishnan,
8. Scitech Publications (India) Pvt. Ltd., Chennai.
9. Stephen Nelson - Field Guide to the Internet.
10. James Meade, Davind Growder, Rhonda Growder - Microsoft DHTML.
11. RosenBrog - A Guide to Multimedia.
12. Ned Sneel - The Internet Starter Kit in 24 hours Techmedia, 1998.
13. Michael Goodwin - Making Multimedia works, Coomdex, 1995.

Ancillary-II – ACHT 02 Chemistry

Unit–I: Basic Organic Chemistry

Classification of organic compounds - Hybridization in methane, ethane, acetylene, benzene -Classification of reagents - electrophiles, nucleophiles and free radicals - Classification of reactions - addition, substitution (nucleophilic & electrophilic) , elimination, condensation and polymerisation - Polar Effects-Inductive effect, resonance, hyper-conjugation, steric effect.

Unit–II: Chemistry of Some Useful Organic Compounds

Structure and uses of the following:

Paracetamol, Penicillin, Morphine, Camphor, Thiopental Sodium, BHC, DDT, CF_2Cl_2. Synthesis, properties and uses of, PTFE, PVC, Bakelite, Nylon 6, 6.

Unit–III: Acid-Base Equilibria

Bronsted definition, Lewis definition, K_a K_b, pK_a and pK_b for Bronsted acids and bases. Relative strengths of Bronsted acids and bases. pH Buffer solution. Henderson's equation. Theory of acid-base indicators.

Unit–IV: Coordination Chemistry

Definition of terms-classification of ligands-chelation- Nomenclature of coordination compounds. Effective Atomic Number and its application to $Ni(CO)_4$, $[Ni(CN)_4]^{2-}$, $[Co(CN)]_6^{3-}$ Role of metal ions in biological systems such as Hemoglobin, Vitamin B12.

Unit–V: Chemical Kinetics and Photochemistry

Rate of chemical reaction, Differential rate expression, order and molecularity, Integrated rate expressions for first, second, and zero order reactions, Half-life period. Effect of temperature on reaction rate - Activation energy. Arrhenius equation, Catalysis - Homogeneous and heterogeneous catalysis.

Introduction to photochemistry - Grothus - Draper Law, Stark-Einstein's Law. Quantum Yield. Fluorescence, Phosphorescence, Photsensitisation.

Text Books and References

1) Veeraiyan V., Text book of Ancillary Chemistry, Highmount Publishing house, 2006.
2) Huheey, Inorganic Chemistry, Addison Wesley, 2005.
3) Soni P.L. and Others, Textbook of Organic chemistry, Sultan Chand and Company, 2006.
4) Soni P.L. and Others, Text book of Inorganic Chemistry, Sultan Chand and Company, 2006.
5) Puri B.R., Sharma and Pathania, Text book of Physical Chemistry, Vishal Publishing Co., 2006.
6) Dara S.S., Text book of Environmental chemistry and Pollution Control, S.Chand and Co., 2006.
7) Vaithyanathan S. and Others, Textbook of Ancillary Chemistry, Priya Publications, 2006.

IMAT 25   TRIGONOMETRY

Objectives: This course is a fundamental one for many courses of this Degree Programme. This covers topics on the expansions of trigonometric functions, hyperbolic functions, inverse circular, inverse hyperbolic functions and it aims to develop computational skills.

UNIT-I

Expansions of $\cos n\theta$, $\sin n\theta$ - Expansion of $\tan n\theta$ in terms of $\tan\theta$ - Expansion of $\tan(A+B+C+\ldots)$ - Formation of Equations.

UNIT-II

Powers of sines and cosines of θ in terms of functions of multiples of θ - expansions of $\sin\theta$ and $\cos\theta$ in a series of ascending powers of θ - Approximations.

UNIT-III

Definition – Relation between Hyperbolic Functions - Inverse Hyperbolic Functions.

UNIT-IV

Resolution into Factors - simple problems only - DeMoivre's property on the Circle and Cote's Property on the Circle. Logarithm of complex quantities.

UNIT-V

Summation of Trigonometric Series: When the angles are in A.P, C+iS method of summation - Method of Differences - Gregory Series - Euler Series.

TEXT BOOK:

Content and treatment as in the book "Trigonometry" by S. Narayanan and T.K. Manicavachagom Pillay, S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai 2009.

Unit– I	Chapter III sections 1 to 3
Unit– II	Chapter III sections 4 and 5
Unit– III	Chapter IV
Unit– IV	Chapter V
Unit– V	Chapter VI sections 1 to 3

REFERENCE BOOKS

1. P.Kandasamy, K.Thilagavathy (2004), Mathematic for B.Sc. Vol.-I, II, III & IV, S.Chand & Company Ltd., New Delhi-55.
2. S.Duraipandian and Laxmi Duraipandian (1984) Trigonometry. Emerald Publishers, Chennai.
3. B.S.Grewal. (2002) Higher Engineering Mathematics. Khanna Publishers. New Delhi.

4. S.L.Loney. (1982) Plane Trigonometry, Part II, Cambridge University Press, London.
5. A.Singaravelu (2003) Algebra and Trigonometry, Vol.-I Meenakshi Agency, Chennai.
6. P.R.Vittal. (2004) Trigonometry, Margham Publications, Chennai.

IMAT 26   VECTOR ANALYSIS AND FOURIER SERIES

Objectives: This course covers the topics in vector and tensor calculus which are essential tools of modern applied mathematics. To develop deep understanding of key concepts followed by problems of applied nature. The portion on Fourier analysis will lead to post-graduate studies and research in pure as well as applied mathematics.

UNIT-I: Differential Vector Calculus
Differentiation of a Vector - Geometrical Interpretation of the Derivative - Differentiation Formulae - Differentiation of dot and Cross Products - Partial Derivatives of Vectors - Differentials of Vectors.
UNIT-II: Gradient, Divergence and Curl
Vector Differential Operator Del - Gradient of a Scalar Function - Directional Derivative - Geometric Interpretation - Gradient of the sum of Functions; of the product of functions and of a function of function - Operations involving Del - Divergence of a Vector and its Physical Interpretation - Curl of a Vector and its Physical Interpretation - Expansion Formulae for Operators involving Del - Solenoidal and Irrotational.
UNIT-III: Vector Integration
The Line Integral - Surface Integral and its Physical Meaning - Surface Integral and the Concept of Divergence of a Vector - Equivalence of two Definitions of Divergence - Statements of Gauss Divergence Theorem and Green's Theorem (only) and Problems - Line Integral - The Concept of the Curl of a Vector - Statement of Stoke's Theorem (only) and Problems.
UNIT-IV: Fourier Series
Euler's Formulae - Conditions for Fourier Expansion - Functions having Discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even periodic Functions - Half-range Series.
UNIT-V: Fourier Transform
Definition - Fourier Integrals - Fourier Since and Cosine Integral - Complex Form of Fourier Integral - Fourier Transform: Fourier Since and Cosine Transforms - Finite Fourier Sine and Cosine Transforms (without proof) - Properties of Fourier Transforms - Convolution Theorem for Fourier Transforms - Parseval's Identity for Fourier Transforms - (without derivation)
TEXT BOOK:
Content and treatment as in the book "Higher Engineering Mathematics" by B.S. Grewal, Khanna Publishers, New Delhi 2002
REFERENCE BOOKS:
1. G.B.Thomas and R.L.Finney. (1998) Calculus and Analytic Geometry, Addison Wesley (9 th Edn), Mass. (Indian Print).
2. M.K.Venkataraman. (1992) Engineering Mathematics-Part B. National Publishing Company, Chennai.
3. P.R.Vittal. (2004) Vector Calculus, Fourier series and Fourier Transform. Margham Publications, Chennai.
4. K. Vairamanickam, Nirmala P. Ratchagar and S. Tamilselvan. (2011) Engineering Mathematics – II, Scitech Publications (India) Pvt. Ltd., Chennai.
5. K. Vairamanickam, Nirmala P. Ratchagar and S. Tamilselvan. (2012) Transforms and Partial Differential Equations, Scitech Publications (India) Pvt. Ltd., Chennai.

ITAC 31   Language – I (Paper – III)

IENC 32 Language – II (Paper – III)

ICEC 33   COMPUTER APPLICATIONS – II

Objectives: The aim is to train the students in Microsoft office 2000 and its intricacies.
UNIT-I
Introduction to Microsoft Office, Create and Modify Documents, Format the Text, Tables within the Documents, Merge the Documents and Print, Working with World Wide Web.
 UNIT-II
Create and Modify Spreadsheets, Format the cells, Different 2D and 3D Charts, Creation and Modification, Budget preparation, functions, printing of Spreadsheets and Charts.
UNIT-III
Concept of data types, field, record, table and Data Base, creation, modification, manipulation, backup and recovery, significance and need of Queries.
UNIT-IV
Importance of the Primary Key, Foreign Keys and Lookup Lists, Significance of Data Validation, Input Mask, Sorting and Indexing, Use Table Relationships and Forms, Application, Reports, creation and printing.
UNIT-V
Create and Modify Presentations, Create Master slide and templates, Different Views of Slide, Add animation and Transitions.
REFERENCE BOOKS
(1) Joe Habraken, "Microsoft Office 2000", PHI, 1998.
(2) "Microsoft Office 2000 Complete", Sybex, 1999.
(3) M.C. Sharma, Desktop Publishing on PC, BPB Publications, 1997.
(4) Krishnan, "Windows and MS-OFFICE 2000 with Database Concepts",
   Scitech Publications (India) Pvt. Ltd., Chennai.
(5) Ron Mansfield, "Working in Microsoft Office", Tata McGraw Hill.

Ancillary-III – AEST 03 Environmental Science

Objectives: The aim of this paper is to introduce the concepts of environmental hazards including polution and their impact. The legistlations available for safeguarding the common people from such hazards are also taught.
UNIT-I
Principles of environmental geology-ecological perspective- problems of environment-global and Indian perspective. Environmental degradation. Components of environment-atmosphere, hydrosphere, lithosphere and biosphere-their interaction and related problems. Global warming and Climate change.
UNIT-II
Introduction to Natural Hazards: Earthquakes and related phenomena, Tsunami, Volcanic Activity, Rivers and Flooding, Slope Processes, Landslides, and Subsidence, Coastal Processes.
UNIT-III
Environmental Pollution - definition, causes and concepts, sources of pollution-nature of pollutants-pollution monitoring and pollution reduction – air pollution, water pollution, soil/land pollution, marine pollution, thermal pollution, nuclear hazards.
UNIT – IV
Methods of mining- Impact of mining, Impact identification of mining operation, waste minimization and utilization. Environmental management of mines, Wasteland reclamation.
UNIT – V
Environmental legislations: laws related to water, air, forest conservation and other acts. Introduction- Hazard and Disaster: Definition and terminologies - Classification. Concept of Disaster Management- Comprehensive Disaster Management Plan. Elements of Disaster. Environmental Impact Assessment, Environmental Education, Environmental Ethics. Solid waste management: causes, effect and control, urban & industrial waste.
Reference Books:
1. Strahler.A.N and Strahler.A.N, A.H.,1973,   Environmental Geosciences,   Wiley International Edition,

2. Ignacimuthu.S, 1998, Environmental Awareness and Protection, Phoenix Publishing House Pvt. Ltd., New Delhi

3. Valdiya, K.S., 1987, Environmental Geology, Indian context, Tata Mc Graw Hill. Bombay.

4. Keller.E.A, 1978, Environmental Geology, A. Charles E.Merrill Pub. Co., A. Bell & Howell Co., London, 4th Ed.

5. Upendra Kumar Sinha, 1986, Ganga-Pollution & Health Hazard Inter-India publication, New Delhi.

6. Lawrence Lundgren, 1986, Environmental Geology, Prentice-Hall.

IMAT 35 ANALYTICAL GEOMETRY

Objectives: Students are exposed to fundamental aspects of Two and Three Dimensional Analytical Geometry and it develops logical and systematic computational skills.

UNIT-I: Two Dimensional Analytical Geometry: Conics

Chord in terms of middle points - Pole, Polar.

UNIT-II: Two Dimensional Analytical Geometry (Contd) Conics

Conjugate Hyperbola, Conjugate Diameter for Ellipse and Hyperbola

UNIT-III: Three Dimensional Analytical Geometry

Planes and Straight lines

UNIT-IV: Three Dimensional Analytical Geometry: Sphere

Section of a Sphere by a Plane- Tangent Plane, Orthogonal Spheres.

UNIT-V: Three Dimensional Analytical Geometry: Cone and Cylinder

Equation of a Cone - Cone whose vertex is at the origin - Quadric Cone with the vertex at the origin - Right Circular Cone - Cylinder- Right Circular Cylinder- Equation of a Cylinder.

TEXT BOOK:

Content and treatment as in the book "Analytical Geometry" by T.K. Manickavachagom Pillay & others, (Two & Three Dimensions) S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai 2004.

REFERENCE BOOKS

1. P.Duraipandian and Laxmi Duraipandian (1965) Analytical Geometry-2D, Asia Publishing company, Bombay

2. P.Duraipandian and Laxmi Duriapandian (1975) Analytical Geometry-3 D, Emerald Publishers, Chennai.

3. G.B.Thomas and R.L.Finney.(1998) Calculus and Analytic Geometry, Addison Wesley (9th Edn.), Mass. (Indian Print).

4. P.R.Vittal (2003) Coordinate Geometry. Margham Publishers, Chennai

ITAC 41 Language I (Paper – IV)

IENC 42   Language II (Paper – IV)

Ancillary-IV – ACOT 04 PRINCIPLES OF ACCOUNTING

Objectives: To train the students to grasp the basic principles and practice of accounting and solve problems relating to these.

UNIT-I Book Keeping:

Meaning, Accounting cycle, Journal- rules of debit and credit, Ledger, Trial balance, Account current, Average due date, Bank reconciliation statement.

UNIT-II Final Accounts:

Preparation of trading account, Profit and loss account, Balance sheet, Adjustments.

UNIT-III Depreciation:

Depreciation provisions and reserves, Concept, Depreciation accounting, Methods of recording depreciation, Methods of providing depreciation.

UNIT-IV Accounting of Non-Trading Institutions:
Introduction, Receipts and payment accounts, Salient features-Income and expenditure accounts, Salient features-Preparation of final accounts of Non-trading concerns.
UNIT-V Special Accounting Areas:
Final accounts of partnership firms.
Final accounts of joint stock companies, as per requirements of Companies Act.
TEXT BOOKS
Content and treatment as in the books.
1. Guptha, R.L and Radhaswamy, M, Financial Accounting, Sultan Chand & Sons, New Delhi, 2003.
2. Iyer S.P., Advanced Accounting, Sultan Chand & Sons, New Delhi, 2003.
3. Shukla M.C., Grewal T.S., Guptha S.C., Advanced Accounts, S. Chand & Co., New Delhi, 2004.
4. Jain S.P. and Narang K.L., Advanced Accountancy, Kalyani Pub., New Delhi, 2004.
REFERENCE BOOKS
1. Mukerjee & Haneef, Modern Accounting, Tata Mc Graw Hill, Pub., New Delhi, 2000.

IMAT44   STATICS

Objectives: This course aims to provide basic skills and problem solving techniques in forces acting at a point, coplanar forces, moment of a set of concurrent forces, couples, reduction of coplanar system of forces, friction and equilibrium of strings and chains.
UNIT-I
Forces acting at a point, Resultant and components, Parallelogram of forces, Analytical expression for the resultant of two forces acting at a point, Triangle of forces, The polygon of forces, Lami's theorem, An extended form of the Parallelogram law of forces, Resolution of a force, Components of a force, Resultant of any number of forces acting at a point, Conditions of equilibrium of any number of forces acting upon a particle.
UNIT-II
Parallel forces and Moments, The resultant of two like and unlike parallel forces acting on a rigid body, Resultant of a number of parallel forces acting on a rigid body, Conditions of equilibrium of three coplanar parallel forces, Centre of two parallel forces, Moment of a force, Varignon's theorem of moments, Generalized theorem of moments.
Couples, Definition, Equilibrium of two couples, Equivalence of two couples, Couples in parallel planes, Representation of a couple by a vector, Resultant of a coplanar couples, Resultant of a couple and a force.
UNIT-III
Equilibrium of three forces acting on a rigid body, Rigid body subjected to any three forces, Three coplanar forces, Conditions of equilibrium, Procedure to be followed in solving any statical problem, Two trigonometrical theorems, Some artifices, Problems on parallel forces.
UNIT-IV
Coplanar forces, Reduction of coplanar forces in general, Reduction of any number of coplanar forces, Conditions and alternative conditions for a system of forces to reduce to a single force or to a couple, Change of the base-point, Equation to the line of action of the resultant, Equation to the line of action of the resultant, General conditions of equilibrium.

UNIT-V
Friction, Statical, Dynamical and Limiting frictions, Laws of friction, Coefficient of friction, Angle of friction, Cone of friction, Numerical values, Equilibrium of a particle on a rough inclined plane, Equilibrium of a body on a rough inclined plane.
TEXT BOOK
Content and treatment as in the book "A Text Book of STATICS" by M.K. Venkataraman, Agasthiar Book Depot, Trichy (1986).

Unit I   -   Chapters 2 all sections.
Unit II   -   Chapter 3 Sections 1to13 and Chapter 4 all sections.
Unit III -   Chapter 5 Sections 1 to 7.
Unit IV -   Chapter 6 Sections 1 to 13.
Unit V   -   Chapter 7 Sections 1 to 13.

REFERENCE BOOKS

1. Text book on STATICS by R.S. Varma, Pothishala Pvt. Ltd., Allahabad.
2. STATICS by A.V. Dharmapadam, S. Viswanathan
   (Printers and Publishers) Private Ltd., (1973).

IMAT 45   MATHEMATICS FOR COMPETITIVE EXAMINATIONS

Objectives: To introduce concepts of mathematics with emphasis on analytical ability and computational skill needed in competitive examinations.

UNIT-I: Problems on General Arithmetic

Problems of ages – Ratio and proportions -Inverse ratio-properties (Addendo, subtrahendo, componendo & dividendo) -ratio of four numbers -increasing and decreasing order of fractions.

UNIT-II

Percentages - Gain and loss percents - Partnership problems.

UNIT-III: Time, Distance and Work

Time and work – Time and distance.

UNIT-IV: Commercial Arithmetic:

Simple interest - Compound interest – Stocks and Shares.

UNIT -V: Data Interpretation

Tabulation – Bar graphs and Pie charts – Line Graphs.

TEXT BOOK:

Content and treatment as in the book "Quantitative Aptitude" by R.S. Agarwal (S. Chand & Co New Delhi 2008).

Unit – I Sections 1.8 and 1.12
Unit – II   Sections 1.10, 1.11 and 1.13
Unit – III   Sections 1.15 and 1.17
Unit – IV   Sections 1.21, 1.22 and 1.29
Unit – V   Sections 2.36 to 2.38

REFERENCE BOOKS

1. Quantitative Aptitude -R.S. Aggarwal (S.Chand & Co - New Delhi 2008)
2. Quantitative Aptitude for Competitive Examinations - Abhigit Guha (Tata McGraw -Hill Pub., Co., Ltd. New Delhi -III Edn.,)
3. Course in Mental Abilities and Quantitative Aptitude for Competitive Examinations - Edgar Thorpe (Tata McGraw Hill Pub., Co., Ltd. New Delhi II Edn.)
4. Statistic, RSN Pillai and A. Bagavathi, S.Chand & Co.,
5. Elements of statistics, Sivadanu Pillai.
6. Algebra, Manickavachakam Pillai & Narayana

IMAT 46 CALCULUS

Objectives: This course develops problem solving skills in differential calculus, applications of differential calculus and integral calculus.

Unit-I

The nth derivative, Leibnitz theorem and its applications, Total differential, $\dfrac{d^2 y}{dx^2}$ and $\dfrac{dy}{dx}$ in terms of partial derivatives of f when f(x,y)=0, Jacobians.

Unit-II

Maxima and minima of functions of two and three independent variables, Necessary and sufficient conditions, Lagrange's method, Problems on maxima and minima (second order conditions must be verified for maxima and minima).

Unit-III

Curvature: Radius of curvature, Centre of curvature in cartesian co-ordinates, Angle between radius vector and tangent, Angle of intersection of two curves, Pedal equation of a curve, Simple problems.

Unit-IV

Integration of irrational functions and Trigonometric functions, Bernoulli formula, Integration by parts; Reduction formulae, Properties of definite integral.

Unit-V

Double integral, Change of order of integration, Application to area, Triple integral and Application to volume of simple solids.

Text Book

Content and treatment as in relevant sections of the book "Calculus", by S.Narayanan and T.K.Manicavachagom Pillay, S. Viswanathan publishers, 1995.

Reference Books

1. Engineering Mathematics, M.K.Venkataraman, The National Publishing Company, Madras.
2. Engineering Mathematics, P. Kandasamy, K. Thilagavathy and K. Gunavathy, S. Chand and Company, 2006.

IMAT 51 REAL ANALYSIS – I

Objectives: To understand various limiting behavior of sequences and series to explore the various limiting processes viz.continuity, uniform continuity, differentiability and integrability and to enhance the mathematical maturity and to work comfortably with concepts.

UNIT-I: Functions & Sequences

Functions – real valued functions – equivalence – countability and real numbers – least upper bound – definition of sequence and subsequence – limit of a sequence – convergent sequence.

UNIT-II: Sequences [Contd...]

Divergent sequences – Bounded sequences – Monotone sequence – Operations on convergent sequences – Operations on divergent sequences – Limit superior and Limit inferior – Cauchy sequences

UNIT-III: Series of Real Numbers

Convergence and Divergence – Series with non negative terms – Alternating series – conditional convergence and Absolute convergence – Test for Absolute convergence.

UNIT-IV: Series of Real Numbers [Contd...]

Test for Absolute convergence – The class $\ell 2$ – Limit of a function on the real line – Metric spaces – Limits in Metric spaces.

UNIT-V: Continuous Functions on Metric Spaces

Functions Continuous at a point on the real line – Reformulation – Functions Continuous on a Metric Spaces – Open Sets – Closed Sets.

TEXT BOOK:

Content and treatment as in the book "Methods of Real Analysis" by R. Goldberg, Oxford & IBH Publishing Co., New Delhi 2000.

       Unit – I   Chapter 1 Sections 1.4 to 1.7, 2.1 to 2.3
       Unit – II   Chapter 2 Sections 2.4 to 2.10
       Unit – III   Chapter 3 Sections 3.1 to 3.4 and 3.6

Unit – IV   Chapter 3 Sections 3.7, 3.10, 4.1 to 4.3
Unit – V   Chapter 5 Sections 5.1 to 5.5

REFERENCE BOOKS:
1. Tom M.Apostol [1974] Mathematical Analysis, 2nd Edition, Addison-Wesley New York.
2. Bartle, R.G. and Shebert [1976] Real Analysis, John Wiley and Sons Inc., New York.
3. Malik, S.C. and Savita Arora [1991] Mathematical Analysis, Wiley Eastern limited, New Delhi.
4. Sanjay Arora and Bansi Lal [1991], Introduction to Real Analysis, Satya Prakashan, New Delhi.

IMAT 52 DIFFERENTIAL EQUATIONS AND APPLICATIONS

Objectives: This course aims to provide logical skills in the formation of differential equations, to expose to different techniques of finding solutions to these equations and in addition stress is laid on the application of these equations in geometrical and physical problems. It also aims to provide logical skills in the formation and solutions techniques of partial differential equations.

UNIT-I: Ordinary Differential Equations

Bernoulli Equation – Exact Differential Equations – Equations Reducible to Exact Equations – Equations of First order and Higher degree: Equations solvable for p, Equation solvable for x and Equations Solvable for y – Clairaut's Equation.

UNIT-II: Ordinary Differential Equations [Contd...]

Method of Variation of Parameters – 2nd order Differential Equations with Constant Coefficients for finding the P.I's of the form e^{ax} V, where V is sin(mx) or cos(mx) and x^n – Equations reducible to Linear equations with constant coefficients – Cauchy's homogeneous Linear Equations – Legendre's Linear Equations – Linear Dependence of Solutions – Simultaneous Equations with Constant Coefficients.

Unit-III Laplace Transform:

Laplace Transform, Inverse Laplace transform, Application to the first and second order linear differential equations and Simultaneous linear differential equations, Simple problems.

Unit-IV Partial Differential Equations:

Partial differential equations: Formation of P.D.E. by eliminating arbitrary constants and arbitrary functions, Complete, Singular and General integral. Solution of equations of standard types: $f(p,q)=0$, $f(x,p,q)=0$, $f(y,p,q)=0$, $f(z,p,q)=0$, $f(x,p)=f(y,q)$, and Clairaut's form. Lagrange's equation $Pp+Qq=R$, Simple problems.

Unit-V Series Solution

Series solutions of first order equations, Second order linear equations, Ordinary points, Regular Singular Points and Legendre polynomials, Properties of Legendre polynomials and Bessel functions and their differential equations.

TEXT BOOKS:

Content and treatment as in the following books:
 1. "Differential Equations, Fourier and Laplace Transforms", by P.R. Vittal, Margham publications, Second Edition, 1999.

Unit I	-	Chapter 2
Unit II	-	Chapter 3.
Unit III	-	Chapter 7.
Unit IV	-	Chapter 5.

2. "Differential equations with applications and historical notes" by George F. Simmons, Tata McGraw Hill Pub. Co., New Delhi, Second Edition, 2003.

Unit V	-	Chapter 5 Sections 26 – 29
		Chapter 8 Sections 44, 45 and 46 (except Gamma function)

REFERENCE BOOKS
(1) Ordinary and partial Differential equations by M.D. Raisinghania and R.S. Aggarwal, Sultan Chand and Company Ltd., 1983.
(2) Ordinary and Partial Differntial Equations by M.D. Raisinghania, S. Chand, 2006

(3) B.S.Grewal [2002] Higher Engineering Mathematics, Khanna Publishers, New Delhi.

IMAT 53   DYNAMICS

Objectives: This course aims to provide basic skills and problem solving techniques in kinematics of point and Newton's laws of motion. Projectiles and simple harmonic motions are studied in detail. Problems in moment of inertia are also considered. The course enhances the problem solving skill of the student.

UNIT-I

Kinematics, Speed, Displacement, Velocity, Composition of velocities; Parallelogram law , Resolution of Velocities , Components of a velocity along two given directions , Triangle of velocities, Theorem, Polygon of velocities,Theorem , Resultant of several simultaneous coplanar velocities of a particle, Relative velocity, Angular velocity, Angular velocity of a particle, Relative angular velocity, Change of velocity, Acceleration, Variable acceleration, Parallelogram law of accelerations, Relative acceleration , Motion in a straight line under uniform acceleration, Motion in a straight line with variable acceleration, Space-times graph, Velocity-time curve, Velocity-space graph , To derive graphically the equations of motion of a particle under constant acceleration, Acceleration of falling bodies, Vertical motion under gravity, Bodies freely falling downward, Motion of a particle down a smooth inclined plane, Theorem, Lines of quickest descent, Theorem.

UNIT-II

The laws of motion: Momentum, Newton's laws of motion, Composition of forces: Conservation of linear momentum, Force of friction, Presssure of a body resting on a moving horizontal plane, Motion of connected particles, Tension in the inextensible string, Atwood's machine, Work, Tension in an elastic string, Work done in stretching an elastic string, Power, Energy, Kinetic Energy, The Principle of work-Energy, Potential Energy, The principle of conservation of energy, Verification of the principle of energy in the case of a freely falling body, Velocity and acceleration of the centre of interia of a system of particles.

UNIT-III

Projectiles: Two fundamental principles, Path of a projectile, Characteristics of the motion of a projectile, The horizontal range, The velocity at time t, Range on an inclined plane.

UNIT-IV

Simple harmonic motion: Simple harmonic motion in a straight line, General solution of the S.H.M. equation, Geometrical representation of a simple harmonic motion, Change of origin, Composition of two simple harmonic motions of the same period and in the same straight line, Composition of two simple harmonic motions of the same period in two perpendicular directions, Force necessary to produce simple harmonic motion, Motion of a particle suspended by a spiral spring, Horizontal oscillations of a particle tied to an elastic spring.

UNIT-V

Moment of Inertia: The definition of parallel axes, The theorem of perpendicular axes, Moments of inertia in some particular cases, Dr. Routh's rule, Equimomential systems.

TEXT BOOK

Content and treatment as in the book "Dynamics" by M.K. Venkataraman, Agasthiar Book Depot, Trichy (1985).

Unit I	-	Chapter 3 all sections
Unit II	-	Chapter 4 all sections
Unit III	-	Chapter 6 sections 1 to 15
Unit IV	-	Chapter 10 sections 1 to 10
Unit V	-	Chapter 12 all sections

REFERENCE BOOKS
1. Mechanics by P. Duraipandian and Laxmi Duraipandian (1979),
   S. Chand and Co., New Delhi.
2. Dynamics by A.V. Dharmapadam, S. Viswanathan (Printers and

Publishers) Pvt. Ltd., 1996.

IMAT 54 PROGRAMMING LANGUAGE C

Objectives: The high level language C is introduced. The variables, constants and their types, Algebraic operations available in the language C are studied. Syntax for IF, IF-ELSE and other decision making statement are given. The switch statement which is an important decision making statement is discussed. Arrays and user-defined functions, available in other languages, are introduced. Pointer which is a special tool in the language C is explained.

UNIT-I

Overview of C:
Basic structure of C programs, Programming style.

Constants, Variables and Data Types:
Character set, C tokens, Keywords and identifiers, Constants, Variables, Data types, Declaration of variables, Assigning values to variables, Defining symbolic constants.

Operators and Expressions:
Arithmetic of Operators, Relational operators, Logical operators, Assignment operators, Increment and decrement operators, Conditional operator, Bitwise operators, Special operators, Arithmetic expressions, Evaluation of expressions, Precedence of arithmetic operators, Some computational problems, Type conversions in expressions, Operator precedence and associativity, Mathematical functions.

Managing Input and Output Operators:
Reading a character, Writing a character, Formatted input, Formatted output.

UNIT-II

Decision Making and Branching:
Decision making with IF statement, Simple IF statement, The IF-ELSE statement, Nesting of IF...ELSE statements, The ELSE IF ladder, The switch statement, The ?: Operator, The GOTO statement.

Decision Making and Looping:
The WHILE statement, The DO statement, The FOR statement, Jumps in loops.

UNIT-III

Arrays:
One-dimensional arrays, Two-dimensional arrays, Initializing two-dimensional arrays, Multidimensional arrays.

User-Defined Functions:
Need for user-defined functions, A multi-function program, The form of C functions, Return values and their types, Calling a function, Category of functions, No arguments and no return values, Arguments but no return values, Arguments with return values, Handling of non-integer functions, Nesting of functions, Recursion, Functions with arrays, The scope and lifetime of variables in functions, Ansi C functions, Points to remember.

UNIT-IV

 Structures and Unions:
Structure definition, Giving values to members, Structure initialization, Comparison of structure variables, Arrays of Structures, Arrays within structures, Structures within structures, Structures and functions, Unions, Size of structures, Bit fields.

Pointers:
Understanding pointers, Accessing the address of a variable, Declaring and initializing pointers, Accessing a variable through its pointer, Pointer expressions, Pointer increments and scale factor, Pointers and arrays, Pointers and character strings, Pointers and functions, Pointers and structures, Points on pointers.

UNIT-V

Dynamic Memory Allocation and Linked Lists:
Dynamic memory allocation, Concepts of linked lists, Advantages of linked lists, Types of linked lists, Pointers revisited, Basic list operations, Application of linked lists.

The Preprocessor:
    Macro substitution, File inclusion, Compiler control directives, ANSI additions.
TEXT BOOK
    Content and treatment as in the book "Programming in ANSI C" by   E.
Balagurusamy, Tata McGraw Hill Pub. Co., Second Edition, 1989.
    Unit I   -   Chapters 1 to 4.
    Unit II   -   Chapters 5 and 6.
    Unit III -   Chapters 7 and 9.
    Unit IV -   Chapters 10 and 11.
    Unit V   -   Chapters 13 and 14.
REFERENCE BOOK
    "The Sprit of C An introduction to Modern Programming", by H. Mullish and L. Cooper,
JAICO Pub., Mumbai, 1997.

IMAT 55 NUMERICAL METHODS

Objectives: The roll of numerical analysis is to develop and analyze the numerical techniques. In this paper, different methods for finding the roots of algebraic and transcendental equations, solutions of simultaneous equations, solutions of differential equations are concentrated. Numerical solutions of partial differential equations such as Elliptic, Poisson and Laplace equations are discussed. Numerical differentiation and integration are also evaluated.
UNIT-I: Finite Differences and Difference Equations:
    Finite difference operator: E-Solution of first and second order linear difference equations with constant coefficients, Non-homogeneous linear difference equations with constant coefficients.
UNIT-II: Interpolation, Numerical Differentiation and Integration:
    Interpolation, Gregory - Newton forward and backward interpolation formula, Newton's divided difference formula, Lagrange's interpolation formula for unequal intervals, Guass interpolation formula, Numerical differentiation, Numerical Integration, Trapezoidal rule.
UNIT-III: Numerical solution of algebraic and transcendental equations:
    Numerical solution of algebraic and transcendental equations, Balzano's bisection method, Successive approximation method, Regula falsi method, Newton Raphson method, Baires method. Numerical solution of simultaneous linear algebraic equations, Gauss elimination method, Gauss-Jordan elimination method, Gauss - Seidel iteration method, Crout's method.
UNIT-IV: Numerical solution of ordinary differential equation:
    Numerical solution of ordinary differential equations of first and second order simultaneous equations, Taylor series method, Euler's method, Improved Euler's method, Modified Euler's method, Runge-Kutta Method of second and fourth order, Milne's Predictor - corrector method – Picard's method.
UNIT-V: Numerical solution of partial differential equation:
    Numerical solution of partial differential equations, Elliptic equation, Poisson's equation, Laplace equation, Lieberman's iterative method, Relaxation Method, Hyperbolic equations.
TEXT BOOK
    Content and treatment as in the book "Numerical methods in Science and Engineering"
by M.K. Venkataraman, National Publishing Co., Chennai, 2001.
    Unit I   -   Chapter V and X.
    Unit II   -   Chapters VI and IX.
    Unit III   -   Chapters III and IV.
    Unit IV   -   Chapter XI.
    Unit V   -   Chapter XII.
REFERENCE BOOKS
    (1) Introductory Methods of Numerical Analysis by S.S. Sastry,
        3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 1998.
    (2) Numerical Methods for Scientists and Engineers by K.Sankara Rao,
        Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2001.

IMAT 61 REAL ANALYSIS – II

Objectives: To understand Integration process of Riemann to develop the understanding of point wise and uniform convergence of sequence and series of functions. To enhance the mathematical maturity and to work comfortably with concepts.

UNIT-I: Connectedness, Completeness

Open Sets – Connected Sets – Bounded Sets and Totally Bounded Sets – Complete Metric Spaces.

UNIT-II: Compactness

Compact Metric Space – Continuous Functions on Compact Metric Spaces - Continuity of Inverse Functions – Uniform Continuity.

UNIT-III: Riemann Integration

Sets of measure zero - Definition Riemann Integral – Properties of Riemann Integral – Derivatives.

UNIT-IV: Riemann Integration [Contd...]

Rolle's Theorem – The law of mean – Fundamental theorems of calculus – Taylor's theorem.

UNIT-V: Sequences and Series of Functions

Pointwise convergence of sequences of functions – Uniform convergence of sequences of functions – consequences of uniform convergence – Convergence and uniform convergence of series of functions.

TEXT BOOK:

Content and treatment as in the book "Methods of Real Analysis" by R.Goldberg, Oxford & IBH Publishing Co., New Delhi.

   Unit – I   Ch. 6.1 to 6.4
   Unit – II   Ch. 6.5 to 6.8
   Unit – III   Ch. 7.1, 7.2 7.4, 7.5
   Unit – IV   Ch. 7.6 to 7.8 and 8.5
   Unit – V   Ch. 9.1 to 9.4

REFERENCE BOOKS:

1. Tom M.Apostol (1974) Mathematical Analysis, 2nd Edition, Addison-Wesley Publishing Company Inc. New York.
2. Bartle, R.G. and Shebert (1976) Real Analysis, John Wiley and Sons Inc., New York,
3. Malik, S.C. and Savita Arora (1991) Mathematical Analysis, Wiley Eastern Limited, New Delhi.
4. Sanjay Arora and Bansi Lal (1991) Introduction to Real Analysis, Satya Prakashan, New Delhi.

IMAT 62 COMPLEX ANALYSIS

Objectives: This paper is an introduction to the theory of analytic functions of one complex variable. Properties of analytic functions, results on linear transformations, problems on complex integration are discussed. Calculus of residues are also studied.

UNIT-I

Analytic function: Introduction, Laws of algebra, Functions of a complex variable, Continuous functions, Analytic functions, Cauchy-Riemann equations.

UNIT-II

Conformal mapping, Bilinear transformation, Special bilinear transformation, Stereo graphical projection.

UNIT-III

Integration in the complex plane, Complex integration, Cauchy's integral theorem, Extension of Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions, Morera's theorem, Cauchy's inequality, Liouville's theorem, Fundamental theorem of algebra, Maximum modulus theorem.

UNIT-IV

Expansion of functions in power series, Taylor's theorem, Laurent's theorem, Singular points; Pole, essential singularity and removable singularity, Weirstrass theorem, Meromorphic function, Argument principle, Rouche's theorem.

UNIT-V

Residues-Evaluation of definite integrals, Evaluation of residue at a pole, Residue theorem, Evaluation of definite integrals, Jordan's lemma.

TEXT BOOK

Content and treatment as in the book "Complex Analysis", by S. Narayanan and T.K. Manicavachagom pillay, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai – 31.

Unit I	-	Chapter 1 and 2all sections
Unit II	-	Chapter 3 all sections
Unit III	-	Chapter 4 all sections
Unit IV	-	Chapter 5 all sections
Unit V	-	Chapter 6 all sections

REFERENCE BOOKS

1. Functions of one Complex Variable, J.B. Conway, Springer-Verlag, 1973.
2. Foundations of Complex Analysis, S. Ponnusamy, Narosa Publishing House, 1995.
3. Complex Analysis, L.V. Ahlfors, McGraw Hill, 1979.

IMAT 63   BASIC ALGEBRA

Objectives: Modern algebra plays a major role in other branches of Mathematics. Properties of groups, various subgroups such as normal subgroups, quotient groups are studied. Homomorphism of groups and rings, automorphisms of groups are discussed. The properties of rings, ideals, quotient rings and Euclidean rings are discussed.

UNIT-I: Group Theory:

Definition and examples of groups, Some preliminary Lemmas, Subgroups.

UNIT-II: Group Theory (continued):

A Counting principle, Normal subgroups and Quotient groups, Homomorphisms.

UNIT-III: Group Theory (continued):

Automorphisms, Cayley's theorem, Permutation groups.

UNIT-IV: Ring Theory

Definition and examples of rings, Some special classes of rings, Homomorphisms, Ideals and quotient rings.

UNIT-V: Ring Theory (continued):

More on ideals and quotient rings, The field of quotients of an integral domain, Euclidean rings.

TEXT BOOK

Content and treatment as in the book "Topics in Algebra" by I.N. Herstein, John Wiley and Sons, New York, 1999.

Unit I	-	Chapter 2: Sections 1 to 4.
Unit II	-	Chapter 2: Sections 5 to.7.
Unit III	-	Chapter 2: Sections 8 to10.
Unit IV	-	Chapter 3: Sections 1 to 4.
Unit V	-	Chapter 3: Sections 5 to7.

REFERENCE BOOKS

(1) R. Balakrishnan and N. Ramabhadharan, A textbook of Modern

   Algebra, Vikas Publishing House, Second Revised Ed. 1994.
(2) J.B. Fraleigh, A first course in Abstract Algebra, Addison-Wesley, Fifth
   Edition, 1999.

IMAT 64   DISCRETE MATHEMATICS

Objectives: Students must understand mathematical reasoning in order to read, comprehend and construct mathematical arguments. Mathematical logic, which serves as foundation for subsequent discussion is discussed. Discrete structures such as sets and permutations are studied. Discrete probability, recurrence relations, conquer relations and principles of inclusion and exclusion are studied.

UNIT I: Logic and Counting:

Propositions and logical operations, Conditional statements, Methods of Proof, Mathematical Induction. Permutations, Combinations, Pigeonhole Principle, Elements of Probability, Recurrence Relations.

UNIT II: Relations and Digraphs:

Product sets and partitions, Relations and Digraphs, Paths in Relations and Digraphs, Properties of relations, Equivalence Relations, Computer Representation of Relations and Digraphs, Operations on Relations, Transitive Closure and Warshall's Algorithm.

UNIT III: Functions:

Functions, Functions for Computer Science, Growth of Functions, Permutation Functions.

UNIT IV: Order Relations and Structures:

Partially Ordered Sets, Extremal Elements of Partially Ordered Sets, Lattice, Finite Boolean Algebras, Functions on Boolean Algebra, Circuit Designs.

UNIT V: Semigroups and Groups:

Semigroups, Product and Quotient of Semigroups, Groups, Product and Quotient of Groups.

TEXT BOOK

Content and treatment as in the book "Discrete Mathematical Structures" by Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, Prentice - Hall of India, Private Limited, New Delhi, 2002.

Unit I   Chapter 2 Sections 1 to 4, Chapter 3 Sections 1 to 5.
Unit II   Chapter 4 Sections 1 to 8.
Unit III Chapter 5 Sections 1 to 4.
Unit IV Chapter 6 Sections 1 to 6.
Unit V   Chapter 9 Sections 1 to 4.

REFERENCE BOOKS

1. Discrete Mathematics with Graph Theory by E.G. Goodaire and M.M. Paramenter, Prentice Hall International Editions, New Jersey (1998).
2. Invitation to Discrete Mathematics by J. Matonsek and J. Nesetril, Clarendon Press, Oxford (1998).
3. Discrete Mathematical Structures with Applications to Computer Science by J.P. Tremblay and R. Manohar, Tata McGraw Hill Publication Company, 1997.

IMAT 65   OPTIMIZATION TECHNIQUES

Objectives: Mathematical programming finds applications in diverse fields including Engineering, Management Sciences, Computer Science and Economics. In this course, the general linear programming problem, simplex computation procedure, revised simplex method, duality problems in linear programming, and some nonlinear programming problems are covered.

UNIT-I

The General Linear Programming problem:, The linear programming problem, properties of solution to the linear programming problem, Generating extreme - point solutions. The Simplex Computational procedure: Development of a minimum feasible solution, computational procedure.

UNIT-II

The Artificial - Basis Technique: A first feasible solution using slack variables, Geometric Interpretation of the simplex procedure.

Degeneracy and anticycling procedure: Perturbation Techniques, The lowest - Index Anticycling Rules, Example of Cycling.

UNIT-III

The Revised Simplex method: The General form of the inverse, The Product form of the inverse, Computational considerations.

The Duality problems of linear programming: The unsymmetric Primal - Dual problems, the symmetric primal-dual problems, Economic Interpretation of the Primal, Dual problems.

UNIT-IV

Additional computational Technique: Determining a first feasible solution, The dual simplex method, Integer programming.

The Transportation problem: The General Transportation problem, Computational procedure for solving the transportation problem, Variations of the transportation problem.

UNIT-V

Non-Linear Programming: The General problem of mathematical programming, Mathematical background, the convex programming problem, Quadratic programming, Separable programming.

TEXT BOOK

Content and treatment as in the book "Linear Programming - methods and applications", Fifth Edition, by Saul I. Gass, McGraw Hill, 1994.

Unit I	-	Chapter 3 Sections 1, 2 and 3 and
		Chapter 4 Sections 1 and 2
Unit II	-	Chapter 4 Sections 3, 4 and 5 and
		Chapter 7 Sections 1, 2 and 3
Unit III -		Chapter 5 Sections 1, 2 and 3 and
		Chapter 6 Sections 1,2 and 3
Unit IV -		Chapter 9 Sections 1, 2 and 3 and
		Chapter 10 Sections 1, 2 and 3
Unit V	-	Chapter 12 Sections 1 to 5

REFERENCE BOOKS

1. Operations Research - An Introduction by H.A. Taha - Sixth Edition, Macmillan publishing Co., New York, 1998.
2. Linear Programming by G. Hadley, Oxford and IBH Pub. Co., New Delhi, 1962.
3. Mathematical Programming by N.S. Kambo, Affliated East-West Press, New Delhi, 1991.
4. Operations Research by J.K. Sharma, Trinity (Laxmi Publications), New Delhi.

IMAT 71 ABSTRACT ALGEBRA

Objectives: Some advanced concepts in group theory are introduced. The algebraic structures rings, vector spaces, inner product spaces and modules are introduced and their properties are studied.

UNIT - I

Permutation groups, Another Counting Principles and Sylow's Theorem.

UNIT - II

Rings, Homomorphisms, Ideals and quotient rings, Field of quotients of an integral domain, and Euclidean rings.

UNIT - III

A particular Euclidean ring – the ruing of Gaussian integrals, Polynomial rings, Polynomials over the rational field, Polynomial rings over commutative rings.

UNIT - IV

Elementary basic concepts of vector spaces and Linear independence and bases.

UNIT - V

Dual spaces, Inner product spaces and Modules.

TEXT BOOKS

Content and treatment as in the book "Topics in Algebra" by I.N. Herstein, John Wiley & Sons (Second Edition), New Delhi, 1975.

Unit – I Chapter 2 Sections 2.10 to 2.12
Unit – II   Chapter 3 Sections 3.1 to 3.7
Unit – III   Chapter 3 Sections 3.8 to 11
Unit – IV   Chapter 4 Sections 4.1 and 4.2
Unit – V   Chapter 4 Sections 4.3 to 4.5

REFERENCE BOOKS

1. Lectures in Abstract Algebra Vol. I by N. Jacobson, D. Van Nostrand Co., New York, 1976.
2. Modern Algebra Vol. I by B.L. Van der Waerden, Frederic Ungar Publishing Company, 1970.
3. Modern Algebra by Surjeet Singh and Qasi Zameeruddin, Vikas Publishing House (Second Edition), New Delh**i,** 1975.
4. Algebra by Michael Artin, Prentice - Hall of India, New Delhi.

IMAT 72   ADVANCED REAL ANALYSIS

Objectives: The concept of derivatives of real valued functions and their properties are studied. Properties of monotonic functions, functions of bounded variations are also introduced. The concept of Riemann-Stieltjes integral and its properties are studied. The notion of convergence and uniform convergence of real valued functions and infinite series of functions are also studied.

UNIT - I:

Derivatives: Definition of derivative, Derivatives and continuity, Algebra of derivatives, The chain rule, One-sided derivatives and infinite derivatives, Functions with nonzero derivative, Zero derivatives and local extrema, Rolle's theorem, The mean-value theorem for derivatives, Intermediate-value theorem for derivatives, Taylor's formula with remainder, Derivatives of vector-valued functions, Partial derivatives.

UNIT - II:

Functions of Bounded Variation: Properties of monotonic functions, Functions of bounded variation, Total variation, Additive property of total variation, Total variation on [a, x] as a function of x, Functions of bounded variation expressed as the difference of increasing functions, Continuous functions of bounded variation.

UNIT – III:

Riemann-Stieltjes Integral: The definition of the Riemann-Stieltjes integral, Linear properties, Integration by parts, Change of variable in a Riemann-Stieltjes integral, Reduction to a Riemann integral, Step functions as integrators, Reduction to a Riemann-Stieltjes integral, Step functions as integrators, Reduction of a Riemann-Stieljes integral to a finite sum, Euler's summation formula, Monotonically increasing integrators, Upper and lower integrals, Additive and linearity properties of upper and lower integrals, Reimann's condition, Comparison theorems.

UNIT – IV:

Riemann-Stieltjes Integral (Continued): Integrators of bounded variation, Sufficient conditions for existence of Riemann-Stieltjes integrals, Necessary conditions for existence of Riemann-Stieltjes integrals, Mean value theorems for Riemann-Stieltjes integrals, The integral as a function of the interval, Second fundamental theorem of integral calculus, Change of variable in a Riemann integral, Second mean-value theorem for Riemann integrals, Riemann-Stieltjes integrals depending on a parameter, Differentiation under the integral sign, Interchanging the order of integration.

UNIT – V:

Sequences of Functions: Pointwise convergence of sequences of functions, Examples of sequences of real-valued functions, Definition of uniform convergence, Uniform convergence and continuity, The Cauchy condition for uniform convergence, Uniform convergence of infinite series of functions, Uniform convergence and Riemann-Stieltjes integration.

TEXT BOOK

Contents and treatment as in the book "Mathematical Analysis" by Tom. M. Apostol, Narosa Publishing House, (Second Edition), New Delhi, 1974.

Unit – I Chapter 5 Sections 5.1 to 5.14
Unit – II   Chapter 6 Sections 6.1 to 6.8
Unit – III   Chapter 7 Sections 7.1 to 7.14
Unit – IV   Chapter 7 Sections 7.15 to 7.25
Unit – V   Chapter 9 Sections 9.1 to 9.6 and 9.8.

REFERENCE BOOKS

1. Principles of Mathematical Analysis by Walter Rudin, McGraw-Hill International Book Company, (Third Edition), New Delhi, 1976.
2. Mathematical Analysis by S.C. Malik and S. Arora, Wiley Eastern Ltd., New Delhi, 1991.

IMAT 73 ADVANCED DIFFERENTIAL EQUATIONS

Objectives: This Course aims to provide problem solving techniques in ordinary differential equations with variable coefficients and some special partial differential equations of Mathematical Physics such as Elliptic and Parabolic equations.

UNIT-I: Linear Equation with Variable Coefficients

Initial value problems - Existence and uniqueness theorems - Solutions to solve a non-homogeneous equation - Wronskian and linear dependence - reduction of the order of a homogeneous equation - homogeneous equation with analytic coefficients -The Legendre equation.

UNIT-II: Linear Equation with Regular Singular Points

Euler equation - Second order equations with regular singular points -Exceptional cases - Bessel Function.

UNIT-III: Existence and Uniqueness of Solution to First Order Equations

Equation with variable separated - Exact equation - method of successive approximations - the Lipschitz condition - convergence of the successive approximations and the existence theorem.

UNIT-IV : ELLIPTIC DIFFERENTIAL EQUATIONS

Derivation of Laplace and Poisson equation - BVP - Separation of Variables - Dirichlet's Problem and Newmann Problem for a rectangle - Interior and Exterior Dirichlets's problems for a circle - Interior Newmann problem for a circle - Solution of Laplace equation in Cylindrical and spherical coordinates - Examples.

UNIT-V : PARABOLIC DIFFERENTIAL EQUATIONS

Formation and solution of Diffusion equation - Dirac-Delta function - Separation of variables method - Solution of Diffusion Equation in Cylindrical and spherical coordinates - Examples.

TEXT BOOKS

Contents and treatment as in the following books:
1. "An Introduction to Ordinary Differential Equations" by E.A. Coddington, Prentice Hall of India, 1987.

Unit-I Chapter - 3 Sections I to 8 [Omit section 9]
Unit-II Chapter 4 : Sections 1 to 4 and 6 to 8 [Omit sections 5 and 9]
Unit-III Chapter 5: Sections 1to 6 [Omit Sections 7 to 9]

2. "Introduction to Partial Differential Equations" by S, Sankar Rao, 2nd Edition, Prentice Hall of India, New Delhi. 2005

Unit-IV Chapter 2: 2.1, 2 2 ,2.5 to 2.13 (omit 2.3 and 2.4)

REFERENCE BOOKS

1. "Differential equations with applications and historical notes" by George F. Simmons, Tata McGraw Hill Publishing Company, (second edition), 2004, New Delhi.
2. Advanced calculus for applications by F.B. Hildebrand, Prentice - Hall. Inc, 1976.
3. I.N.Sneddon, Elements of Partial Differential Equations, McGraw Hill, New Delhi, 1983.
4. M.D.Raisinghania, Advanced Differential Equations, S.Chand & Company Ltd., New Delhi, 2001.

IMAT 74 PROGRAMMING LANGUAGE C++

Objectives: After having a course on the language C, the much sought after language is C++. The language C++ is a Object Oriented Programming Language. First the syntax of the language C++ is introduced. This is followed by Control statement, Arrays, Functions, Pointers, Structures and Classes. Many problems are solved after writing algorithms and programs in C++.

UNIT - I: Using Turbo C++:

Setting Up Turbo C++, Memory Models, The Demonstration Tour, Borland Program Examples, Borland C++ Options, Take the Tour. Your First Program: Invoking Turbo C++, Naming Your Program, Using the Editor, Saving Your Program, Compiling and Linking, Running the program. Errors: Compiler Errors, Linker Errors, Run-time Errors. Other IDE features: Compiling and Linking Shortcut, Exiting from the IDE, Examining Files, Opening an Existing File, DOS Shell.

C++ Programming Basics:

Basic Program Construction: Functions, Program Statements, White Space. Output Using Cout: String Constants. Preprocessor Directives: The # include Directive, Header Files. Comments: Comments Syntax, When to Use Comments, Alternative Comment Syntax. Integer variables: Defining Integer Variables, Declarations and Definitions, Variable Names, Assignment Statement, Integer Constants, Output variations. Character Variables: Character Constants, Initialization, Escape Sequences. Input with Cin: Variables Defined at Point of Use, Cascading, Expressions, Precedence. Type float: Floating-Point Constants, The Const Qualifier, The # define Directive. Manipulators: The end L Manipulator, The set W Manipulator, Type Long, Cascading the Insertion Operator, Multiple definitions, The IOMANIP.H Header File. Variable Type Summary: Unsigned data types. Type Conversion: Automatic Conversions, Casts. Arithmetic operators: The Remainder Operator, Arithmetic Assignment operators, Increment Operators. Library Functions: Header Files, Library Files, Header Files and Library Files, Two Ways to Use # include.

UNIT - II: Loops and Decisions:

Relational operators. Loops: The for Loop, Using Turbo C++ Debugging Features, for Loop Variations, The while Loop, Precedence: Arithmetic and Relational Operators, The do loop, When to Use Which Loop. Decisions: The if Statement, The if...else Statement, The else...if Construction, The Switch Statement. The Conditional Operator. Logical Operators: Logical OR Operator, Logical AND Operator, The Logical NOT Operator, Precedence Summary, Other Control Statements, The break Statement, The continue Statement, The GOTO Statement.

UNIT - III: Functions:

Simple Functions: The Function Declaration, Calling the Function, The Function Definition, Comparison with Library Functions, Eliminating the Declaration. Passing Arguments to Functions: Passing Constants, Passing Variables, Passing by Value, Passing Structure Variables, Names in the Declaration. Returning Values from Functions: The return Statement, Returning structure Variables. Reference Arguments: Passing Simple Data Types by Reference. Overloaded Functions: Different Numbers of Arguments, Different Kinds of Arguments. Inline Functions: Default Arguments, Variables and Storage Classes: Automatic Variables, External Variables, Static Variables, Storage, Returning by Reference.

UNIT - IV: Arrays:

Array Fundamentals. Defining Arrays, Array Elements, Accessing Array Elements, Averaging Array Elements, Initializing Arrays, Multidimensional Arrays, Passing Arrays to

Functions, Arrays of Structures. <u>Arrays as Class Member Data</u>: Arrays of Objects, Arrays of English Distances, Arrays of Cards, <u>String</u>: Variables, Avoiding Buffer Overflow, String Constants, Reading Embedded Blanks, Reading Multiple Lines, Copying a String the Hard Way, Copying a String the Easy Way, Arrays of Strings, Strings as Class Members, A User-Defined String Type.

UNIT - V: Pointers:

Addresses and Pointers, The Address of Operator & Pointer Variables, Accessing the Variable Pointed To, Pointer to void. <u>Pointers and Arrays</u>: Pointer Constants and Pointer Variables. <u>Pointers and Functions</u>: Passing Simple Variables, Passing arrays, Sorting Array Elements. <u>Pointers and Strings</u>: Pointers to String Constants, Strings as Function Arguments, Copying a String Using Pointers, Library String Functions, Arrays of Pointers to Strings.

TEXT BOOK

Content and treatment as in the book "Object-Oriented Programming in TURBO C++" by Robert Lafore, Galgotia Publications Pvt. Ltd., New Delhi, 1996.

Unit-I	Chapters 2 & 3
Unit-II	Chapter 4
Unit-III	Chapter 6
Unit-IV	Chapter 8
Unit-V	Chapter 12

REFERENCE BOOK

Programming in ANSI C by E. Balagurusamy, Tata McGraw Hill Publishing Ltd., (Second Edition), New Delhi, 1992.

Optional –I

IPHO 75 - Classical Mechanics and Special Theory of Relativity

Objective: The contents emphasize the advantage of energy representation in dynamics and the macroscopic properties in terms of microscope manifestations..

Unit – I

Principle of Newtonian Mechanics – particle mechanics – conservation laws of linear momentum, Angular momentum and energy of a particle and body – Constraints and classification with examples – particle motion under a constant force – Motion of a system with variable mass.

Unit – II

Principle of virtual work – D'Alembert's principle – generalized coordinates – Lagrange equations – Cyclic or ignorable coordinates – remarks about the Lagrangian – Generalized moments and energy – Hamilton's principle – Hamilton's equations of motion.

Unit – III

Motion of a rigid body – the inertia tensor – Euler's equation of motion – Euler's angles – motion of a symmetric top – Poisson brackets and their properties – conservation theorems in Poisson brackets – small oscillations – normal modes – free vibrations of linear triatomic molecules – Harmonic oscillator – as an example of Hamilton-Jacobi method.

Unit – IV

Newtonian relativity- Michelson Morley experiment- Lorentz transformation and Consequences- relativity of simultaneity- the Lorenz-Fitz Gerald length contraction, Time dilation- Addition velocities.

Unit – V

Variation of moss with velocity, Moss energy relation, Minkowski four dimensional contiumum- Four vectors Compton scattering.

Text Books and References:
1. R.G.Takwale and P.S.Purani, Introduction to classical mechanics - Tata Macgraw Hill Publishing co Ltd., New Delhi.
2. B.D.Gupta and Sathyaprakash.-Classical Mecanics-Kedaernath Ramnath and CO .

3. Sathyaprakash and J.P.Agarwal- Statistical Mechanics- Kedar Nath Ram nath and Co.Publishers, MEERUT. 2003.
4. M.C Guptha -Statistical Thermo Dynamics -Weiley Eastern Limeted, New Delhi.
5. Herbert Gold Stein, - Classical Mechanics – Narosa Publishing House, Chennai .
6. V.B.Bhatia., - Classical Mechanics, Narosa Publishing House, Chennai – 6, 1997
7. B.K.Agarwal and Melvin Eisner, - Statistical Mechanics- New age international (p) Ltd. Chennai, 1994.
8. S.C.Garg, R.M.Bansal and C.K.Ghosh , - Thermal Physics. Tata McGrew Hill Publishing co Ltd. Delhi,1993.

IMAT 81   ADVANCED ALGEBRA

Objectives: Finite extensions of fields and algebraic elements are introduced. Galois gave the connection between normal subgroups and normal extensions. This concept is given as fundamental theorem of Galois. The properties of Linear transformations are given and their canonical forms like, triangular form, rational form are studied.

UNIT - I
　　　　Extension Fields, Roots of Polynomials, More about roots.

UNIT – II
　　　　The elements of Galois theory, Solvability by radicals, Finite fields.

UNIT - III
　　　　The algebra of linear transformations, Characteristic roots, Matrices, Canonical forms: Triangular form.

UNIT - IV
　　　　Nilpotent transformations and their canonical forms, Jordan Form, Rational canonical form.

UNIT - V
　　　　Hermitian, Unitary and Normal transformations, Real quadratic forms.

TEXT BOOK
　　　　Content and treatment as in the book "Topics in algebra" by I.N. Herstein, John Wiley & Sons (Second Edition) New Delhi, 1975.

Unit-I	Chapter 5: Sections 5.1, 5.3 and 5.5
Unit-II	Chapter 5: Sections 5.6 and 5.7 and Chapter 7: Section 7.1
Unit-III	Chapter 6: Sections 6.1 to 6.4
Unit-IV	Chapter 6: Sections 6.5 to 6.7
Unit-V	Chapter 6: Sections 6.10 and 6.11

REFERENCE BOOKS
1. Lectures in abstract algebra Vol. II and Vol. III by N. Jacobson, D. Van Nostrand Co., New York.
2. Modern Algebra Vol. I by B.L. Van der Waerden, Frederic Ungar Publishing Company, 1970.
3. Modern Algebra Vol. I by Surjeet Singh and Qasi Zammeruddin, Vikas Publishing House (Second Edition), New Delhi, 1975.
4. Algebra by M. Artin, Prentice-Hall of India, New Delhi, 1994.

IMAT 82   MEASURE THEORY AND INTEGRATION

Objectives: The concept of Lebesgue measure is introduced. Measure space and integration with respect to a measure are introduced.

UNIT - I
　　　　Lebesgue Outer measure, Measurable sets, Regularity, Measurable functions, Borel and Lebesgue measurability.

UNIT - II

Integration of nonnegative functions, General integral, Integration of series, Riemann and Lebesgue integrals.

UNIT - III

Continuous non-differentiable functions, Lebesgue differential theorem (statement only), Differentiation and Integration, Lebesgue set, Convergence in measure, Almost uniform convergence.

UNIT – IV

Measures and outer measures, Extension of a measure, Uniqueness of the extension completion of a measure, Measure spaces, Integration with respect to a measure.

UNIT - V

L^p spaces, Convex functions, Jensen's inequality, The inequalities of Holder and Minkowski completeness of $L^p (\mu)$.

TEXT BOOK

Contents and treatment as in the book "Measure Theory and Integration" by G. de Barra, New Age International Publishers, 2005.

Unit – I Chapter 2 Sections 2.1 to 2.5
Unit – II   Chapter 3 Sections 3.1 to 3.4
Unit – III   Chapter 4 Sections 4.2, 4.4 to 4.6 and Chapter 7 Sections 7.1
                                                              and 7.2
Unit – IV   Chapter 5 Sections 5.1 to 5.6
Unit – V   Chapter 6 Sections 6.1 to 6.6

REFERENCE BOOKS

1. Real Analysis by Royden, MacMillan Publishing Company, New York, 1968.
2. Mathematical Analysis by V. Ganapathy Iyer, Tata McGraw Hill Publication Co. Ltd., New Delhi.
3. Measure Theory by P.R. Halmos, Van Nostrand Princeton, New Jersey, 1950.

IMAT 83 ADVANCED COMPLEX ANALYSIS

Objectives: This course aims to train the students to get essential knowledge in functions of a complex variable. Analytic functions and their properties, Residue theorem and its applications, Riemann mapping theorem and Elliptic functions and their properties are discussed in detail.

UNIT - I

Complex integration:

Line integrals, Rectifiable arcs, Line integrals as functions of arcs, Cauchy's theorem for a rectangle, Cauchy's theorem in a Disc.

Cauchy's integral Formula:

The index of a point with respect to a closed curve, The integral formula, Higher derivatives.

UNIT - II

Local Properties of Analytic Functions:

Removable Singularities, Taylor's theorem, Zeros and poles, The Local Mapping and The Maximum Principle.

The General Form of Cauchy's Theorem:

Chains and cycles, Simple connectivity, Locally exact differentials, Multiply connected regions.

UNIT - III

Harmonic Functions:

Definition and basic properties, The mean-value property, Poisson's Formula, Schwarz's theorem, The Reflection principle.

Power Series Expansions:

Weierstrass's Theorem, The Taylor series, The Laurent Series.

Partial Fractions and Factorization:

Partial fractions, Infinite products and Canonical products.

UNIT - IV
Normal Families:
      Equicontinuity, Normality and Compactness, Arzela's Theorem, Families of Analytic Functions, The classical definition.
The Riemann Mapping Theorem:
      Statement and Proof
Conformal mapping of Polygons:
      The behavior at an angle, The Schwarz-Christoffel formula, Mapping on a rectangle, The triangle functions of Schwarz.
UNIT - V
Elliptic Functions:
      Doubly periodic functions - The period module, Unimodular transformations, The canonical basis, General properties of Elliptic functions.
      Weierstras theory - The Weierstras P -function, The Functions ζ (z) and σ (z), The associated Differential equation.
TEXT BOOK
      Content and treatment as in the book "Complex Analysis" by L.V. Ahlfors, (Third edition), McGraw Hill Inc., New Delhi, 1979.
      Unit-I   Chapter 4 Sections 1 & 2.
      Unit-II Chapter 4 Sections 3, 4(4.1, 4.2, 4.6 and 4.7 only)
      Unit-III Chapter 4 Section 6; Chapter 5 Sections 1,2 (2.1,2.2 & 2.3
                  only)
      Unit-IV Chapter 5 Section 5, Chapter 6 Sections 1 and 2.
      Unit-V Chapter 7 Sections 2 and 3 (3.1, 3.2, and 3.3 only)
REFERENCE BOOKS
1. Functions of One Complex Variable by J.B. Conway, Springer-Verlag, 1973.
2. Notes on Complex Function Theory by Donald Sarason, Hindustan Book Agency, 1994.
3. Complex Variables by H. Silverman, Hughton Miffin Company.
4. Foundations of Complex Analysis by S. Ponnusamy, (Second edition), Narosa, 2005.

IMAT 84   SOFT SKILLS

IMAP 85   COMPUTER PRACTICAL – I
(Using C language)

Objectives: This Paper is divided into four parts viz solution of transcendental and polynomial equations in one variable, solution of linear equations, solution of ordinary differential equations and numerical integration. This paper gives practical applicability of C programming to some of the problems in numerical mathematics.

1. Solution of transcendental and polynomial equations in one variable:
    i. Newton's Method
    ii. Method of Bisection
    iii. Method of Regula Falsi
2. Solution of Linear Equations:
    i. Jacobi's Iterative Method
    ii. Gauss-Seidal Iterative Method
3. Numerical Solution of Ordinary Differential Equations:
    i. Euler's Method.
    ii. Modified Euler's Method
    iii. Runge-Kutta Method of order four
4. Numerical Integration:

i. Simpson's one third rule
ii. Simpson's three eighth rule
iii. Weddle's rule.

TEXT BOOK

Content and treatment as in relevant sections of "Numerical Algorithms" by E.V. Krishnamoorthy and S.K. Sen, Affiliated East West Press Pvt., Ltd., (Second Edition), 1996.

<div align="center">

Optional-2
OIMAT 86 - MATHEMATICAL STATISTICS

</div>

Objectives: The objective is to train students in some concepts in mathematical statistics. The notion of random variables, distribution function and characteristic functions are introduced. Some examples of discrete and continuous random variables are introduced and their properties are studied.

UNIT-I Random Variables:

The concept of a random variable, The distribution function, Random variables of the discrete type and the continuous type, functions of random variables, Multi dimensional random variables, Marginal distributions, Conditional distributions, Independent random variables, Functions of multi dimensional random variables.

UNIT-II Parameters of the distribution of a random variable:

Expected values, Moments, The Chebyshev inequality, Absolute moments, Order parameters, Moments of random vectors, Regression of first type, Regression of the second type.

UNIT-III Characteristic Functions:

Properties of characteristic functions, The characteristic functions and moments, Emi invariants, The characteristic function of the sum of independent random variables, Determination of the distribution function by the characteristic function, The characteristic function of multidimensional random vectors, Probability generating functions.

UNIT-IV Some Probability Distributions:

One point and two point distributions, The Bernoulli scheme, The binomial distribution, The Poisson scheme, The generalized binomial distribution, The Polya and hypergeometric distributions, The Poisson distribution.

UNIT-V Some Probability Distributions (Continued):

The uniform distribution, The normal distribution, The gamma distribution, The beta distribution, The Cauchy and Laplace distributions, The multidimensional normal distribution, The multinomial distribution.

TEXT BOOK

Content and treatment as in the book "Probability Theory and Mathematical Statistics" by Marek Fiszs, John Wiley, New York, (Third edition), 1963.

Unit – I   Chapter 2: Sections 2.1 to 2.9.
Unit - II   Chapter 3: Sections 3.1 to 3.8.
Unit - III   Chapter 4: Sections 4.1 to 4.7.
Unit - IV   Chapter 5: Sections 5.1 to 5.5.
Unit - V   Chapter 5: Sections 5.6 to 5.12.

REFERENCE BOOKS

1. Random variables and probability distributions by H. Cramer, University Press, Cambridge, 1937.
2. Mathematical methods in Statistics Topology by H. Cramer, Princeton University Press, Princeton, 1946.
3. Mathematical Statistics by Samuel S. Wilks, John Wiley & sons, New York, 1962.

<div align="center">

IMAT 91 TOPOLOGY

</div>

Objectives: The ideas and methods of topology have transformed large parts of geometry and analysis. This subject is of interest in its own right, and it also serves to lay the foundations for future studies in analysis and geometry. In this course we teach the basics of topology including

connectedness, compactness, countability, separation axioms, Tychonoff theorem and complete metric spaces.

UNIT-I

Topological spaces, Basis for a topology, The order topology, The product topology on $X \times Y$.

UNIT-II

The subspace topology, Closed sets and limit points, Continuous function, The product topology.

The metric topology, Connected spaces, Connected subspaces of the real line, Components and Local connectedness.

UNIT-III

Compact spaces, Compact subspaces of the real line, Limit point compactness, Local compactness.

UNIT-IV

Countability axioms, The separation axioms, Normal spaces, Urysohn Lemma, Urysohn metrization theorem, The Tietze extension theorem.

UNIT-V

The Tychonoff Theorem, Stone-Cech compactification, Complete metric spaces, Compactness in metric spaces.

TEXT BOOK

Content and treatment as in the book "Topology" by James R. Munkres, Prentice Hall of India, (Second edition), New Delhi, 2000.

Unit – I Chapter 2: Sections 12 to 15.
Unit - II Chapter 2: Sections 16 to 21 and
Chapter 3: Sections 23 to 25.
Unit - III Chapter 3: Sections 26 to 29.
Unit - IV Chapter 4: Sections 30 to 35.
Unit - V Chapter 5: Sections 37 and 38;
Chapter 7: Sections 43 and 45 only.

REFERENCE BOOKS

1. Elements of General topology by S.T. Hu, Holden-Day Inc, San Francisco, 1964.
2. Topology by J.G. Hocking and G.S. Young, Addison-Wesley Pub. Com, 1961.
3. Introduction to Topology and Modern analysis by G.F. Simmons, McGraw Hill International Edition, Singapore, 1963.
4. Topology of Metric Spaces by S. Kumaresan, Narosa Publishing house, 2005.

IMAT 92 GRAPH THEORY

Objectives: Graph Theory is an integral part of Discrete Mathematics. It has applications to many fields, including computer science, physics, chemistry, psychology and sociology. In this course we teach basic topics in graph theory such as Trees, Directed graphs, Connectivity, Euler tours, Hamilton cycles, Matchings, Colourings, Planar graphs.

UNIT-I: Graphs and Subgraphs:

Graphs and Simple Graphs, Graph Isomorphism, The Incidence and Adjacency Matrices, Subgraphs, Vertex Degrees, Paths and Connection and Cycles.

Trees:

Trees, Cut Edges and Bonds, Cut Vertices and Cayley's Formula.

UNIT-II: Connectivity and Hamilton Cycles:

Connectivity, Blocks, Euler Tours and Hamilton Cycles.

UNIT-III: Matchings:

Matchings, Matchings and Coverings in Bipartite Graphs and Perfect Matchings.

UNIT-IV: Edge Colourings:

Edge Chromatic Number, Vizing's Theorem.

Vertex Colourings:

Chromatic Number, Brooks' Theorem, Hajos' Conjecture - Dirac's Theorem, Chromatic Polynomials, Girth and Chromatic Number.

UNIT-V: Planar Graphs:

Plane and Planar Graphs, Dual Graphs, Euler's Formula, The Five - Colour Theorem, Nonhamiltonian Planar Graphs.

TEXT BOOK

Contents and treatment as in the book 'Graph Theory with Applications' by J.A. Bondy and U.S.R. Murty, Macmillan Company, 1976.

Unit – I	Chapter 1: Sections 1 to 7;
	Chapter 2: Sections 1 to 4.
Unit - II	Chapter 3: Sections 1, 2; and
	Chapter 4: Sections 1 and 2.
Unit – III	Chapter 5: Sections 1 to 3.
Unit - IV	Chapter 6: Sections 1, 2; and Chapter 8: Sections 1 to 5.
Unit - V	Chapter 9: Sections 1 to 3 and 6, 7

REFERENCE BOOKS

1. Graph Theory by R. Gould, The Benjamin/Cummings Publishing Company, Inc., California, 1988.
2. Pearls in Graph Theory by N. Hartsfield and G. Ringel, Academic Press, 1990.
3. Graph Theory by F. Harary, Addison-Wesley, (Second Printing) 1971.
4. Basic Graph Theory by K.R. Parthasarathy, Tata McGraw Hill Publishing Company Limited, New Delhi, 1994.
5. A Text book of Graph Theory by R. Balakrishnan and K. Ranganathan, Springer-Verlag, New York, Inc., 2000.
6. Introduction to Graph Theory by D.B. West, Pearson Education (Second Edition), 2001.

IMAT 93 DIFFERENTIAL GEOMETRY

Objectives: To introduce space curves surfaces, curves on surfaces and study some of their properties. To study the notion of geodesic and its properties. To understand some type of special surfaces such as developables and minimal surfaces.

UNIT - I

Space curves, Arc length, Tangent, normal and binormal, Curvature and torsion of a curve given as the intersection of two surfaces.

UNIT - II

Contact between curves and surfaces, Tangent surface, involutes and evolutes, Intrinsic equations, Fundamental existence theorem for space curves, Helices.

UNIT - III

Surface, Curves on a surface, Metric, Direction coefficients, Geodesics, Canonical geodesic equations, Normal property of geodesics, Geodesic curvature.

UNIT - IV

Gauss-Bonnet theorem, Gaussian curvature, Surfaces of constant curvature, Conformal mapping, Only statements of Dini's theorem and Tissot's theorem.

UNIT - V

Second fundamental form, Developables, Developables associated with space curves, Developables associated with curves on surfaces, Minimal surfaces.

TEXT BOOK

Content and treatment as in the book "An Introduction to Differential Geometry" by T.J. Willmore, Oxford University Press, New Delhi, 1959.

Unit-I	Chapter 1 Sections 1 to 5
Unit-II	Chapter 1 Sections 6 to 9
Unit-III	Chapter 2 Sections 1and 2, 5,6,10,11,12 and 15

Unit-IV Chapter 2 Sections 16 to 20
Unit-V Chapter 3 Sections 1 and 4 to 7
REFERENCE BOOK
Lectures on Classical Differential Geometry by D.T. Struik, Addison-Wesley Press, 1950.

IMAT 94 PROBABILITY THEORY

Objectives: The objective is to train students in some rigorous concepts in probability theory through measure theoretic approach. Different types of convergence concepts are discussed. The weak and strong laws of large numbers are studied. The concept of characteristic function and different versions of central limit theorems are also taught.

UNIT-I: Distribution Function:
Monotone functions, Distribution functions, Absolutely continuous and Singular distributions.

Measure Theory:
Classes of sets, Probability measures and their distribution functions.

Random variable, Expectation, Independence:
General definitions, Properties of mathematical expectation, Independence.

UNIT-II: Convergence Concepts:
Various modes of convergence, Almost sure Convergence; Borel-Cantelli lemma, Vague Convergence, Continuation.

UNIT-III: Law of Large Numbers. Random series:
Simple limit theorems, Weak law of large numbers, Convergence of series, Strong law of large numbers.

UNIT-IV: Characteristic Function:
General properties; Convolutions, Uniqueness and inversion, Convergence theorems, Simple applications.

UNIT-V: Central limit theorem and its Ramifications:
Liapounov's theorem, Lindeberg-Feller theorem, Ramification of the central limit theorem.

TEXT BOOK
Content and treatment as in the book "A Course in Probability Theory" by K.L. Chung, Academic Press, Second Edition, 1974.

Unit - I	Chapter 1(Sections 1 to 3).
	Chapter 2 (Sections 1 and 2).
	Chapter 3 (Sections 1 to 3).
Unit – II	Chapter 4 (Sections 1 to 4).
Unit - III	Chapter 5 (Sections 1 to 4).
Unit – IV	Chapter 6 (Sections 1 to 4).
Unit - V	Chapter 7 (Sections 1 to 3).

REFERENCE BOOKS
1. Modern Probability Theory, B.R. Bhat, Wiley Eastern, New Delhi.
2. Measure, Integration and Probability, C.W. Burril, McGraw Hill.

IMAP 95   COMPUTER PRACTICAL – II

Objectives: This paper is divided into four parts namely solution of Linear Programming problems, solution of Inventory models, problems in Number Theory and problems involving Matrices. This paper gives a practical knowledge to solve problems including the fields of optimization, number theory and matrix theory.

1. Solution of Linear Programming Problem.
2. Deterministic Inventory Models.
   i. Single-item Static Model.

ii. Single-item Static Model with Price Breaks.

iii. Multi-item Static Model with Storage Limitation.

3. Number Theory:

i. Reversing of an integer series.

ii. Generating Fibonocci series.

iii. Average and Standard Deviation of numbers.

iv. Identification of Prime, Even and Odd integers.

4. Matrix Theory

i. Determinant of a matrix.

ii. Rank of a matrix.

iii. Inverse of a matrix.

iv. Product of matrices.

TEXT BOOK

Content and treatment as in relevant sections of the following books:

1. 'Optimization Methods' by K.V. Mital and C. Mohan, Third Edition, New Age International Publishers, New Delhi.

2. 'Operations Research - An Introduction' by Hamdy A. TAHA, Macmillan Publishing Company, New York, (Fourth Edition) 1987.

Optional -3
OMPY 96   COMPARATIVE RELIGION

Objectives: To make the students aware of the Principles of major religions. To make the students aware of the techniques of comparing religions.

UNIT-I: Hinduism

God World – Man – Evil and suffering - Life after death – Human destiny – Hindu Ethics, prayer and rituals.

UNIT-II: Christianity

God World – Man – Evil and suffering - Life after death – Human destiny – Hindu Ethics and prayer.

UNIT-III: Islam

God - World – Man – Evil and suffering - Life after death – Human destiny –Ethics and prayer.

UNIT-IV: Buddhism

God-hood – World – Man – Evil and suffering – Life after death – Ultimate destiny – Buddhist discipline.

UNIT-V: Jainism and Comparison of Religions

God-hood – World – Man – Evil and suffering Life after death – Ultimate destiny – Jain discipline – Comparison between Hinduism, Christianity, Islam, Buddhism and Jainism.

Text Books:

1. Kedar Nath Tiwari, Comparative Religion, Motilal Banarsidas, Delhi, 1990.
2. Ram Shankar Srivastava, Comparative Religion, Munshiram Manoharlal Publishers Pvt. Ltd., New Delhi 1974.
3. Suda J.P, Religion in India, Sterling Publishers Pvt. Ltd., New Delhi, 1978.

Reference Books:

1. Widgoery, A.C, The Comparative Study of Religions, Munshi Ram Manoharlal, Delhi, 1922.
2. Max Mullar, F, Natural Religion, collected works Asian Educational Service, Delhi, 1979.
3. Rajendra Verma, Comparative Religion: concepts and Experience, Intellectual Publishing House, Delhi, 1984.
4. Ward J.Follows. Religions East and West. Holt Rinehart and Winston, New York, 1979.
5. Brodov, V. Indian Philosophy in Modern Times, Progress Publishers, Moscow,1984.

IMAT 101   FUNCTIONAL ANALYSIS

Objectives: There are many domains in the broad field of topology. The following are the few viz, the theory of Banach and Hilbert Spaces and their operators and Banach algebras. In this course we teach some results on Banach spaces, Hilbert spaces, operator theory and Banach algebras. Each of these subjects starts from the fundamental knowledge and develops its own methods of dealing with its own characteristic problems.

UNIT - I
Linear transformations, Banach spaces, Continuous linear transformations, The Hahn-Banach theorem.
UNIT - II
The natural embedding of N into N^{**}, The open mapping theorem, The conjugate of an operator.
UNIT - III
Hilbert space, Orthogonal complements, Orthonormal sets, The Conjugate space H, The adjoint of an operator, Self adjoint operators, Normal and Unitary operators.
UNIT - IV
Finite dimensional Spectral theory, Matrices, Determinants and Spectrum of an operator, The spectral theorem.
UNIT - V
Banach algebras - Definition and some examples, Regular and singular elements, Topological divisors of zero, The spectrum, The formula for the spectral radius.
TEXT BOOK
Content and treatment as in the book "Introduction to Topology and Modern Analysis" by G.F. Simmons, McGraw Hill Book Company, 1963.

Unit-I	Chapter 8: Section 44 only and
	Chapter 9: Sections 46, 47 and 48.
Unit-II	Chapter 9: Sections 49, 50 and 51.
Unit-III	Chapter 10: Sections 52 to 58.
Unit-IV	Chapter 11: Sections 60, 61 and 62.
Unit-V	Chapter 12: Sections 64 to 68.

REFERENCE BOOKS
1. Functional Analysis by B.V. Limaye, Prentice - Hall of India, New Delhi, 1981.
2. Functional Analysis by Bachmann and Narishi, Academic Press.
3. Beginning Functional Analysis by Karen Saxe, Springer, 2002
4. A First Course in Functional Analysis by C. Goffman and G. Padrick, Chelsea Pub.

IMAT 102   STOCHASTIC PROCESSES

Objectives: Advanced level of Mathematical Sophistication and enhancing the horizons of knowledge are the major objectives of this paper. This paper deals with the theory of Markov and renewal processes. Because of the simplicity and applicability, more theoretical discussion is devoted to Markov processes. Nevertheless, some simple concepts of renewal theory and stationary processes have also been included. The aim is to familiarize the student with the use of stochastic models in different areas.

UNIT - I: Stochastic Processes:
Introduction, Specification of Stochastic Processes, Stationary Process, Martingales.
Markov Chains:
Definition and Examples, Higher Transition Probabilities, Generalization of independent Bernoulli Trials: Sequence of Chain Dependent Trials, Classification of States and Chains.
UNIT - II: More on Markov Chains:

Determination of Higher Transition Probabilities, Stability of a Markov System, Markov Chain with Denumerable Number of States, Reducible Chains.

UNIT - III: Markov Processes with Discrete State Space: Poisson Process and its Extensions:

Poisson Process, Poisson Process and Related Distributions, Generalization of Poisson Process, Birth and Death Process, Markov Process with Discrete State Space (Continuous Time Markov Chains).

UNIT - IV: Markov Chains and Markov Processes with Continuous State Space:

Markov Chains with Continuous State Space, Introduction, Brownian Motion, Wiener Process, Differential Equations for a Wiener Process, Kolmogorov Equations, First Passage Time Distribution for Wiener Process.

UNIT - V: Renewal Processes and Theory:

Renewal Process, Renewal Processes in Continuous Time, Renewal Equation, Stopping time: Wald's Equation, Renewal Theorems, Delayed and Equilibrium Renewal Processes.

TEXT BOOK

Content and treatment as in the book "Stochastic Processes" by J. Medhi, New Age International (P) Limited, Publishers, New Delhi, (Second Edition), 1994.

Unit-I   Chapter 2: Sections 1 to 4 and Chapter 3: Sections 1 to 4.
Unit-II   Chapter 3: Sections 5,6,8 and 9.
Unit-III Chapter 4: Sections 1 to 5.
Unit-IV Chapter 3: Section 11
                  Chapter 5: Sections 1 to 5.
Unit-V   Chapter 6: Sections 1 to 6.

REFERENCE BOOKS

1. Stochastic Processes by J.L. Doob, Wiley, New York, 1953.
2. A First Course in Stochastic Processes, by S. Karlin and H.M. Taylor, Academic Press (second edition), New York, 1975.
3. Stochastic Processes by S.M. Ross, Wiley, New York, 1983.

IMAT 103 ALGEBRAIC NUMBER THEORY

Objectives: The prime aim of this paper is to enrich the knowledge of Number Theory. The concepts of primes, congruences, prime power moduli, power residues, quadratic residues, greatest integer function, Moebius inversion formula are introduced. Diophantine equations and their positive solutions are discussed. Algebraic numbers, algebraic integers, primes in quadratic fields and unique factorization property are also considered.

UNIT - I: Divisibility and Congruences:

Divisibility, Primes, Congruences, Solutions of Congruences, Congruences of degree 1, The function $\varphi(n)$, Congruences of higher degree.

UNIT - II: Quadratic Reciprocity:

Prime power moduli, Prime modulus, Congruences of degree two, Power Residues, Quadratic residues, Quadratic reciprocity, The Jacobi symbol.

UNIT - III: Some functions of number theory:

Greatest integer function, Arithmetic functions, The Moebius inversion formula, The Multiplication of Arithmetic functions.

UNIT - IV: Some Diophantine Equations:

Diophantine equations, The equation $ax+by=c$, Positive solutions, The equation $x^2+y^2=z^2$. Sums of four and five squares, Sum of two squares.

UNIT - V: Algebraic numbers:

Polynomials, Algebraic numbers, Algebraic integers, Quadratic fields, Units in Quadratic fields, Primes in quadratic fields, Unique Factorization in the fields $Q(\sqrt{m})$.

TEXT BOOK

Contents and treatment as in the book "An Introduction to the Theory of Numbers", Ivan Niven and H.S. Zuckerman, Wiley Eastern Limited, New Delhi, 1994.

Unit - I Chapter 1 Sections 1 to 3 and
Chapter 2 Sections 1 to 5
Unit - II   Chapter 2 Sections 6 to 9 and
Chapter 3 Sections 1 to 3
Unit – III   Chapter 4 Sections 1 to 4
Unit - IV   Chapter 5 Sections 1 to 3, 5,7 and 10
Unit - V   Chapter 9 Sections 1, 2 and 4 to 8

REFERENCE BOOKS
(1) Introduction to Analytical Number Theory, Tom M. Apostal, Narosa Pub. Company, New Delhi, 1980.
(2) Elementary Theory of Numbers, C.Y. Hsiung, World Scientific, Singapore, 1992.
(3) An Introduction to the Theory of Numbers, G.H. Hardy and E.M. Wright, Clarendon Press, (Third edition), 1954.

Optional 4
OIMAT 104A   FLUID DYNAMICS

Objectives: This course aims to discuss kinematics of fluids in motion, Equations of motion of a fluid, three dimensional flows, two dimensional flows and viscous flows.

Unit I:
        Kinematics of Fluids in Motion: Real fluids and ideal fluids – Velocity of a fluid at a point stream lines – path lines – Steady and unsteady flows – Velocity potential – The velocity vector – Local and particle rates of changes – Equations of continuity– Examples.

Unit II:
        Equation of Motion of a fluid: Pressure at a point in a fluid at rest – Pressure at a point in a moving fluid – Condition at a boundary of two invicid immersible fluids. Euler's equation of motion – Discussion of the case of steady motion under conservative body forces.

Unit III:
        Some three dimensional flows: Introduction – Sources – Sinks and doublets – Images in rigid infinite plane – Axis symmetric flows – Stokes stream function.

Unit IV:
        Some two-dimensional flows: Two dimensional flows – Meaning of two dimensional flow – Use of cylindrical polar co-ordinates – The stream function – Complex potential for two dimensional – Irrational incompressible flow – Complex velocity potential for standard two dimensional flows – Examples.

Unit V:
        Viscous flows: 21Viscous flows – Stress components in a real fluid –Relation between Cartesian components of stress – Translation motion of fluid elements – The rate of strain quadric and principle stresses – Further properties of the rate of strain quadric – Stress analysis in fluid motion – Relation between stress and rate of strain – The coefficients of viscosity and Laminar flow – The Navier – Stokes equations of motion of a viscous fluid.

Text Book:
        Content and treatment as in the book "Fluid Dynamic", F. Chorlton, CBS Publication New Delhi, 1985.

Unit – I   Chapter 2: Sections 2.1 to 2.8
Unit – II   Chapter 3: Sections 3.1 to 3.7
Unit – III   Chapter 4: Sections 4.1 to 4.3 and 4.5
Unit – IV   Chapter 5: Sections 5.1 to 5.6
Unit – V   Chapter 8: Sections 8.1 to 8.9.

References:
1. G.K. Batchaelor, An Introduction to Fluid Mechanics, Foundation Books, New Delhi,1994.

2. S.W. Yuan, Foundations of Fluid Mechanics, Prentice Hall of India Pvt.Ltd., New Delhi, 1976.
3. R.K. Rathy, An Introduction to Fluid Dynamics, IBH Publ. Comp. New Delhi,1976.

OIMAT 104B   FUZZY SETS AND THEIR APPLICATIONS

Objective:
      This course aims to offer fuzzy sets, fuzzy relations, fuzzy logic, fuzzy composition and applications.
Unit I:
      Fuzzy sets: Fuzzy sets – Basic types – Basic concepts - Characteristics – Significance of the paradigm shift – Additional properties of α- Cuts.
Unit II:
      Fuzzy Sets Versus CRISP Sets: Representation of Fuzzy sets – Extension principle of Fuzzy sets – Operation on Fuzzy Sets – Types of Operation – Fuzzy complements.
Unit III:
      Operations on Fuzzy Sets:Fuzzy intersection – t-norms, Fuzzy unions – t conorms – Combinations of operations – Aggregation operations.
Unit IV:
      Fuzzy Arithmetic: Fuzzy numbers – Linguistic variables – Arithmetic operation on intervals – Lattice of Fuzzy numbers.
Unit V:
      Constructing Fuzzy Sets: Methods of construction: An overview – Direct methods with one expert – Direct method with multiple experts – indirect method with multiple experts and one expert – Construction from sample data.
Text Book:
      Content and treatment as in the book "Fuzzy Sets and fuzzy Logic:Theory and Applications", G.J. Klir, and Bo Yuan, Prentice Hall of India Ltd., New Delhi, 2005.
      Unit – I   Chapter 1: Sections 1.3 to 1.5 and Chapter 2: Sections 2.1
      Unit – II   Chapter 2: Sections 2.2 to 2.3 and Chapter 3: Sections 3.1

                                                                                    to 3.2
      Unit – III   Chapter 3: Sections 3.3 to 3.6
      Unit – IV   Chapter 4: Sections 4.1 to 4.4
      Unit – V   Chapter 10: Sections 10.1 to 10.7
References:
1. H.J. Zimmermann, Fuzzy Set Theory and its Applications, Allied Publishers, Chennai, 1996.
2. A. Kaufman, Introduction to the Theory of Fuzzy Subsets, Academic Press, New York, 1975.
3. V.Novak, Fuzzy Sets and Their Applications, Adam Hilger, Bristol, 1969.

OPTIONAL - 1
(Other Department students to choose one from the following)

OIMAT 75A   PROGRAMMING LANGUAGE C

Objectives: The high level language C is introduced. The variables, constants and their types, Algebraic operations available in the language C are studied. Syntax for IF, IF-ELSE and other decision making statement are given. The switch statement which is an important decision making statement is discussed. Arrays and user-defined functions, available in other languages, are introduced. Pointer which is a special tool in the language C is explained.
UNIT-I
 Overview of C:
      Basic structure of C programs, Programming style.
Constants, Variables and Data Types:
Character set, C tokens, Keywords and identifiers, Constants, Variables, Data types, Declaration of variables, Assigning values to variables, Defining symbolic constants.

Operators and Expressions:

Arithmetic of Operators, Relational operators, Logical operators, Assignment operators, Increment and decrement operators, Conditional operator, Bitwise operators, Special operators, Arithmetic expressions, Evaluation of expressions, Precedence of arithmetic operators, Some computational problems, Type conversions in expressions, Operator precedence and associativity, Mathematical functions.

Managing Input and Output Operators:

Reading a character, Writing a character, Formatted input, Formatted output.

UNIT-II

Decision Making and Branching:

Decision making with IF statement, Simple IF statement, The IF-ELSE statement, Nesting of IF...ELSE statements, The ELSE IF ladder, The switch statement, The ?: Operator, The GOTO statement.

Decision Making and Looping:

The WHILE statement, The DO statement, The FOR statement, Jumps in loops.

UNIT-III

Arrays:

One-dimensional arrays, Two-dimensional arrays, Initializing two-dimensional arrays, Multidimensional arrays.

User-Defined Functions:

Need for user-defined functions, A multi-function program, The form of C functions, Return values and their types, Calling a function, Category of functions, No arguments and no return values, Arguments but no return values, Arguments with return values, Handling of non-integer functions, Nesting of functions, Recursion, Functions with arrays, The scope and lifetime of variables in functions, Ansi C functions, Points to remember.

UNIT-IV

 Structures and Unions:

Structure definition, Giving values to members, Structure initialization, Comparison of structure variables, Arrays of Structures, Arrays within structures, Structures within structures, Structures and functions, Unions, Size of structures, Bit fields.

Pointers:

Understanding pointers, Accessing the address of a variable, Declaring and initializing pointers, Accessing a variable through its pointer, Pointer expressions, Pointer increments and scale factor, Pointers and arrays, Pointers and character strings, Pointers and functions, Pointers and structures, Points on pointers.

UNIT-V

Dynamic Memory Allocation and Linked Lists:

Dynamic memory allocation, Concepts of linked lists, Advantages of linked lists, Types of linked lists, Pointers revisited, Basic list operations, Application of linked lists.

The Preprocessor:

Macro substitution, File inclusion, Compiler control directives, ANSI additions.

TEXT BOOK

Content and treatment as in the book "Programming in ANSI C" by   E. Balagurusamy, Tata McGraw Hill Pub. Co., Second Edition, 1989.

Unit I	-	Chapters 1 to 4.
Unit II	-	Chapters 5 and 6.
Unit III -		Chapters 7 and 9.
Unit IV -		Chapters 10 and 11.
Unit V	-	Chapters 13 and 14.

REFERENCE BOOK

"The Sprit of C An introduction to Modern Programming", by H. Mullish and L. Cooper, JAICO Pub., Mumbai, 1997.

OIMAT 75B   NUMERICAL METHODS

Objectives: The roll of numerical analysis is to develop and analyze the numerical techniques. In this paper, different methods for finding the roots of algebraic and transcendental equations, solutions of simultaneous equations, solutions of differential equations are concentrated. Numerical differentiation and integration are also evaluated.

UNIT - I: The solution of Numerical Algebraic and Transcendental Equations:

Introduction, The Bolzano's bisection method, Method of successive Approximations or the iteration method, The method of false position (Regula Falsi Method), Newton's iteration Method (Newton - Raphson method).

UNIT - II: Simultaneous Linear Algebraic Equations:

Gauss Elimination method, Computation of the inverse of a matrix using Gauss elimination method, Method of Triangularisation (Method of Factorization), Crout's method, Iterative methods, Jacobi method of iteration (Gauss-Jacobi Method), Gauss Seidal method of iteration.

UNIT - III: Interpolation:

Introduction, Linear interpolation, Gregory Newton Forward and Backward interpolation Formula, Equidistant terms with one or more missing values.

Interpolation with unequal intervals:

Divided Differences, Properties of Divided differences, Newton's interpolation formula for unequal intervals, Lagrange's interpolation formula, Inverse interpolation.

UNIT - IV: Numerical Differentiation and Integration:

Introduction, Newton's forward difference formula to compute the derivatives, Newton's backward difference formula to compute the derivatives, Derivatives using Stirling's formula.

Trapezoidal rule, Simpson's rule, Practical applications of Simpson's rule, Trapezoidal rules.

UNIT - V: Numerical Solution of Ordinary Differential Equations:

Euler's method, improved Euler method, modified Euler method, Runge-Kutta methods, Second order Runge-Kutta Method, Higher order Runge - Kutta method.

TEXT BOOK

Content and treatment as in the book "Numerical Methods in Science and Engineering" by M.K. Venkataraman, The National Publishing Company, Madras, 1991.

Chapters - III, IV, VI, IX, XI.

REFERENCE BOOKS

1. Introductory Methods of Numerical Analysis by S.S. Sastry, Prentice Hall of India (P) Ltd. 1994.
2. Numerical Methods for Scientific and Engineering Computation, M.K. Jain, S.R.K. Iyengar, and R.K. Jain, Wiley Eastern Ltd., Third Edition, 1993.

OPTIONAL - 2
(Other Department students to choose one from the following)
OIMAT 87A DISCRETE MATHEMATICS
(For all M.Sc. students except Mathematics)

Objectives: Students must understand mathematical reasoning in order to read, comprehend and construct mathematical arguments. Mathematical logic, which serves as foundation for subsequent discussion is discussed. Discrete structures such as sets and permutations are studied. Discrete probability, recurrence relations, conquer relations and principles of inclusion and exclusion are studied.

UNIT I: Logic and Counting:

Propositions and logical operations, Conditional statements, Methods of Proof, Mathematical Induction. Permutations, Combinations, Pigeonhole Principle, Elements of Probability, Recurrence Relations.

UNIT II: Relations and Digraphs:

Product sets and partitions, Relations and Digraphs, Paths in Relations and Digraphs, Properties of relations, Equivalence Relations, Computer Representation of Relations and Digraphs, Operations on Relations, Transitive Closure and Warshall's Algorithm.

UNIT III: Functions:

Functions, Functions for Computer Science, Growth of Functions, Permutation Functions.

UNIT IV: Order Relations and Structures:

Partially Ordered Sets, Extremal Elements of Partially Ordered Sets, Lattice, Finite Boolean Algebras, Functions on Boolean Algebra, Circuit Designs.

UNIT V: Semigroups and Groups:

Semigroups, Product and Quotient of Semigroups, Groups, Product and Quotient of Groups.

TEXT BOOK

Content and treatment as in the book "Discrete Mathematical Structures" by Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, Prentice - Hall of India, Private Limited, New Delhi, 2002.

Unit I	Chapter 2 Sections 1 to 4, Chapter 3 Sections 1 to 5.
Unit II	Chapter 4 Sections 1 to 8.
Unit III	Chapter 5 Sections 1 to 4.
Unit IV	Chapter 6 Sections 1 to 6.
Unit V	Chapter 9 Sections 1 to 4.

REFERENCE BOOKS

1. Discrete Mathematics with Graph Theory by E.G. Goodaire and M.M. Paramenter, Prentice Hall International Editions, New Jersey (1998).
2. Invitation to Discrete Mathematics by J. Matonsek and J. Nesetril, Clarendon Press, Oxford (1998).
3. Discrete Mathematical Structures with Applications to Computer Science by J.P. Tremblay and R. Manohar, Tata McGraw Hill Publication Company, 1997.

OIMAT 87B   PROGRAMMING LANGUAGE C++

Objectives: After having a course on the language C, the much sought after language is C++. The language C++ is a Object Oriented Programming Language. First the syntax of the language C++ is introduced. This is followed by Control statement, Arrays, Functions, Pointers, Structures and Classes. Many problems are solved after writing algorithms and programs in C++.

UNIT - I: Using Turbo C++:

Setting Up Turbo C++, Memory Models, The Demonstration Tour, Borland Program Examples, Borland C++ Options, Take the Tour. Your First Program: Invoking Turbo C++, Naming Your Program, Using the Editor, Saving Your Program, Compiling and Linking, Running the program. Errors: Compiler Errors, Linker Errors, Run-time Errors. Other IDE features: Compiling and Linking Shortcut, Exiting from the IDE, Examining Files, Opening an Existing File, DOS Shell.

C++ Programming Basics:

Basic Program Construction: Functions, Program Statements, White Space. Output Using Cout: String Constants. Preprocessor Directives: The # include Directive, Header Files. Comments: Comments Syntax, When to Use Comments, Alternative Comment Syntax. Integer variables: Defining Integer Variables, Declarations and Definitions, Variable Names, Assignment Statement, Integer Constants, Output variations. Character Variables: Character Constants, Initialization, Escape Sequences. Input with Cin: Variables Defined at Point of Use, Cascading, Expressions, Precedence. Type float: Floating-Point Constants, The Const Qualifier, The # define Directive. Manipulators: The end L Manipulator, The set W Manipulator, Type Long, Cascading the Insertion Operator, Multiple definitions, The IOMANIP.H Header File. Variable Type Summary: Unsigned data types. Type Conversion: Automatic Conversions, Casts. Arithmetic operators: The Remainder Operator, Arithmetic Assignment operators, Increment Operators.

Library Functions: Header Files, Library Files, Header Files and Library Files, Two Ways to Use # include.

UNIT - II: Loops and Decisions:

Relational operators. Loops: The for Loop, Using Turbo C++ Debugging Features, for Loop Variations, The while Loop, Precedence: Arithmetic and Relational Operators, The do loop, When to Use Which Loop. Decisions: The if Statement, The if...else Statement, The else...if Construction, The Switch Statement. The Conditional Operator. Logical Operators: Logical OR Operator, Logical AND Operator, The Logical NOT Operator, Precedence Summary, Other Control Statements, The break Statement, The continue Statement, The GOTO Statement.

UNIT - III: Functions:

Simple Functions: The Function Declaration, Calling the Function, The Function Definition, Comparison with Library Functions, Eliminating the Declaration. Passing Arguments to Functions: Passing Constants, Passing Variables, Passing by Value, Passing Structure Variables, Names in the Declaration. Returning Values from Functions: The return Statement, Returning structure Variables. Reference Arguments: Passing Simple Data Types by Reference. Overloaded Functions: Different Numbers of Arguments, Different Kinds of Arguments. Inline Functions: Default Arguments, Variables and Storage Classes: Automatic Variables, External Variables, Static Variables, Storage, Returning by Reference.

UNIT - IV: Arrays:

Array Fundamentals. Defining Arrays, Array Elements, Accessing Array Elements, Averaging Array Elements, Initializing Arrays, Multidimensional Arrays, Passing Arrays to Functions, Arrays of Structures. Arrays as Class Member Data: Arrays of Objects, Arrays of English Distances, Arrays of Cards, String: Variables, Avoiding Buffer Overflow, String Constants, Reading Embedded Blanks, Reading Multiple Lines, Copying a String the Hard Way, Copying a String the Easy Way, Arrays of Strings, Strings as Class Members, A User-Defined String Type.

UNIT - V: Pointers:

Addresses and Pointers, The Address of Operator & Pointer Variables, Accessing the Variable Pointed To, Pointer to void. Pointers and Arrays: Pointer Constants and Pointer Variables. Pointers and Functions: Passing Simple Variables, Passing arrays, Sorting Array Elements. Pointers and Strings: Pointers to String Constants, Strings as Function Arguments, Copying a String Using Pointers, Library String Functions, Arrays of Pointers to Strings.

TEXT BOOK

Content and treatment as in the book "Object-Oriented Programming in TURBO C++" by Robert Lafore, Galgotia Publications Pvt. Ltd., New Delhi, 1996.

Unit-I   Chapters 2 & 3
Unit-II Chapter 4
Unit-III Chapter 6
Unit-IV Chapter 8
Unit-V Chapter 12

REFERENCE BOOK

Programming in ANSI C by E. Balagurusamy, Tata McGraw Hill Publishing Ltd., (Second Edition), New Delhi, 1992.

<div align="center">

Ancillary Papers
Offered by the Department of Mathematics to students of Ist and IInd semesters of Five year Integrated M.Sc. Courses in other Departments of Faculty of Science

MATHEMATICS – I

</div>

Objectives: The aim of this paper is to introduce the concepts of series, convergence, test for convergence, matrices, rank, Eigen values, Eigen vectors and Caley-Hamilton theorem. Some ideas of trigonometry like expansion of sines and cosines, in powers of sin θ, cos θ are studied. The concept of differentiation and its applications are also introduced.

UNIT- I

Series, Comparision test, Integral test, Comparision of ratios, D'Alembert's ratio test, Cauchy's root test, Alternating series, Convergence of exponential series, Uniform convergence.

UNIT- II

Matrix operations, Rank of a matrix, Normal form of a matrix, Inverse of a matrix, Eigen values and Eigen vectors, Caley-Hamilton theorem, Reduction to a diagonal form.

UNIT-III

Expansion of sin $n\theta$, cos $n\theta$, tan $n\theta$ in powers of sin θ, cos θ and tan θ, Exponential function of a complex variable, circular function of a complex variable, Hyperbolic functions, Inverse hyperbolic functions.

UNIT-IV

Differentiation, Successive differentiation, Meaning of derivative.

UNIT- V

Maxima and minima, Rolle's theorem and Mean value theorem, Expansions of functions, Partial differentiation.

TEXT BOOK:

Content and treatment as in the book "Higher Engineering Mathematics" by B.S. Grewal, Khanna Publishers, 2008.

Unit I   Chapter 9 Sections 9.3 to 9.17 except 9.14
Unit II   Chapter 2 Sections 2.5 to 2.9 and 2.14 to 2.17
Unit III Chapter 19 Section 19.6 to 19.11

Content and treatment as in the book "Calculus" Vol. I by S. Narayanan and T.K. Manicavachogam Pillay, S. Viswanathan Printers, 2009.

Unit IV Chapters 2,3 and 4
Unit V   Chapters 5,6,7 and 8 (Sections 1.1 to 1.7)

REFERENCE BOOKS:

1. G.B.Thomas and R.L.Finney. (1998) Calculus and Analytic Geometry, Addison Wesley (9 th Edn), Mass. (Indian Print).
2. M.K.Venkataraman. (1992) Engineering Mathematics-Part B. National Publishing Company, Chennai.

MATHEMATICS – II

Objectives: In this paper the student is exposed to the idea of integration and different methods of integration. The application of integration to the evaluation of areas and volumes is also introduced. The notion of vector and its derivative is also taught. The notion of line integral, surface integral and volume integral using vectors is also studied and the verification of three basic theorems of vector calculus namely Green's theorem, Gauss divergence theorem and Stoke's theorem are carriedout.

UNIT-I Integration

Introduction, Definite integral, Methods of integration, Integrals of the form

(i) $\int \dfrac{f'(x)}{f(x)} dx$

(ii) $\int F\{f(x)\}f'(x)\,dx$

(iii) $\int \dfrac{dx}{ax^2+bx+c} dx$

(iv) $\int \dfrac{lx+m}{ax^2+bx+c} dx$

(v) $\int \dfrac{1}{\sqrt{ax^2+bx+c}}$

(vi) $\int \dfrac{px+q}{\sqrt{ax^2+bx+c}} dx$

UNIT-II Integration

Properties of definite integrals, Integration by parts, Reduction formula for the following types

(i) $I_n = \int x^n e^{ax}$ S n→+ve integer

(ii) $I_n = \int \cos^n x \, dx$ n, positive integer

(iii) $I_n = \int \sin^n x \, dx$

(iv) $I_{m,n} = \int \sin^m x \cos^n x \, dx$ Bernoulli's formula.

UNIT-III

Area under plane curves, Area of a closed curves, Area between two intersecting curves, Areas in polar coordinates, Volume of the solid of revolution, Length of a curve, Area of surface of revolution.

UNIT – IV

Vector differentiation, Scalar functions, Vector functions, Differentiation of a vector, Differentaitions formulas, Differentation of dot and cross products, The Vector differential operator Del, Gradient of a scalar function, Directional derivatives, Divergence of a vector, Curl of a vector, Expansion formulae, Second order differential operators, Solenoidal and irrotational fields.

UNIT – V

Vector integration, The line integral, Green's theorem in two dimesions-verification, Gauss divergence theorem (without proof)-verification and evaluation of integrals, Stoke's theorem (without proof)-verification and evaluation of integrals.

TEXT BOOK:

Content and treatment as in the book "Calculus (Major)" Vol. II by S. Narayanan and T.K. Manicavachogam Pillay, S. Viswanathan Printers, 2003.

      Unit I   Chapter 1 Sections 1 to 8

      Unit II   Chapter 1 Sections 11 to 15.1

      Unit III   Chapter 2 Sections 1.1 to 1.4, Sections 3 to 5

Content and treatment as in the book "Vector Calculus and Fourier Series" by M.K. Venkataraman and Manorama Sridhar, by The National Publishing Company, 2002.

      Unit IV   Chapter 2 Sections 2.2 to 2.4, 2.6, 2.7.

                            Chapter 3 Sections 3.2, 3.3, 3.4, 3.7, 3.9, 3.11, 3.12, 3.15.

      Unit V   Chapter 4 Sections 4.1, 4.3, 4.9 and 4.12

REFERENCE BOOKS:

1. G.B.Thomas and R.L.Finney. (1998) Calculus and Analytic Geometry, Addison Wesley (9th Edn), Mass. (Indian Print).
2. M.K.Venkataraman. (1992) Engineering Mathematics-Part B. National Publishing Company, Chennai.
3. P.R.Vittal. (2004) Vector Calculus, Fourier series and Fourier Transform. Margham Publications, Chennai.
4. B.S. Grewal (2008) Higher Engineering Mathematics, Khanna Publishers, 2008.