

**B.Sc.,B.Ed.,**

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**PART III**  
**SPECIALIZATION OF THE SUBJECTS**  
**(MAIN)**

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**MATHEMATICS**  
**PHYSICS**  
**CHEMISTRY**  
**BOTANY**  
**ZOOLOGY**  
**COMPUTER SCIENCE**

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**PART III**  
**MATHEMATICS**

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**B.Sc., B.Ed. LIBERAL OPTIONS**  
**PART III: B.SC.B.ED.**  
**Branch: MATHEMATICS**

SEM	No.	CODE	Sub	Name of the course	CCE	UE	Total
I	Core 1		Main 1	Theory of Equations & Trigonometry	30	70	100
	Core 2		Main 2	Differential Calculus	30	70	100
	Core 3		Main 3	Analytical Geometry 3D	30	70	100
	Core 4 (Supportive 1)		Anci 1-1	Physics I / Fundamentals of Computers	30	70	100
II	Core 5		Main 4	Integral Calculus	30	70	100
	Core 6		Main 5	Abstract Algebra	30	70	100
	Core 7		Main 6	Real Analysis I	30	70	100
	Core 8 (Supportive 2)		Anci 1-2	Physics II/ Principles of Programming and "C"	30	70	100
III	Core 9		Main 7	Linear Algebra	30	70	100
	Core 10		Main 8	Ordinary Differential Equations	30	70	100
	Core 11		Main 9	Operations Research I	30	70	100
	Core 12 (Supportive 3)		Anci 2-1	Chemistry I/Object Oriented Programming	30	70	100
IV	Core 13		Main 10	Real Analysis II	30	70	100
	Core 14		Main 11	Complex Analysis I	30	70	100
	Core 15		Main 12	Mathematical Statistics I	30	70	100
	Core 16 (Supportive 4)		Anci 2-2	Chemistry II/ Visual Programming	30	70	100
V	Core 17		Main 13	Partial Differential Equations	30	70	100
	Core 18		Main 14	Vector Calculus	30	70	100
VI	Core 19		Main 15	Operations Research II	30	70	100
	Core 20		Main 16	Complex Analysis II	30	70	100
VII	Core 21		Main 17	Mathematical Statistics II	30	70	100
VIII	Core 22		Main 18	Numerical Methods & Programming Lab	30	70	100

\*note: Stream for Supportive Papers should be chosen in the first semester, same stream should be chosen in the successive semesters

Stream A: Science related papers (Physics I, II and Chemistry I, II) or

Stream B: Computer related papers

**B.SC., B.ED. MATHEMATICS**  
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**CORE 1: THEORY OF EQUATIONS & TRIGONOMETRY**

<b>UNIT I</b>	Relations between the roots and the coefficients of a general polynomial equations in one variable – Transformation of equations – Descarte’s rule of signs.
<b>UNIT II</b>	Solution of cubic equations :Cardon's Method - Trigonometrical method – Horner’s Method, Bi-quadratic equation – Ferrari method.
<b>UNIT III</b>	De Moivre’s theorem and its applications – Direct and Inverse circular and hyperbolic functions.
<b>UNIT IV</b>	Logarithm of a complex quantity- Expansion of Trigonometrical functions.
<b>UNIT V</b>	Gregory's series- Summation of series.
<b>Prescribed Text(specify sections clearly)</b>	<ol style="list-style-type: none"> <li>1. Algebra Volume-1, T.K. Manicavachagom Pillay , T.Natarajan and K.S. Ganapathy,. Viswanathan (Printers &amp; Publishers) Pvt. Lid, (1999)</li> <li>2. Trigonometry, S. Narayanan and T.K. Manicavachagom Pillai, S. Viswanathan (Printers &amp; Publishers) Pvt. Ltd, (1997)</li> </ol>
<b>Recommended books</b>	1. Plane Trigonometry-Part-I&II(6 <sup>th</sup> Edition), S.L.Loney, Arihant Publications, 2016.
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>

## CORE 2: DIFFERENTIAL CALCULUS

UNIT I	$n^{\text{th}}$ derivative – Standard results – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula.
UNIT II	Total differential coefficients – Euler’s theorem - Partial derivatives of a function of two functions -Equations of tangent and normal - Taylor expansions of single and double variables.
UNIT III	Maxima and Minima of two variables – Lagrange’s method of undetermined multipliers - Angle of intersection of curves – Sub tangent and Sub Normal. -
UNIT IV	Angle between the radius vector and tangent – Angle between the intersection of two curves – Polar sub tangent and sub normal.
UNIT V	Circle, radius and centre of curvature – Cartesian formula for radius of curvature – envelope.
<i>Prescribed Text(specify sections clearly)</i>	<i>Calculus Volume — I, T. K. Manickavachagom Pillai, Printers and Publishers (May1992 Edition)</i> <i>Unit 1 : Chapter 3</i> <i>Unit 2: Chapter 8</i> <i>Unit 3 : Chapter 8, 9</i> <i>Unit 4 : Chapter 9</i> <i>Unit 5 : Chapter 10 (Section 1)</i>
<i>Reference books</i>	<ol style="list-style-type: none"> <li><i>Calculus(2<sup>nd</sup> Edition), Lipman Bers and Frank Karal, Holt McDougal, 1976.</i></li> <li><i>Thomas’ Calculus 12<sup>th</sup> Edition, George B.Thomas, Maurice D.Weir and Joel Hass, Pearson Education, 2015.</i></li> </ol>
<i>e-Learning Source</i>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>



**SEMESTER I**

Part III - B.Sc.B.Ed - Mathematics Syllabi

Pondicherry University

**CORE 3:ANALYTICAL GEOMETRY 3D**

UNIT I	Angle between 2 lines-projections-direction cosines-relation between the direction cosines of a straight line-the projection of the line joining $P(x_1,y_1,z_1)$ and $Q(x_2,y_2,z_2)$ on any line with d.c.'s $l,m,n$ -direction cosines of any line joining 2 points-angle between the lines whose direction cosines are $(l_1,m_1,n_1)$ and $(l_2,m_2,n_2)$ .
UNIT II	General equation, angle between two planes, length of perpendicular from a given point to a plane, equations of the plane bisecting the angle between two planes.
UNIT III	Symmetrical form, line through two points, reduction of unsymmetrical form to the symmetrical form - condition for a line to lie on a plane - plane through a line - condition for the two lines to be coplanar (Cartesian form) - equation of the plane containing two lines - To find the shortest distance between two skew lines - equation of the shortest Distance in Cartesian.
UNIT IV	Equation of a sphere with given centre and radius - general equation of a sphere - diameter form - and circular section.
UNIT V	Equation of a Cone with its vertex at the origin - equation of a quadratic cone with given vertex and given guiding curve - necessary condition for general equation of second degree to represent a cone - circular cone - equation of circular cone with given vertex - axis and semi vertical angle.
<i>Prescribed Text (specify sections clearly)</i>	<i>1. A Text Book of Analytical Geometry of Three dimensions by T.K.Manickavachagom Pillai and T.Natarajan S. Viswanathan Printers &amp; Publishers) — (2008)</i>
<i>Reference books</i>	<i>1. Text Book of Analytic Geometry -2D, P. Durai Pandian, EMERALD Publishers (1968) 2. Simplified Course in Solid Geometry(3D) by H.K.Dasse, H.C.Saxena, M.D.Raisinghania – S.Chand &amp; Company</i>
<i>e-Learning Source</i>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>

**CORE 4: (SUPPORTIVE 1) PHYSICS I**

**UNIT-I:** Moment of inertia – radius of gyration - parallel and perpendicular axis theorem, calculation of moment of inertia of (a) ring (b) disc (c) hollow and solid spheres. Angular momentum, torque and the relation between them. Simple harmonic motion, equation of SHM, composition of two SHM at right angles, Lissajous figures.

**UNIT-II:** Young's modulus — bulk modulus — rigidity modulus and Poisson's ratio — derivation of the expression for bending moment of a beam in terms of its curvature of neutral axis – determination of Young's modulus of a rectangular bar — non – uniform bending — pin and microscope method-with theory (mathematical derivation) – expression for couple per unit twist-determination of rigidity modulus – torsion pendulum.

**UNIT-III:** Surface tension and surface energy – interfacial surface tension-experimental determination of surface tension by drop weight method-variation of surface tension with temperature — Jaeger's method – streamline and turbulent motion- equation of continuity.

**UNIT -IV:** Newton's law of cooling – determination of specific heat of liquid-Barton's cooling correction in calorimetric experiments – specific heat capacity of gases – ratio of specific heat capacities — determination of the ratio of specific heats of gases – Clement and Desormes method. Coefficient of thermal conductivity of a bad conductor - Lee's disc method-determination of thermal conductivity by Forbes's method. Blackbody radiation-Stefan's law – determination of Stefan's constant — second law of thermodynamics –Carnot cycle – indicator diagram – derivation of efficiency-Kelvin temperature scale.

**UNIT - V:** Interference — method of producing coherent sources - Fresnel's biprism — Newton's rings through transmission and reflection - Interferometers - Michelson's Interferometer – wavelength determination - Jamin's refractometer. Diffraction - Fresnel's diffraction – Fraunhofer diffraction – half period zones-rectilinear propagation of light – diffraction at a straight edge. Polarization – optical activity-specific rotator power – Polarimeter – Lawrence half shade - determination of specific rotator power-double refraction – optic axis.

**TEXTBOOKS:**

1. Dr.Sabesan and others, A Textbook of Allied Physics Vol-I and Vol-II
2. Ponnusamy and others, Ancillary Physics.
3. Kamalakannan and others, Ancillary Physics.

**REFERENCE BOOKS**

1. Halliday, Resnik & Walker, Fundamentals of Physics, 5 Ed.(Asian Books Pvt. Ltd., New Delhi)

**PHYSICS I – PRACTICALS**

**Choose any 7 experiments from the list given below for each semester without overlap**

**LIST OF EXPERIMENTS:**

1. Young's modulus-Non-Uniform bending-Pin& Microscope
2. Rigidity modulus-Torsional oscillations without masses.
3. Comparison of coefficient of viscosity.
4. Surface tension of a liquid and interfacial surface tension by drop weight method.
5. Spectrometer –Refractive index of a liquid- Hollow prism.
6. Spectrometer -Grating-N determination by normal incidence method.
7. Spectrometer -Grating-wavelength determination by minimum deviation method.
8. Newton's Rings.
9. Thermal conductivity of a bad conductor - Lee's disc method
10. Post office box- laws of resistance and specific resistance.
11. Melde's apparatus-Determination of frequency.
12. Meter Bridge - Temperature coefficient of the material of a coil of wire
13. Potentiometer – calibration of low range voltmeter (0 -1.5 V).
14. Potentiometer - calibration of ammeter (0-1.5 amps).
15. Figure of merit of a periodic moving coil galvanometer.
16. Field along the axis of the circular coil carrying current- Determination of BH.
17. Newton's law of cooling and specific heat determination
18. Frequency measurement by forming Lissajous figures
19. Study of Half wave rectifier.
20. Transistor characteristics-CE mode- only transfer characteristics.

**TEXTBOOKS:**

1. Ouseph and V.Srinivasan, Practical Physics- Part-I &II.

**REFERENCE BOOKS**

1. Mathchan Lazarus and others-Practical Physics.

**CORE 4: (SUPPORTIVE 1) FUNDAMENTALS OF COMPUTER SCIENCE****UNIT I**

Introduction of computers- Generations of Modern computers Classification of digital Computer. Memory Units: RAM, ROM, PROM, EPROM, and EEPROM Auxiliary Storage Devices: Magnetic storage devices-Floppy Diskettes, Hard disks, Removable Hard disks, Magnetic Tapes, Optical Storage-CD-ROM.

**UNIT II**

Input Devices: Keyboard, Mouse, Track ball, Joystick, Scanner, Digital Camera, MICR, OCR, Barcode Reader, Touch Screen, Light Pen. Output Devices: Monitor, Printer, Plotter, Sound Card and Speaker.

**UNIT III**

Programming Languages; Machine Language, Assembly Language, High Level Language, Types of High-Level Language - Introduction to Software Development: Defining the Problem, Program Design, Coding, Testing, Documenting, and maintaining the program.

**UNIT IV**

Introduction to C- Character set, Tokens, Identifiers and keywords. Data type, Declarations, Expressions, statements and symbolic constants, Input-Output: getchar, putchar, scanf, printf, gets, puts, Pre-processor commands, #include, define, preparing and running a complete C program.

**UNIT V**

Operators and expressions: Arithmetic, Unary, Logical, bit-wise, assignments and conditional operator, comma operator , Library functions. Control statements: While, do, for statement, jump in loops, nested loops, if-else, switch, break, continue and goto statements.

**TEXT BOOK**

- 1.Alexis Leon and Mathews Leon, Introduction to Computers , Leon TECHWorld, 1999.
- 2.E. Balagurusamy , Programming In ANSI C , Tata McGraw Hill , 2004

**REFERENCE**

- 1.Peter Norton, Introduction to Computers , Second edition, Tata McGraw Hill Publications 1998.
- 2.Byron S. Gottfried, Programming with C , Schaum s Outline Series, TMH ,2<sup>nd</sup> Edition 1998.
3. Kris A. Jamsa , Programming in C , Galgotia Publications PVT.Ltd. (1988).
- 4.Kernighan, B.W...,and Ritchie, D.M., The C Programming Language Prentice Hall of India, 1989.

**PRACTICAL - COMPUTER PRACTICE LAB**

**MS-WORD**

1. Text Manipulations and Text Formatting
2. Usage of Bookmarks, Footnotes, Columns & Hyperlink
3. Usage of Header, Footer, Bulleting and Numbering & Borders and Shading
4. Usage of Tables - Sorting & Formatting
5. Usage of Spell Check, Find and replace
6. Picture insertion and alignment
7. Creation of documents using templates
8. Mail Merge, Envelopes and Labels

**MS-EXCEL**

9. Cell Editing and Formatting
10. Usage of Formulae and Built-in functions
11. Data Sorting, filter, form, subtotal, validation, Goal seek
12. Inserting Clip arts, objects, pictures and Data Filter, Validation, Subtotals
13. Usage of auditing, comments
14. Graph
15. Usage of Auto Formatting, Conditional Formatting & Style

**MS - POWER POINT**

16. Inserting New slides, text box, object, charts, tables, pictures, movies and sound
17. Slide layout, Colour Scheme, Background and Design template
18. Preparation of organizational charts
19. Preset and custom animation, action buttons and settings, Slide Transitions and animations, view show, slide sorter view
20. Presentation using Wizards
21. Usage of Design templates

**Introduction to C- PROGRAMMING**

22. Check for Biggest Number ,Prime Number, Armstrong number,
23. Fibonacci Series
24. Summation of the series:  $\sin(x)$  ,  $\cos(x)$ ,  $\exp(x)$

## CORE 5: INTEGRAL CALCULUS

<b>UNIT I</b>	Integration of rational algebraic functions – Integration of irrational algebraic functions - Properties of definite integrals
<b>UNIT II</b>	Integration by parts – Bernoulli’s formula – Reduction formulae
<b>UNIT III</b>	Evaluation of double integral – Changing of order of integration - Double integral in Polar co-ordinates – Triple integral
<b>UNIT IV</b>	Jacobian – Change of variables in the case of two variable and three variables – Transformation from Cartesian to polar co-ordinate - Transformation from Cartesian to spherical co-ordinates -
<b>UNIT V</b>	Properties – relation between Beta and Gamma functions - Recurrence formula
<b>Prescribed Text(specify sections clearly)</b>	<i>Calculus Volume II , S.Narayanan and T.K. Manickavasagam Pillai (2008)</i> Unit I : Chapter 1 : 7.3, 7.4, 7.5, 8, 11 Unit II : Chapter 1: 12,13, Unit III: Chapter 5 : 2.1, 2.2, 3.1, 4 Unit IV : Chapter 6: 1.1, 1.2, 2.1,2.2,2.3,2.4 Unit v: Chapter 7: 2.1, 2.2, 2.3, 3, 4, 5
<b>Reference books</b>	<ol style="list-style-type: none"> <li>1. <i>Integral Calculus, N. P. Bali, Laxmi Publications, Delhi, (1991)</i></li> <li>2. <i>Calculus(2<sup>nd</sup> Edition), Lipman Bers and Frank Karal, Holt McDougal, 1976.</i></li> <li>3. <i>Thomas’ Calculus 12<sup>th</sup> Edition, George B.Thomas, Maurice D.Weir and Joel Hass, Pearson Education, 2015.</i></li> </ol>
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>

## CORE 6: ABSTRACT ALGEBRA

<b>UNIT I</b>	Definition of Group - examples of groups - Some preliminary lemmas - Subgroups.
<b>UNIT II</b>	A counting principle - Normal subgroups and Quotient Groups – Homomorphisms.
<b>UNIT III</b>	Automorphisms - Cayley's theorem - Permutation groups.
<b>UNIT IV</b>	Definition of Ring- examples of a rings - Some special classes of rings - Homomorphisms – Ideals and quotients rings.
<b>UNIT V</b>	More ideals and quotients rings -The field of quotients of an integral domain.
<b>Prescribed Text(specify sections clearly)</b>	<i>I.N. Herstein, Topics in Algebra (Second Edition), John Wiley &amp; Sons (2003)</i> Unit I : Sections 2.1 to 2.4 Unit II : Sections 2.5 to 2.7(except applications 1 & 2 of 2.7) Unit III: Sections 2.8 to 2.10 Unit IV: Sections 3.1 to 3.3 Unit V : Sections 3.4,3.6
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. A First course in Algebra by J. B. Fraleigh, Addison Wesley.</li> <li>2. Modern Algebra by M.L. Santiago, (TMG)</li> <li>3. Abstract Algebra(3<sup>rd</sup> Edition), I.N.Herstein, John Wiley, 1996.</li> </ol>
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>

## CORE 7: REAL ANALYSIS I

<b>UNIT I</b>	Sets and elements — Operations on sets — Functions - Real valued functions - Equivalence — Countability — Real numbers — Least upper bound — Greatest lower bound.
<b>UNIT II</b>	Definition of sequence and subsequence — Limit of a sequence — Convergent sequence — Bounded sequence Monotone sequence - Operation on convergent sequence - Limit superior and limit inferior — Cauchy sequence
<b>UNIT III</b>	Convergence and divergence- Series with non - negative terms - Alternating series — Conditional convergence and absolute convergence- Tests for absolute convergence - Series whose terms form a non - increasing sequence — Summation by parts.
<b>UNIT IV</b>	Limit of a function on the real line - Metric spaces (Examples 4 and 5 under 4.2 c to be omitted) - Limits in metric spaces.
<b>UNIT V</b>	Functions continuous at a point on the real line Reformulation — Functions continuous on a metric space - Open sets and closed sets – Discontinuous functions on $\mathbb{R}$
<b>Prescribed Text (specify sections clearly)</b>	<i>Methods of Real Analysis, Treatment as in Richard R. Goldberg (1970)</i> Unit 1 : Chapter 1 Unit 2, 3: Chapter 2 and Chapter 3 (up to 3.8) Unit 4 : Chapter 4 Unit 5 : Chapter 5
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. <i>A First Course in Mathematical Analysis- D somasundaram &amp; B Choudhyri- Narosa Publishing house New Dehli</i></li> <li>2. <i>Introduction to Calculus and Analysis, Vol.I, Richard Courant and Fritz John, Springer 1999.</i></li> <li>3. <i>Introduction to Real Analysis, 4<sup>th</sup> Edition, Robert G. Bartle and Donald R. Sherbert, Wiley-2014.</i></li> </ol>
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>



**CORE 8: (SUPPORTIVE 2) PHYSICS II**

**UNIT-I:** Ultrasonics – magnetostriction – piezo electric methods – properties of ultrasonic waves and applications.

**UNIT -II:**Gauss's law with proof – Electric intensity and potential due to a uniformly charged hollow conductor at a point outside, on the surface and inside a spherical conductor — capacity of a parallel plate condenser with and without a dielectric slab - capacity of a spherical conductor-Biot & Savart's law — field along the axis of a circular coil carrying current – force on current carrying conductor placed in a magnetic field – theory of moving coil galvanometer.

**UNIT -III:** Magnetic properties of materials – relation between – the three magnetic vectors – susceptibility and permeability - para, dia and ferromagnetism (qualitative ideas) – magnetic hysteresis – superconductivity – persistent current and Meissner Effect.

**UNIT-IV:** Breakdown of classical mechanics — photo electric effect — Compton effect - Davison- Germer experiment - Matter waves-wave packets-de Broglie ideas- Heisenberg uncertainty principle. Radio active isotopes (production and uses) – particle accelerator – linear accelerator – particle detectors – Wilson cloud chamber – Scintillation counter – nuclear models – Liquid drop model-Fission and Fusion reaction- nuclearreactors.

**UNIT-V:** Rectifiers & filters (qualitative ideas) – Transistor characteristics – transistor as a RC coupled amplifier – frequency response (without derivation) – band width – basic principles of an oscillator-Hartley oscillator – working (without derivation) – elementary ideas about modulation – elementary ideas about TV transmission and reception.

**TEXTBOOKS:**

1. Dr.Sabesan and others, A Textbook of Allied Physics-Vol-I and Vol-II.
2. Ponnusamy and others, Ancillary Physics.
3. Kamaiakannan and others, AncillaryPhysics.

**REFERENCEBOOKS**

1. Halliday, Resnik, Walker, Fundamentals of Physics, 5<sup>th</sup>Ed. (Asian Books Pvt. Ltd., New Delhi)

**PHYSICS II – PRACTICALS**

Ref: Physics Practical I

**CORE 8: (SUPPORTIVE 2) PRINCIPLES OF PROGRAMMING AND C****UNIT I**

Introduction to Programming Algorithms, Flowchart, Source Program, Object Program, Compilers, Interpreters, Assemblers, Modular Programming: Structured Programming, Top-down approach.

**UNIT II**

Arrays: Defining and processing. One dimensional arrays- Two dimensional arrays. Initializing One and Two dimensional arrays- Multi dimensional arrays. Character Arrays and Strings- Introduction. Declaring and initializing String variables Comparison of Two Strings String - handling functions, Table of Strings

**UNIT III**

Functions: Defining and accessing: Passing arguments, Function prototypes, Function calls- Categories of functions- Nesting of functions- Recursion. Use of library functions, Scope, Visibility and Lifetime of variables.

**UNIT IV**

Structure: Defining and processing. Structure initialization Operations on individual members Arrays of structures Arrays within Structures, Structures and Functions- Passing to a function, Union.

**UNIT V**

Pointers: Declarations and initialization of pointer variables, Accessing pointer variables, Passing to a function. Operations on pointers, pointer and arrays. Array of pointers, Pointer to Functions. Data Files: Open, close, create, process unformatted data files.

**TEXT BOOK**

- 1.E.Balagurusamy, Programming in ANSC C , Tata McGraw Hill, 2004
2. Byron S. Gottfried, Programming with C , Schaum s Outline Series, TMH ,2<sup>nd</sup> Edition 1998.

**REFERENCE**

1. Kris A. Jamsa , Programming in C , Galgotia Publications PVT.Ltd. (1988)
2. Kernighan, B.W.,and Ritchie, D.M., The C Programming Language Prentice Hall of India, 1989.

**PRACTICAL - PROGRAMMING IN C**

1. Array Operations
2. String Manipulations
  - a. Counting number of vowels, consonants, words, white spaces in a string
  - b. Reversing a string and check for palindrome
  - c. Finding the number of occurrences of a sub string in a given string
  - d. Sub string replacing and removal
3. Using Functions
4. Recursion
  - a. Factorial
  - b. Reversing a string
  - c. Fibonacci Sequence
5. Matrix Manipulations using functions and Case structure
  - a. Addition & Subtraction
  - b. Multiplication
  - c. Transpose
  - d. Check if the given matrix is a Magic square
6. Searching
7. Sorting
8. Structures
9. Pointers
10. File

## CORE 9: LINEAR ALGEBRA

<b>UNIT I</b>	Vector spaces - Elementary Concepts - subspaces
<b>UNIT II</b>	Linear independence - Bases - Dual spaces
<b>UNIT III</b>	Inner product spaces
<b>UNIT IV</b>	Algebra of Linear transformations - Characteristic roots.
<b>UNIT V</b>	Matrices : Canonical forms - triangular forms
<b>Prescribed Text(specify sections clearly)</b>	<i>Topics in Algebra – I.N Herstein, Wiley Eastern Limited</i> Chapter -4: Sections 4.1 – 4.4 Chapter -5; Sections 6.1—6.4
<b>Reference Books</b>	1. <i>First course in Algebra - John B. Fraleigh, Addison Wesley</i> 2. <i>University Algebra – N. S. Gopalakrishnan - Wiley Eastern Limited</i> 3. <i>Textbook of Algebra – R. Balakrishnan &amp; N. Ramabadrán, Vikas Pub. Co</i> 4. <i>S. Lipschutz –Linear Algebra, TMG Hill</i> 5. <i>M.L.Santiago – Modern Algebra TMG Hill</i>
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>

## CORE 10: ORDINARY DIFFERENTIAL EQUATIONS

<b>UNIT I</b>	Exact differential equations – Equations of the First, but of higher degree – Equations solvable for $dy/dx$ , solvable for $y$ , solvable for $x$ , Clairaut's form
<b>UNIT II</b>	Linear Differential equations with constant co-efficients - Linear differential equations with variable coefficients.
<b>UNIT III</b>	Method of Variation of parameters – Simultaneous Linear differential equations with constant coefficients
<b>UNIT IV</b>	Laplace transform – basic properties – transforms of derivatives and integrals functions – derivatives and integrals of transforms – transforms of step function – and impulse functions – transforms of periodic functions
<b>UNIT V</b>	Inverse Laplace transforms – convolution theorem – initial and final value theorem – solution of linear ODE of second order with constant coefficients using Laplace transform.
<b>Prescribed Text(specify sections clearly)</b>	<ol style="list-style-type: none"> <li>1. <i>Calculus III S.Narayanan and T.K. Manicavachagom Pillay , for Units I,II and III</i></li> <li>2. <i>Engineering Mathematics - II by Dr. M.B.K. Moorthy for Unit IV and Unit V</i></li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. <i>Introductory course in Differential equations , D.A.Murray, Orient Longman (1967)</i></li> <li>2. <i>Advance Engineering Mathematics , Erwin Kreyzsig, Wiley India Edition (2010)</i></li> <li>3. <i>Engineering Mathematics , M.K.Venkataraman, National Publications , Chennai (2009)</i></li> <li>4. <i>Boyce and Di Prima, Differential Equations and Boundary Value Problems, Wiley,10<sup>th</sup> edition 2012</i></li> </ol>
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>

## CORE 11: OPERATIONS RESEARCH I

<b>UNIT I</b>	Mathematical formulation of LPP – Graphical Solution of LPP – Definition of LPP – Canonical and Standard forms of LPP – Ordinary Simplex Method to solve LPP (Method and problems only) – Uses of Artificial variables Method (Big – M Method) - Two Phase Method
<b>UNIT II</b>	Duality in LPP – Conversion of Primal to Dual – Duality and Simplex Method (Method and problems only) – Dual Simplex Method
<b>UNIT III</b>	General Transportation Problems – Finding IBFS for Transportation Problems – North-West corner Method – Least Cost Method – Vogel’s approximation Method – Test for Optimality – Degeneracy in Transportation Problems – MODI Method – Unbalanced Transportation Problems
<b>UNIT IV</b>	Mathematical formulation of Assignment Problems – Assignment Method – Travelling Salesman Problems
<b>UNIT V</b>	Two person zero sum game – MAXIMIN – MINIMAX Principle – Saddle Point – Games without Saddle Point – Graphical solutions of $2 \times n$ and $m \times 2$ games – Dominance Property – General solution of $m \times n$ games by LPP
<b>Prescribed Text(specify sections clearly)</b>	<i>Operations Research by KantiSwarup , P.K.Gupta and Man Mohan (2006)</i> <i>Unit I: Chapter 2: Sections 2.1 – 2.3, Chapter 3: Sections 3.1 – 3.5</i> <i>Chapter 4: Sections 4.1 – 4.4</i> <i>Unit 2: Chapter 5 : Sections 5.1 – 5.7, 5.9</i> <i>Unit3: Chapter 10: Sections 10.1 – 10.14</i> <i>Unit 4: Chapter 11: Sections 11.1 – 11.6</i> <i>Unit 5: Chapter 17: Sections 17.1 – 17.10</i>
<b>Reference Books</b>	1. <i>Resource Management Techniques(Operations Research) by V. Sundaresan, K. S. Ganapathy Subramanian, K. Ganesan – A. R. Publications</i> 2. <i>Operations Research: An Introduction, 9<sup>th</sup> edition, Hamdy A.Taha, Pearson, 2010</i>
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>

**CORE 12: (SUPPORTIVE 3) CHEMISTRY I****Unit 1**

Intermolecular forces - Vanderwall and London forces. Liquid state theory and properties of liquids, liquid-crystal formation and applications. Solid state- forces in solids- covalent, ionic, metallic, and Vanderwall's, Lattice energy.

**Unit 2**

Theory of semi-conductors and its application. Bond properties- types of hybridization, bond length, bond order, bond strength. Resonance energy- resonance strength of multiple bonded species Carbon Monoxide, Nitrous Oxide, phenol, benzaldehyde, aniline.

**Unit 3**

Covalent bond- Orbital Overlap- hybridization, geometry of organic molecules- methane, ethylene, acetylene, benzene. Electron displacement effects, inductive, resonance, hyperconjugative and steric effects-their effect on properties of compounds. Stereoisomerism- Optical isomerism-optical activity, lactic acid, tartaric acid, racemization, resolution.

**Unit 4:**

Aromatic compounds-electrophilic substitution in benzene, mechanism of nitration, halogenation, Alkylation and Acylation. Preparation, properties and uses of Naphthalene, Furan, Thiophene, Pyrrole, Pyridine, Chloroform and Carbon Tetrachloride.

**Unit5:**

Keto-enol tautomerism. Geometric isomerization, maleic acid and fumaric acid. Rotation around single bond proffered rotations, conformers of ethane, propane, n- butane and cyclohexane. Axial and equatorial bonds.

**Text books:**

1. P. W. Atkins Physical Chemistry, 6th ed, 1998.
2. Wade, L.G. Organic Chemistry, Pearson Education, 5th ed, 2003.
3. M. Ladd. Introduction to Physical Chemistry, Cambridge, 1998.

**CHEMISTRY I PRACTICALS**

1. Estimation of sodium hydroxide using sodium carbonate standard.
2. Estimation of hydrochloric acid using oxalic acid standard.
3. Estimation of borax using sodium carbonate standard.
4. Estimation of ferrous sulphate using Mohr's salt standard.
5. Estimation of oxalic acid using ferrous sulphate standard.
6. Preparation of the following inorganic compounds: ferrous ammonium sulphate, manganous sulphate, sodium thiosulphate.

**CORE 12: (SUPPORTIVE 3) OBJECT ORIENTED PROGRAMMING****UNIT I**

Introduction to Object Oriented Programming (OOP ),C++ programming basic, Loops and decisions: Relational operators, loops, decision, logical operators, precedence.

**UNIT II**

Structures, enumerated data types. Function: simple functions, passing argument to functions, returning values from functions, reference arguments, overloaded functions, inline functions, variable and storage classes.

**UNIT III**

Objects and classes: Classes and Objects, Specifying the class, using the class, constructors, destructors, object as function arguments, returning object from function. Arrays: Arrays fundamentals, Array a Class member data, Array of objects, Strings. Operator overloading: unary operator, overloading binary operators, Data conversion.

**UNIT IV**

Inheritance: Derived Base class, derived class constructors, overloading member functions, class hierarchies, public and private inheritance, levels of inheritance multiple inheritance. Pointers: Address and pointers, pointers and arrays, pointers and functions, pointers and strings, Memory management, pointer to objects.

**UNIT V**

Virtual functions and other functions: Virtual functions, Friend functions, Static functions, this pointer. Files and Stream: String I/O, Object I/O with multiple objects, file pointer, disk I/O with member functions.

**TEXT BOOK**

1. Robert Lafore , Object Oriented Programming C++ , Galgotia Pub.

**REFERENCE**

1. Stephen Parta , C++ Primer Plus , Galgotia Pub.
2. E.Balagurusamy , Object Oriented Programming with C++

**OOPS LAB**

1. Simple functions & Inline functions
2. Function overloading & Operator Overloading
3. Usage of classes and Objects
4. Constructors and Destructors
5. Inheritance & Multiple Inheritance
6. Pointers
7. Virtual Functions, Friend functions, this pointer and Static functions
8. Files



## CORE 13: REAL ANALYSIS II

<b>UNIT I</b>	More about open sets - Connected sets. Bounded sets and totally bounded sets - Complete metric spaces.
<b>UNIT II</b>	Compact metric spaces Continuous functions on compact metric Spaces - Continuity of the inverse function - Uniform continuity.
<b>UNIT III</b>	Sets of measure zero - Definition of the Riemann integral - Existence of the Riemann integral - Properties of the Riemann integral
<b>UNIT IV</b>	Derivatives - Rolle's theorem - The Law of the Mean - Fundamental theorem of Calculus - - Improper integrals.
<b>UNIT V</b>	Hyperbolic function - The exponential function - The logarithmic function - Definition of $x^a$ - The trigonometric function - Taylor Theorem -L'Hopital's rule.
<b>Prescribed Text(specify sections clearly)</b>	<i>Methods of Real Analysis, Treatment as in Richard R. Goldberg, (1970)</i> Unit 1: 6.1 to 6.4 Unit 2: 6.5 to 6.8 Unit 3: 7.1 to 7.4 Unit 4: 7.5 to 7.10 Unit 5: 8.1 to 8.7
<b>Reference Books</b>	1. <i>First Course in Mathematical Analysis by Dr.Somasundaram &amp; B Choudhyri- Narosa Publishing house New Dehli</i> 2. <i>Real Analysis- by Shanti Narayanan</i>
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>

## CORE 14: COMPLEX ANALYSIS I

<b>UNIT I</b>	Complex numbers - Definitions - Algebraic properties - Cartesian co-ordinates - Triangular inequality - Polar Form - Powers and roots - Region in the complex plane .
<b>UNIT II</b>	Analytic functions - Functions of a complex variable - Mapping - Limit - Theorems on limits - Continuity - Derivatives - Differentiation formula - Cauchy Riemann equations - Sufficient conditions.
<b>UNIT III</b>	Cauchy Riemann equations in polar form - Analytic functions - Harmonic functions.
<b>UNIT IV</b>	Elementary functions - Exponential function - Trigonometric functions and their--properties - Hyperbolic functions - Logarithmic function – Branches - properties of logarithms - Complex exponents - Inverse trigonometric & hyperbolic functions.
<b>UNIT V</b>	Mapping by elementary functions - The linear function $1/z$ - Linear fractional transformation - The function $w = \exp(z)$ , $W = \sin z$ , $W = \cos z$ , $z^{1/2}$ - Successive transformation $W = z + 1/z$ .
<b>Prescribed Text(specify sections clearly)</b>	<i>Complex Variables and Applications, James Ward Brown and Ruel V Churchill, McGraw - Hill, International Edition (2009)</i> UNIT I - chapter 1 UNIT II - chapter 2 UNIT III - chapter 2 UNIT IV - chapter 3 UNIT V - chapter 4
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. <i>Functions of a Complex variable by B. S. Tyagi – KedarNath Ram NathPublishers(P) Ltd.</i></li> <li>2. <i>Complex Analysis by P. Duraipandian and KayalalPachaiappa – S.Chand&amp; Co.</i></li> <li>3. <i>S. Ponnusamy, Foundations of Complex analysis, (2<sup>nd</sup> Edition), Narosa, 2011.</i></li> <li>4. <i>V.Karunakaran, Complex Analysis, (2<sup>nd</sup> Edition), Narosa 2005</i></li> </ol>
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>

## CORE 15: MATHEMATICAL STATISTICS I

<b>UNIT I</b>	Random variables – Distribution function – Discrete random variable – Continuous random variable – Continuous distribution function – Two dimensional random variables – Joint probability function – Mathematical expectation and variance.
<b>UNIT II</b>	Moment generating function – Properties of MGF – Cumulants – Properties of Cumulants – Characteristic function – Properties of characteristic function – Tchebychev's inequality.
<b>UNIT III</b>	Binomial distribution – Moments of binomial distribution – Recurrence relation for the moments of binomial distribution – MGF of Binomial distribution – Characteristic function of Binomial distribution – Fitting a binomial distribution.
<b>UNIT IV</b>	Poisson distribution – Moments of the Poisson distribution – Recurrence relation for moments of Poisson distribution – Moment generating function of Poisson distribution – Characteristic function of Poisson distribution – Fitting a Poisson distribution.
<b>UNIT V</b>	Normal distribution – Properties of normal distribution – Mode, Median, MGF, Moments Points of inflexion, Median deviation about mean, Area property of Normal distribution – Problems using area Properties.
<b>Prescribed Text(specify sections clearly)</b>	<i>Fundamentals of Mathematical Statistics by S.C.Gupta, V.K.Kapoor, Sultan Chand and Sons , 11<sup>th</sup> edition</i> Unit I : 5.1 to 5.4, 6.1 to 6.9 Unit II : 6.10 to 6.13 Unit III : 7.2 Unit IV : 7.3 Unit V : 8.2.1 to 8.2.11
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. <i>Statistical methods by S.P.Gupta – Sultan Chand.</i></li> <li>2. <i>Statistics(Theory and Practice) by R.S.N.Pillai &amp; V. Bagavathy - S.Chand &amp; Co.</i></li> <li>3. <i>Robert V. Hogg and Allen T. Craig , Introduction to Mathematical Statistics (Fifth Edition) Pearson Education, 2005</i></li> </ol>
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>

**CORE 16: (SUPPORTIVE 4) CHEMISTRY II****Unit 1:**

Co-ordination chemistry – definition of terms, classification of ligands, nomenclature. Chelation – examples, chelate effect explanation. Werner's theory- conductivity and precipitation studies. Sedgwick's theory- Effective atomic number concept. Pauling's theory-postulates, applications to octahedral, square, planar and tetrahedral complexes.

**Unit 2:**

Biological role of Hemoglobin and Chlorophyll. EDTA and its applications. Environmental chemistry- Green House Effect, global warming, Ozone depletion, BOD and COD – importance, rainwater harvesting-needs, methods, advantage. Pollution – types, strategies in its control.

**Unit 3:**

Carbohydrates-classification, preparation and properties of Glucose, Fructose and Sucrose. Discussion of ring structure and mutarotation. Properties of starch and cellulose. Interconversion of Glucose and Fructose. Amino-acids classification, preparation and properties of Glycine and Alanine, preparation of peptides by Bergman method. Classification of proteins according to composition, function and shape. Protein denaturation.

**Unit 4:**

Dyes and Drugs-Azo dyes-congo Red, Triphenylmethans, Malachite Green, Food colours. Sulpha drugs-sulphonamides and sulpha pyrimidine, preparation and uses. Antibiotics-penicillin and Chloromycetin-source, structure and uses. Vitamins- source and structure of vitamin A, B, C, D, E and F (structural elucidation not required).

**Unit 5:**

Electrochemistry- Kohlrauch law-measurement of conductance , pH determination, conductometric titrations, hydrolysis of salts, derivation of Kh. Galvanic cells, EMF standard electrode potentials, reference electrodes, electrochemical series and its application, electroplating and its application. Corrosion-methods of prevention. Bioenergetics-Chemical kinetics-order of reaction (zero and first order), half-life period. Chemical equilibrium-basic idea.

**Text books:**

1. P. W. Atkins Physical Chemistry, 6th edition, 1998.
2. Wade, L.G, Organic Chemistry, Pearson Education, 5th edition, 2003.
3. M. Ladd, introduction to Physical Chemistry, Cambridge, 1998.

**CHEMISTRY II PRACTICAL**

1. Detection of elements –nitrogen, sulphur and halogens.
2. Preliminary test and detection of carbohydrate, urea, benzamide and aromatic amines.
3. Detection of anions: carbonate, sulphide, sulphate, fluoride, chloride, bromide, nitrate, oxalate, phosphate.
4. Reaction of aldehyde (aromatic), ketone (aliphatic and aromatic), carbohydrate, carboxylic acid (mono-and dicarboxylic-), phenol, aromatic primary amine, amide and diamide.
5. Systematic analysis of organic compounds containing one functional group and characterization by confirmatory tests or derivatives.

**CORE 16: (SUPPORTIVE 4) VISUAL PROGRAMMING****VISUAL PROGRAMMING****UNIT I**

Introduction to GUI - Visual Basic: Starting and Exiting Visual Basic Project Explorer Working with Forms Properties Window Using the Toolbox Toolbars Working with Projects Programming Structure of Visual Basic applications Event and Event driven procedures

**UNIT II**

Adding code and using events: Using literals data types - declaring and using variables using the operator subroutines and functions looping and decision control structures if then else structure select structure, for next, do.. loop and while.. wend.- Using intrinsic Visual basic Controls with methods and Properties: Label ,Text box, Command button, Frame, Checkbox, option button, List box, Combo box, Drive List box, directory List box and file list box Formatting controls control arrays, Tab order

**UNIT III**

Functions and Procedure - Passing arguments by value and reference Arrays, dynamic arrays User defined datatypes symbolic constants using Dialog boxes: Input box, Message box functions - String functions, date and Time function, numeric functions

**UNIT IV**

Menus: creating menus, adding code to menus, using MDI forms - MDI form basic building MDI form creating MDI Child Forms

**UNIT V**

Database object (DAO) and properties accessing Recordset objects Move first, MoveLast, MovePrevious and MoveNext methods Begin, Commit and Rollback transaction accessing Microsoft Access files. Active Data Objects (ADO) ADO and OLE DB and ADO Primer What are OLE DB and ADO? ADO object Model Converting DAO Code to Use ADO Connecting to the database Retrieving a recordset Creating a query dynamically Using a parameterized query using action queries - Adding records Editing records closing the database connection.

**TEXT BOOKS**

1. Gary Cornwell Visual basic 6, Tata McGraw Hill
2. Scott warner Teach yourself Visual basic 6, Tata McGraw-Hill
3. Noel Jerke The Complete Reference, Tata McGraw-Hill
4. Eric A. Smith, Valar Whisler, and Hank Marquis Visual Basic programming

**PRACTICAL - VISUAL PROGRAMMING LAB**

1. Building simple applications
2. Working with intrinsic controls and ActiveX controls
3. Application with multiple forms
4. Application with dialogs
5. Application with Menus
6. Application using data controls
7. Application using Common Dialogs
8. Drag and Drop Events
9. Students mark sheet processing

## CORE 17: PARTIAL DIFFERENTIAL EQUATIONS

<b>UNIT I</b>	Formation of Partial differential equations – by elimination of arbitrary constants – by elimination of arbitrary functions – Singular integral – General integral.
<b>UNIT II</b>	Standard types of first order equations – Standard 1,2,3,4 - Equations reducible to standard forms.
<b>UNIT III</b>	Lagrange's equations - Charpit's Method.
<b>UNIT IV</b>	Linear Partial Differential equation of Second and higher order with constant coefficients.
<b>UNIT V</b>	One dimensional wave equations, heat equation, Laplace equation – Simple problems.
<b>Prescribed Text (specify sections clearly)</b>	<i>S.Narayanan and T.K. Manicavachagom Pillay , Calculus III Unit 1, 2, 3 : Chapter 4  Transforms and Partial differential equations by Dr. A. Singaravelu Unit 4 : Chapter 3 Unit 5 : Chapter 4</i>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li><i>1. Introductory course in Differential equations , D.A.Murray, Orient Longman (1967)</i></li> <li><i>2. Advance Engineering Mathematics , Erwin Kreyzsig, Wiley India Edition (2010)</i></li> <li><i>3. Engineering Mathematics , M.K.Venkataraman, National Publications , Chennai (2009)</i></li> </ol>
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>

## CORE 18: VECTOR CALCULUS

<b>UNIT I</b>	Gradient of a scalar function –properties – directional derivatives – Divergence of a vector function – Curl of a vector function – related problems
<b>UNIT II</b>	Vector identities – Line integrals – related problems
<b>UNIT III</b>	Surface integrals – Volume integrals
<b>UNIT IV</b>	Green’s theorem – Stokes’s theorem – Verification of theorems
<b>UNIT V</b>	Gauss divergence theorem – Verification of theorem
<b>Prescribed Text(specify sections clearly)</b>	1. <i>Vector Analysis- P.Duraipandian, LaxmiDuraipandian, Emerald Publishers pvt. Ltd. 1990</i>
<b>Reference Books</b>	1. <i>Engineering Mathematics – II by Dr.M.B.K.Moorthy</i> 2. <i>Vector Analysis, Murray R. Spiegel, Seymour Lipschutz and Dennis Spellman, 2<sup>nd</sup> Edition, Schaum’s outline, McGraw Hill 2009.</i>
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>



**CORE 19: OPERATIONS RESEARCH II**

<b>UNIT I</b>	Network and Basic Components – Logical sequence – Rules for Network Construction – Critical Path Analysis – Probability Considerations in PERT – Difference between PERT and CPM
<b>UNIT II</b>	Deterministic inventory Models <ol style="list-style-type: none"> <li>1. Uniform rate of demand infinite rate of production, no shortage</li> <li>2. Uniform rate of demand, Finite rate of replenishment , no shortages</li> <li>3. Uniform rate of demand, instantaneous Production with shortages</li> <li>4. Uniform rate of demand, instantaneous Production with shortages and fixed time</li> </ol>
<b>UNIT III</b>	Queueing Systems – Elements of Queueing systems – Characteristics of queueing Systems – Distribution of Arrivals – Distribution of Inter arrival time – Classification of queueing Models – Deriving Steady state Probabilities for M/M/1 queueing systems - System Measures - Little formula - Deriving Steady state Probabilities for M/M/1 queueing systems with finite capacity - System Measures – Related Problems.
<b>UNIT IV</b>	Multi server queueing Model - Deriving Steady state Probabilities for M/M/c queueing system - System Measures – Deriving Steady state Probabilities for M/M/c queueing system with finite capacity - System Measures – Related Problems.
<b>UNIT V</b>	Methodology of Simulation – Event type simulation – Generation of random numbers – Monte – Carlo Simulation on Inventory Problems - simulation of Queueing Systems.
<b>Prescribed Text(specify sections clearly)</b>	<i>Operations Research by KantiSwarup , P.K.Gupta and Man Mohan (2006)</i> <i>Unit 1: Chapter 21: Sections 21.1 – 21.7</i> <i>Unit 2: Chapter 19 : Sections 19.1 – 19.7</i> <i>Unit3: Chapter 20: Sections 20.1 – 20.8</i> <i>Unit 4: Chapter 20: Sections 20.8</i> <i>Unit 5: Chapter 23: Sections 23.1 – 23.9</i>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. <i>Resource Management Techniques(Operations Research) by V. Sundaresan, K. S. Ganapathy Subramanian, K. Ganesan – A. R. Publications</i></li> <li>2. <i>Operations Research: An Introduction, 9<sup>th</sup> edition, Hamdy A.Taha, Pearson, 2010</i></li> </ol>
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>

## CORE 20: COMPLEX ANALYSIS II

<b>UNIT I</b>	Contour integrals- - Examples - The Cauchy Goursat's theorem - A preliminary lemma - Proof of Cauchy Goursat's theorem - Simply and multiple connected domains.
<b>UNIT II</b>	The Cauchy integral formula -Derivatives of analytic functions - Morera's theorem - Maximum moduli of functions-Liouville's theorem- The fundamental theorem of algebra.
<b>UNIT III</b>	Convergence of sequences and series - Taylor series - Observations and examples – Laurent Series (statement only).
<b>UNIT IV</b>	Singularities - Definitions and examples - Residues - The residue theorem - The principal part of a function - Residues and poles – zeros and poles of order m.
<b>UNIT V</b>	<p>Type 1 : <math>\int_{-\infty}^{\infty} \frac{p(x)}{q(x)} dx</math></p> <p>Type 2 : <math>\int_{-\infty}^{\infty} \frac{p(x)}{q(x)} \sin ax \, dx</math> or <math>\int_{-\infty}^{\infty} \frac{p(x)}{q(x)} \cos ax \, dx</math></p> <p>Type 3 : <math>\int_0^{2\pi} F(\sin \theta, \cos \theta) d\theta</math></p> <p>where p(x) and q(x) are real polynomials with no factor in common and q(x) has no real zeros.</p>
<b>Prescribed Text(specify sections clearly)</b>	<p><i>Complex Variables and Applications, James Ward Brown and Ruel V Churchill, McGraw - Hill, International Edition (1990)</i></p> <p>Unit I : Chapter 4:Section 34-38</p> <p>Unit II: Chapter 4 Section 39-43</p> <p>Unit III:Chapter 5:Section 44-48</p> <p>Unit IV:Chapter 6:Section 53-57</p> <p>Unit V:Chapter 6:Section 58-60</p>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. <i>Functions of a Complex variable</i> by B. S. Tyagi – KedarNath Ram NathPublishers(P) Ltd.</li> <li>2. <i>Complex Analysis</i> by P. Duraipandian and KayalalPachaiappa – S.Chand&amp; Co.</li> <li>3. S. Ponnusamy, <i>Foundations of Complex analysis</i>, (2<sup>nd</sup> Edition), Narosa, 2011.</li> <li>4. V.Karunakaran, <i>Complex Analysis</i>, (2<sup>nd</sup> Edition), Narosa 2005</li> </ol>
<b>e-Learning Source</b>	<p><a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a></p> <p><a href="http://ocw.mit.edu">http://ocw.mit.edu</a></p> <p><a href="http://mathforum.org">http://mathforum.org</a></p>

## CORE 21: MATHEMATICAL STATISTICS II

<b>UNIT I</b>	Correlation – Properties - Rank Correlation – Bivariate correlation
<b>UNIT II</b>	Regression – Properties – Regression equations
<b>UNIT III</b>	Sampling – Types of sampling – Parameter and statistics – Test of significance – Null hypothesis – Alternate hypothesis – Procedures in testing of hypothesis – errors in sampling critical region – level of significance
<b>UNIT IV</b>	Test of significance of large sampling – Test of significance of single mean – Test of significance of difference between two means – test of significance of proportion – test of significance of difference between two proportions – test of significance of difference between two standard deviation
<b>UNIT V</b>	Chi square test (definition) – chi square test for test of goodness of fit – independence of attributes – student's t – distribution (definition) – t-test for single mean – t- test for difference between two means – t–test for dependent sample – t-test for co-efficient of correlation
<b>Prescribed Text(specify sections clearly)</b>	<i>Fundamentals of Mathematical Statistics by S.C.Gupta, V.K.Kapoor, Sultan Chand and Sons , 11<sup>th</sup> edition</i> Unit I : 10.1 to 10.6 Unit II : 10.7 Unit III : 12.1 to 12.7 Unit IV : 12.8 – 12.15 Unit V : 13.1, 13.7, 14.1, 14.2
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. <i>Statistical methods by S.P.Gupta – Sultan Chand.</i></li> <li>2. <i>Statistics(Theory and Practice) by R.S.N.Pillai&amp; V. Bagavathy - S.Chand&amp; Co.</i></li> <li>3. <i>Robert V. Hogg and Allen T. Craig , Introduction to Mathematical Statistics (Fifth Edition) Pearson Education, 2005</i></li> </ol>
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>

## CORE 22: NUMERICAL METHODS

<b>UNIT I</b>	Numerical solution of algebraic and transcendental equations – Bolzano’s bisection method - Successive approximation method – Regula falsi method – Newton-Raphson method.
<b>UNIT II</b>	Numerical solution of simultaneous linear algebraic equations – Gauss elimination method - Gauss Jordan elimination method – Gauss Seidel iteration method.
<b>UNIT III</b>	Finite difference operator - Interpolation – Newton-Gregory forward and backward interpolation – Newton’s divided difference formula – Lagrange’s interpolation formula for uneven intervals – Gauss interpolation formula – Numerical differentiation – Numerical Integration – Trapezoidal rule – Simpson’s 1/3 <sup>rd</sup> rule.
<b>UNIT IV</b>	Numerical solutions of Ordinary differential equations of first and second order – Simultaneous equations – Taylor series method – Picard’s method.
<b>UNIT V</b>	Euler’s method – Improved Euler’s Method - Modified Euler’s Method – Runge-Kutta method of second and fourth order – Milne’s predictor corrector method.
<b>Prescribed Text(specify sections clearly)</b>	<i>Numerical Method in Science and Engineering, M.K.Venkataraman, National Publication Co, Chennai(2001)</i> Unit 1: Chapter 3 and 4 Unit 2: Chapter 5 Unit 3: Chapter 6 and 9 Unit 4: Chapter 11 (Relevant portions) Unit 5: Chapter 11 (Relevant portions)
<b>Reference Books</b>	<i>Computer oriented Numerical Methods by V. Rajaram – PHI(P) Ltd.</i>
<b>e-Learning Source</b>	<a href="http://ndl.iitkgp.ac.in">http://ndl.iitkgp.ac.in</a> <a href="http://ocw.mit.edu">http://ocw.mit.edu</a> <a href="http://mathforum.org">http://mathforum.org</a>

**PROGRAMMING LAB IN NUMERICAL METHODS – PRACTICAL**

## LIST OF PRACTICALS

1. Write a program to solve algebraic and transcendental equations by Bisection method
2. Write a program to solve algebraic equation and transcendental by Newton-Raphson method
3. Write a program to solve simultaneous linear algebraic equations by Gauss jordan method
4. Write a program to find the inverse of a matrix of order n
5. Write a program to find the determinant of a matrix of order n
6. Write a program to solve simultaneous linear algebraic equations by Gauss Seidal
7. Write a program to evaluate definite integral by Trapezoidal rule
8. Write a program to evaluate definite integral by Simpson's 1/3 rule
9. Write a program to solve first order ODE by Euler's method
10. Write a program to solve the first order ODE by Runge Kutta method

**Text Book:**

Handmade Lab Manualfor Programming Lab

***e-Learning Source***

<http://ndl.iitkgp.ac.in>  
<http://ocw.mit.edu>  
<http://mathforum.org>

