JAMAL MOHAMED COLLEGE (Autonomous), Tiruchirappalli-620 020
PG Programme –Course Structure under CBCS
(For the candidate admitted from the academic year 2017-2018 onwards) 10.02.2017

<table>
<thead>
<tr>
<th>SEM</th>
<th>Course Code</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Ins. Hrs / Week</th>
<th>Credit</th>
<th>Marks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>17PMA1C1</td>
<td>Core- I</td>
<td>Real Analysis</td>
<td>6</td>
<td>5</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA1C2</td>
<td>Core- II</td>
<td>Algebra</td>
<td>6</td>
<td>5</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA1C3</td>
<td>Core- III</td>
<td>Ordinary Differential Equations</td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA1C4</td>
<td>Core- IV</td>
<td>Numerical Analysis</td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA1CE1</td>
<td>Elective- I#</td>
<td></td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td></td>
<td>30</td>
<td>22</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>17PMA2C5</td>
<td>Core- V</td>
<td>Topology</td>
<td>6</td>
<td>5</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA2C6</td>
<td>Core- VI</td>
<td>Complex Analysis</td>
<td>6</td>
<td>5</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA2C7</td>
<td>Core- VII</td>
<td>Linear Algebra</td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA2C8</td>
<td>Core- VIII</td>
<td>Partial Differential Equations</td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA2CE2</td>
<td>Elective- II#</td>
<td></td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td></td>
<td>30</td>
<td>22</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>17PMA3C9</td>
<td>Core- IX</td>
<td>Measure theory and integration</td>
<td>6</td>
<td>5</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA3C10</td>
<td>Core- X</td>
<td>Fuzzy Sets and their Applications</td>
<td>6</td>
<td>5</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA3C11</td>
<td>Core- XI</td>
<td>Fluid Dynamics</td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA3C12</td>
<td>Core- XII</td>
<td>Advanced Graph Theory</td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA3CE3</td>
<td>Elective-III#</td>
<td></td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA3EC1</td>
<td>Extra Credit</td>
<td>Discrete Mathematics</td>
<td></td>
<td>-</td>
<td>5*</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td></td>
<td>30</td>
<td>22</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>17PMA4C13</td>
<td>Core- XIII</td>
<td>Functional Analysis</td>
<td>6</td>
<td>5</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA4C14</td>
<td>Core- XIV</td>
<td>Advanced Operations Research</td>
<td>6</td>
<td>5</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA4C15</td>
<td>Core- XV</td>
<td>Integral Equations and Calculus of Variations</td>
<td>6</td>
<td>5</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA4CE4</td>
<td>Elective-IV#</td>
<td></td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA4PW</td>
<td>Project</td>
<td></td>
<td>6</td>
<td>5</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>17PMA4EC2</td>
<td>Extra Credit</td>
<td>Differential Geometry</td>
<td></td>
<td>-</td>
<td>5*</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td></td>
<td>30</td>
<td>24</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>GRAND TOTAL</td>
<td></td>
<td>100</td>
<td>2000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Not considered for grand total and CGPA

<table>
<thead>
<tr>
<th>SEMESTER</th>
<th>Course Code</th>
<th>CORE BASED ELECTIVE</th>
<th>Ins. Hrs / Week</th>
<th>Credit</th>
<th>Marks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>17PMA1CE1AT</td>
<td>C++ Programming</td>
<td>3</td>
<td>2</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>17PMA1CE1AP</td>
<td>C++ Programming - Practical</td>
<td>3</td>
<td>2</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>17PMA1CE1B</td>
<td>Control Theory</td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>II</td>
<td>17PMA2CE2A</td>
<td>Classical Dynamics</td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA2CE2B</td>
<td>Mathematical Methods in Biology</td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>III</td>
<td>17PMA3CE3A</td>
<td>Mathematical Statistics</td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA3CE3B</td>
<td>Computer Algorithms</td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>IV</td>
<td>17PMA4CE4A</td>
<td>Stochastic Processes</td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>17PMA4CE4B</td>
<td>Queuing Theory and Non-Linear Programming</td>
<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
</tr>
</tbody>
</table>
### SEMESTER I: CORE-I
### REAL ANALYSIS

<table>
<thead>
<tr>
<th>Course Code</th>
<th>17PMA1C1</th>
<th>Max. Marks</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours/Week</td>
<td>6</td>
<td>Internal Marks</td>
<td>25</td>
</tr>
<tr>
<td>Credits</td>
<td>5</td>
<td>External Marks</td>
<td>75</td>
</tr>
</tbody>
</table>

**Objective:**
To test the convergence of sequences and series of functions and to study the concepts in integration.

**Prerequisite:**
This course requires the basic knowledge on real numbers, sequences and series, continuity and Riemann-Stieltjes integral.

**UNIT I**
18 hours
Basic topology - # Metric spaces # - Compact sets - Perfect sets - Connected sets.

**UNIT II**
18 hours
Continuity - Limits of functions - Continuous functions - Continuity and compactness - Continuity and connectedness - Discontinuities - Monotone functions.

**UNIT III**
18 hours
Differentiation - The Derivative of a real function - Mean value theorems - The continuity of Derivatives - L'Hospital’s rule - Derivatives of Higher order - Taylor’s Theorem – Differentiation of Vector - valued Functions.

**UNIT IV**
18 hours
Riemann - Stieltjes integral - Definition and existence of the integral - #Properties of the integral# - Integration and differentiation - Rectifiable Curves.

**UNIT V**
18 hours
Sequences and series of functions - # Uniform convergence # - Uniform convergence and continuity - Uniform convergence and integration - Uniform convergence and differentiation – Stone-Weierstrass theorem

# Self-study portion.

**Text Books:**

- **UNIT I** Chapter 2 Sections 2.15 - 2.47
- **UNIT II** Chapter 4 Sections 4.1 – 4.31
- **UNIT III** Chapter 5 Sections 5.1 – 5.19
- **UNIT IV** Chapter 6 Sections 6.1 - 6.22, 6.26, 6.27
- **UNIT V** Chapter 7 Sections 7.1 - 7.18, 7.26, 7.27
Books for Reference:

Prepared by:
   Mr. S. Masoothu
   Mr. D. Dhamodharan
   Ms. G. Mehboobnisha
Semester I: Core II
Algebra

Course Code: 17PMA1C2  Max. Marks: 100
Hours/Week: 6  Internal Marks: 25
Credit: 5  External Marks: 75

Objective:
To provide foundation in group and to enhance the power of ideas for solving the problems in algebra.

Prerequisite:
This course requires the basic knowledge on groups, rings, fields and ideals.

Unit I 18 hours
# Basic properties on groups and subgroups
# - Automorphisms on a group – Cayley’s theorem - Another Counting Principle

Unit II 18 hours
Sylow’s theorems– Direct products (Internal and External) of subgroups on a group

Unit III 18 hours
Polynomial Rings over the rationals - Polynomials over the rational field – Properties on Primitive polynomials – Polynomial rings over commutative rings

Unit IV 18 hours

Unit V 18 hours
The Elements of Galois theory – Finite fields
# # Self-study portion.

Text Book:

Unit I  Chapter 2  Sections 2.8, 2.9, 2.11
Unit II  Chapter 2  Sections 2.12, 2.13
Unit III  Chapter 3  Sections 3.9 – 3.11
Unit IV  Chapter 3  Sections 5.1, 5.3, 5.5
Unit V  Chapter 5  Sections 5.6 and Chapter 7  Section 7.1
**Books for Reference:**

**Prepared by:**

- Dr. A. Solairaju
- Mr. D. Dhamodharan
- Ms. B. Shafina Banu
Objective:
To learn Mathematical methods to solve higher order ordinary differential equations and apply to dynamical problems of practical interest.

Prerequisite:
This course requires the basic knowledge on differentiation and problem solving in differentiation.

UNIT I
Second order linear Equations- #The general solution of the Homogeneous equation#- The Use of a known solution to find another- The Homogeneous equation with constant coefficients- The method of variation of parameters.

UNIT II
Oscillations and the sturm separation theorem – The sturm comparison theorem - Series solutions of First order equations-Second order linear equations-ordinary points.

UNIT III
Regular singular points-Regular singular points (continued) - Gauss’s Hypergeometric equation- #The point at Infinity#.

UNIT IV

UNIT V
Linear systems- Homogeneous linear systems with constant coefficients – The method of successive approximations – Picard’s theorem.

# # Self-study portion.

Text Book:

UNIT I
Sections 14, 15, 16, 17, 19
UNIT II
Sections 24, 25, 27, 28
UNIT III
Sections 29, 30, 31, 32
UNIT IV
Sections 44, 45, 46, 47
UNIT V
Sections 55, 56, 68, 69

Books for Reference:
Prepared by:

Dr. S. Ismail Mohideen
Mr. U. Abuthahir
Ms. A. Nafiunisha
Objective:
To develop a sound knowledge and appreciation of the ideas and concepts related to polynomials, interpolation, and to give a strong foundation to take up advanced level courses in analysis.

Prerequisite:
This course requires the basic knowledge on iteration methods, interpolation, approximation, differentiation and integration.

UNIT I 18 hours

UNIT II 18 hours

UNIT III 18 hours

UNIT IV 18 hours

UNIT V 18 hours

# Self-study portion.
Text Book:

UNIT I
Chapter II Sections 2.4, 2.9

UNIT II
Chapter III Sections 3.4, 3.7, 3.11

UNIT III
Chapter IV Sections 4.5, 4.6, 4.7, 4.9

UNIT IV
Chapter V Sections 5.2, 5.5, 5.6, 5.7, 5.8, 5.11

UNIT V
Chapter VI Sections 6.3, 6.4, 6.7

Books for Reference:

Prepared by:
Major. N. Abdul Ali
Mr. U. Abuthahir
Ms. S. Sharmila Banu
SEMESTER I: ELECTIVE – I
C++ PROGRAMMING

Course Code : 17PMA1CE1AT  Max Marks : 50
Hours/Week : 3  Internal Marks : 10
Credit : 2  External Marks : 40

Objective:
To introduce the benefits of using C++ and object-oriented programming techniques for application development and write programs for a wide variety problems in mathematics.

Prerequisite:
This course requires the basic knowledge on C programming.

UNIT I  9 Hours

UNIT II  9 Hours

UNIT III  9 Hours

UNIT IV  9 Hours

UNIT V  9 Hours

Text Book:

UNIT I  Chapter 1 - 1.4, 1.5; Chapter 2 – 2.1, 2.3, 2.4, 2.5, 2.6
Chapter 3 – 3.3 to 3.8; 3.10, 3.12, 3.13, 3.14, 3.19, 3.24

UNIT II  Chapter 4 – 4.2 to 4.6; 4.9; Chapter 5 – 5.3, 5.4, 5.7, 5.8, 5.9, 5.13 to 5.16; 5.18

UNIT III  Chapter 6 – 6.2 to 6.5; 6.7, 6.9, 6.11, Chapter 7 – 7.2 to 7.5

UNIT IV  Chapter 8 – 8.2 to 8.9

UNIT V  Chapter 11 – 11.1 to 11.4; 11.6 to 11.10

Reference Books:

Prepared by:
   Dr. M. Mohamed Jabarulla
   Dr. S. Sajitha Begum
   Mr. H. Sheik Mujibur Rahman
Objective:
To enable the students to acquire programming skills by applying various features of C++ Language.

Prerequisite:
This course requires the basic knowledge on C programming and text editor.

List of Practical:

1. Develop a C++ Program using functions.
2. Develop a C++ Program to implement the function overloading.
3. Develop a C++ Program to implement the Friend, Inline and Virtual Functions.
4. Develop a C++ Program to implement classes and objects.
5. Develop a C++ Program to implement Arrays of Objects.
6. Develop a C++ Program to implement constructors and destructors.
7. Develop a C++ Program to add two complex numbers using Operator Overloading.
8. Develop a C++ Program to multiply two matrices using Operator Overloading.
9. Develop a C++ Program to implement Pay Bill application by using Inheritance.
10. Develop a C++ Program to implement Mark List Application by using Files.

Prepared by:
Dr. M. Mohamed Jabarulla
Dr. S. Sajitha Begum
Mr. H. Sheik Mujibur Rahman
SEMMESTER I: ELECTIVE – I
CONTROL THEORY

Course Code : 17PMA1CE1B                Max. Mark :  100
Hours/Week :  6                          Internal Mark :  25
Credit :  4                                External Mark :  75

Objective:
To study observability, controllability, stability and optimal control of linear systems.

Prerequisite:
This course requires the basic knowledge on differential equations and functional.

UNIT I 18 hours
Observability: Linear Systems – Observability Grammian – Constant coefficient systems –
Reconstruction kernel – Nonlinear Systems

UNIT II 18 hours
Controllability: Linear systems – Controllability Grammian – Adjoint systems – Constant coefficient
systems – steering function – Nonlinear systems

UNIT III 18 hours
Stability: stability – Uniform Stability – Asymptotic Stability of Linear Systems - Linear time
varying systems – Perturbed linear systems – Nonlinear systems

UNIT IV 18 hours
Stabilizability: Stabilization via linear feedback control – Bass method – Controllable subspace –
Stabilization with restricted feedback

UNIT V 18 hours
Optimal control: Linear time varying systems with quadratic performance criteria – Matrix
Riccati equation – Linear time invariant systems – Nonlinear Systems

Text Book:

UNIT I Chapter 2
UNIT II Chapter 3 Sections 3.1 - 3.3
UNIT III Chapter 4
UNIT IV Chapter 5
UNIT V Chapter 6

Books for Reference:
2. Functional Analysis and Modern Applied Mathematics by R.F.CurtainandA.J.Pritchard,
3. Controllability of Dynamical Systems by J.Klamka, Kluwer Academic Publisher, Dordrecht,
4. Mathematics of Finite Dimensional Control Systems by D.L.Russell, Marcel Dekker, New York,
   1979.
Prepared by:

Dr. R. Jahir Hussain
Objective:
To study topological spaces, continuous functions, connectedness, compactness, countability and separation axioms and complete metric spaces.

Prerequisite:
This course requires the basic knowledge on mapping between sets, open sets, limits, continuity, convergence, metric space and geometrical structure.

UNIT I 18 hours
- Topological spaces - Basis for a topology- Order topology, product topology- Subspace topology- Closed sets and limit points - Continuous functions - # Product Topology #.

UNIT II 18 hours
- Metric topology - Metric topology (continued) - Connected spaces.

UNIT III 18 hours
- Compact spaces - Limit point compactness - Tychonoff theorem.

UNIT IV 18 hours
- Countability Axioms - Separation axioms - Urysohn Lemma - Urysohn Metrization theorem - Completely regular spaces.

UNIT V 18 hours
- Complete Metric Spaces - Compactness in metric spaces - Baire Spaces.

# # Self-study portion.

Text Book:

UNIT I Sections 2.1 - 2.8
UNIT II Sections 2.9, 2.10, 3.1
UNIT III Sections 3.5, 3.7, 5.1
UNIT IV Sections 4.1 - 4.4, 5.2
UNIT V Sections 7.1, 7.3, 7.7

Books for Reference:
SEMESTER II: CORE-VI
COMPLEX ANALYSIS

Course Code : 17PMA2C6  Max. Marks : 100
Hours/Week : 6  Internal Marks : 25
Credits : 5  External Marks: 75

Objective:
To introduce advanced concepts of complex analysis.

Prerequisite:
This course requires the basic knowledge on analytic function, complex integration and
power series.

UNIT I  18 hours
Fundamental theorems – Line integrals - Rectifiable arcs - Line integrals as functions of arcs
-Cauchy’s theorem for a rectangle - Cauchy’s theorem in a disk. Cauchy’s integral formula –
Index of a point with respect to a closed curve - Integral formula for higher derivatives.

UNIT II  18 hours
Local properties of analytical functions – Removable singularities - Taylor’s theorem -
Zeros and poles. Local mapping - Maximum principle. General form of Cauchy theorem – Chains
and cycles -Simple connectivity - Homology.

UNIT III  18 hours
General statement of Cauchy’s theorem - Proof of Cauchy’s theorem - Locally exact
differentials. Calculus of residue - Residue theorem - Argument principle - Evaluation of definite
integrals.

UNIT IV  18 hours
Harmonic functions – Definition and basic properties – Mean-value property - Poisson’s
formula- Schwartz’s theorem - Reflection principle. Power series expansions – Weierstrass’s
theorem – Taylor series - Laurent series.

UNIT V  18 hours
Partial fractions and factorization – Partial fractions - Infinite products - Canonical
products -Gamma functions.

Text Book:

UNIT I  Chapter 4  Sections 1.1 - 1.5, 2.1 - 2.3.
UNIT II  Chapter 4  Sections 3.1 - 3.4, 4.1 - 4.3.
UNIT III  Chapter 4  Sections 4.4 - 4.6, 5.1 - 5.3
UNIT IV  Chapter 4  Sections 6.1 - 6.5
Chapter 5  Sections 1.1 - 1.3
UNIT V  Chapter 5  Sections 2.1 - 2.4
Books for Reference:


Prepared by:
   Dr. R. Jahir Hussain
   Ms. B. Fathima Kani
   Mr. M. Sathik Jaseen
Objective:
To understand the various aspects of Linear Algebra and to train in problem-solving skill.

Prerequisite:
This course requires the basic knowledge on vector space, linear independent and dependent and linear map.

UNIT I 18 hours

UNIT II 18 hours

UNIT III 18 hours

UNIT IV 18 hours
Characteristic values – Annihilating polynomials – Invariant subspaces - Simultaneous triangulation and simultaneous diagonalization.

UNIT V 18 hours
Direct - Sum Decompositions – Invariant Direct sums – Primary Decomposition theorem.

# # Self- study portion.

Text Book:

UNIT I Chapter 1 Sections 1.2 - 1.4 and Chapter 2 Sections 2.1 – 2.3.
UNIT II Chapter 3 Sections 3.1 - 3.7.
UNIT III  Chapter 4  Sections 4.2 - 4.5  and  Chapter 5  Sections 5.2 - 5.4.
UNIT IV  Chapter 6  Sections 6.1 - 6.5.
UNIT V  Chapter 6  Sections 6.6 - 6.8.

Books for Reference:

Prepared by:
  Dr. A. Solairaju
  Mr. D. Dhamodharan
  Ms. K. Prasanna Devi
SEMESTER II: CORE-VIII
PARTIAL DIFFERENTIAL EQUATIONS

Course Code: 17PMA2C8  Max. Marks : 100
Hours/Week : 6  Internal Marks : 25
Credits : 4  External Marks: 75

Objective:
To give an introduction to Mathematical techniques in Analysis of P.D.E.

Prerequisite:
This course requires the basic knowledge on partial differentiation and problem solving partial differentiation.

UNIT I  18 hours
Curves and Surfaces-Genesis of First Order P.D.E-Classification of Integrals-Linear equations of the First Order- Pfaffian Differential Equations-Compatible Systems-Charpit’s method.

UNIT II  18 hours
Jacobi’s Method-Integral Surfaces Through a given Curve-Quasi-Linear Equations.

UNIT III  18 hours

UNIT IV  18 hours

UNIT V  18 hours

# # Self-study portion.

Text Book:

UNIT I  Chapter I  Sections  1.1-1.7
UNIT II  Chapter I  Sections  1.8-1.10
UNIT III  Chapter II  Sections  2.1-2.3.3
UNIT IV  Chapter II  Sections  2.3.5-2.4.9
UNIT V  Chapter II  Sections  2.4.12-2.6.2

Books for Reference:

Prepared by:
   Dr. A. Prasanna
   Mr. U. Abuthahir
   Ms. A. Nafuinisha
Objective:

To study mechanical systems under generalized coordinate systems, virtual work, energy and momentum, to study mechanics developed by Newton, Lagrange and Hamilton Jacobi concepts.

Prerequisite:

This course requires the basic knowledge about mechanics and statics.

UNIT I 18 hours
Mechanical system – Generalized Co-ordinates – Constraints – Virtual work – Energy and Momentum

UNIT II 18 hours
Derivation of Lagrange’s Equation – Examples – Integrals of the motion - Simple Problems

UNIT III 18 hours
Rayleigh’s Dissipation Function – Impulsive motion - Velocity dependent potentials

UNIT IV 18 hours
Hamilton’s principle – Hamilton’s equation - Other variational principles

UNIT V 18 hours
Hamilton’s principal function – The Hamilton’s – Jacobi equation – Separability - Simple Problems

# Self-study portion.

Text Book:

UNIT I Sections 1.1 - 1.5
UNIT II Sections 2.1 - 2.3
UNIT III Sections 3.1, 3.2 and 3.4
UNIT IV Sections 4.1, 4.2, 4.3
UNIT V Sections 5.1, 5.2 and 5.3

Books for Reference:

Prepared by:
Major. N. Abdul Ali
Mr. D. Dhamodharan
Ms. M. S. Afya Farhana
SEMESTER II: ELECTIVE - II
MATHEMATICAL METHODS IN BIOLOGY

Course Code : 17PMA2CE2B
Max. Marks : 100
Hours/Week : 6
Internal Marks : 25
Credit : 4
External Marks : 75

Objective:
To introduce Mathematics as a tool in the study of Biology.

Prerequisite:
This course requires the basic knowledge on sequence alignments and DBMS

UNIT I 18 hours
Sequence alignments, Basic string definitions, The importance of sequence comparison in Molecular Biology, The edit distance between two strings, String alignment, Edit graphs, Stringsimilarity, Alignment graphs, Local alignment, Introduction to Gaps, CDNA matching, A concrete illustration, Choices for gap weights, Time analysis.

UNIT II 18 hours
Overview of RDBMS, Advantages of DBNS, Normalization, Oracle data types, Introduction to SQL, DDL, DML, & TLC commands. Data definition Language, Data Manipulation Language, Transaction Control & data, Control language Grant & Revoke Privilege Command.

UNIT III 18 hours
Multiple sequence alignments, the morphological to the molecular, Common multiple alignment methods, multiple sequence alignments, Local alignment gaps, parametric sequence alignments, suboptimal alignments, Multifunction tools for sequence analysis.

UNIT IV 18 hours
Phylogenetic analysis, Evolutionary Trees and Phylogeny, Ultrasonic trees, Parsimony, Ultrametric problem, Perfect phylogeny, Phylogenetic alignment, Connection between multiple alignment and tree construction, Methods in Phylogeneic Analysis, Profiles and Motifs

UNIT V 18 hours

Text Books:
Books for Reference:
2. Dan Gusfield, Algorithms on Strings, trees and sequences, Cambridge University Press, USA.

Prepared by:

Dr. R. Jahir Hussain
Objective:
To understand measure on a real line, Borel measure, Lebesgue measure, measure on measurable space and product measure.

Prerequisite:
This course requires the basic knowledge about sets, functions and real numbers.

UNIT I 18 hours
#Set function and properties on sets in real line# - Measure on a real line – Lebesgue Outer measure – Measurable sets – Regularity – Measurable functions.

UNIT II 18 hours
#Borel set- Continuous function and integral function# - Borel and Lebesgue measurability – Integration of Functions of a real variable – Integration of non-negative functions – General Integral.

UNIT III 18 hours
#Measure on measurable space# - Abstract Measure Space – Measure and Outer measure – Uniqueness of the extension – Completion of a measure – Measure space – Integration with respect to measure.

UNIT IV 18 hours
#Countable and additive# - Convergence in measure – Almost uniform convergence - Signed measure and their derivatives – Hahn Decomposition – Jordan Decomposition.

UNIT V 18 hours
#Product space# - RadonNikodym theorem – Measure and Integration in a Product space – Measurability in a Product Space – Product Measure and Fubini’s theorem.
#  # Self-study portion.

Text Book:

UNIT I  Sections 2.1 – 2.4
UNIT II Sections 2.5, 3.1 – 3.2
UNIT III Sections 5.1 - 5.6
UNIT IV Sections 7.1,7.2,8.1,8.2
UNIT V  Sections 8.3, 10.1, 10.2

Books for Reference:

Prepared by:
   Dr. A. Solairaju
   Ms. M. S. Afya Farhana
   Mr. D. Dhamodharan
Objective:
To study the uncertainty environment, the fuzzy sets incorporates imprecision and subjectivity into the model formulation and solution process. The fuzzy set theory is to make the final crisp values.

Prerequisite:
This course requires the basic knowledge about sets, logic, arithmetic and LPP.

UNIT I 18 hours

UNIT II 18 hours
Fuzzy Arithmetic – Fuzzy numbers - Linguistic variables – Arithmetic operations on intervals – Arithmetic operations on Fuzzy numbers – Lattice of Fuzzy numbers – Fuzzy equations.

UNIT III 18 hours

UNIT IV 18 hours

UNIT V 18 hours
Fuzzy Relations – Composition of fuzzy relations – Properties of fuzzy relations.

# Self study

Text Books:
UNIT I
Chapter 1 Sections 1.3, 2.3
Chapter 3 Sections 3.1&3.2 T.B-1

UNIT II
Chapter 4 Sections 4.1-4.6 T.B-1

UNIT III
Chapter 8 Sections 8.2, 8.3, 8.5-8.7 T.B-1

UNIT IV
Chapter 15 Sections 15.2, 15.6, 15.7 T.B-1

UNIT V
Chapter 1 Sections 1.3-1.5 T.B-2

Books for Reference:

Prepared by:
Dr. A. Nagoor Gani
Ms. B. Fathima Kani
Mr. H. Sheik Mujibur Rahman
Objective:
To give an introduction to the behavior of fluids in motion and the applications of Complex integration in the analysis of the flow of liquids.

Prerequisite:
This course requires the basic knowledge on physical concepts of liquids and gas.

UNIT I 18 hours
Real fluids and ideal fluids - Velocity of a fluid at a point - Streamlines and pathlines - Steady and unsteady flows. Velocity potential - Vorticity vector - Local and particle rates of change - Equation of continuity - Worked examples - Acceleration of a point of a fluid.

UNIT II 18 hours
Pressure at a point in a fluid at rest - Pressure at a point in a moving fluid - Conditions at a boundary of two inviscid Immissible fluids - Euler’s equations of motion - Bernoulli’s equation - Worked examples - Some flows involving axial symmetry - Some special two dimensional flows - Impulsive motion.

UNIT III 18 hours
Some three dimensional flows - Sources, sinks and doublets - Images in a rigid infinite plane - Axis-symmetric flows - Stokes stream function - Some special forms of the stream function for Axis-symmetric irrotational motions.

UNIT IV 18 hours
Two dimensional flow - Use of cylindrical polar coordinates - Stream function. Complex potential for two-dimensional irrotational - Incompressible flow - Complex velocity potential for standard two-dimensional flows - Uniform stream, line sources and line sinks, line doublets, line vortices - Worked examples.

UNIT V 18 hours
Two dimensional image systems – Milne-Thomson circle theorem - Some applications of the circle theorem - Extension of the circle theorem - Theorem of Blasius - Use of conformal transformation – Some hydro dynamical aspects of conformal transformation - Worked example.

# Self-study portion.

Text Book:

UNIT I Chapter 2 Sections 2.1 to 2.9
UNIT II Chapter 3 Sections 3.1 to 3.6, 3.9 to 3.11
UNIT III Chapter 4 Sections 4.1 to 4.3, 4.5, 4.5.1
UNIT IV  Chapter 5 Sections 5.1 to 5.6
UNIT V  Chapter 5 Sections 5.7 to 5.10.2

Books for Reference:

Prepared by:
    Dr. A. Mohamed Ismayil
    Mr. D. Dhamodharan
    Ms. S. Sharmila Banu
Objective:
To familiarize with various concepts that has proved fruitful in modern graph theory.

Prerequisite:
This course requires the basic knowledge about graph theory.

UNIT I 18 hours
Connectivity and edge-connectivity – 2-connected graphs – Menger’s theorem.

UNIT II 18 hours

UNIT III 18 hours

UNIT IV 18 hours

UNIT V 18 hours
Perfect Graphs – Perfect Graph Theorem – Chordal Graphs – Interval Graphs – Comparability Graphs.

Text Book:

UNIT I Chapter 3 Sections 3.1 - 3.3
UNIT II Chapter 6 Sections 6.1 - 6.5
UNIT III Chapter 7 Sections 7.1, 7.2, 7.4 - 7.7
UNIT IV Chapter 10 Sections 10.1 - 10.4, 10.6, 10.7
UNIT V Chapter 12 Sections 12.1 - 12.5

Books for Reference:
2. S.A. Choudum, First Course in Graph Theory, Macmillan India Limited, New Delhi (2009).

Prepared by:
  Dr. R. Jahir Hussain
  Dr. S. Shajitha Begum
  Mr. H. Sheik Mujibur Rahman
SEMESTER III: ELECTIVE - III
MATHEMATICAL STATISTICS

Course Code : 17PMA3CE3A  Max. Marks : 100
Hours/Week : 6  Internal Marks : 25
Credits : 4  External Marks: 75

Objective:
To impact the knowledge in Mathematical Statistics.

Prerequisite:
This course requires the basic knowledge on probability and statistics.

UNIT I  18 hours

UNIT II  18 hours

UNIT III  18 hours
Convergence of Random Variables: Convergence in Probability-Convergence almost surely –Convergence in Distribution-Convergence in rth Mean-Monotone Convergence Theorem-Fatou’s Theorem- Dominated Convergence Theorem.

UNIT IV  18 hours

UNIT V  18 hours

Text Book:

UNIT I  Chapter 3  Sections 3.1 – 3.6.
UNIT II  Chapter 4  Sections 4.1 – 4.4 and Chapter 5  Sections 5.1 – 5.3.
UNIT III  Chapter 6  Sections 6.1 - 6.5.
UNIT IV  Chapter  10  Sections 10.1 – 10.3.
UNIT V  Chapter  11  Sections 11.1 – 11.3.

Books for Reference:

Prepared by:
Dr. P. Muruganantham
Mr. M. Sathik Jaseen
Ms. A. Thagasin Banu
Objective:
To motivate the students to Computational Mathematics, a recent trend in both educational and industrial fields.

Prerequisite:
This course requires the basic knowledge on algorithm and Data structures.

UNIT I 18 hours

UNIT II 18 hours
Divide and Conquer – General method, Binary search, Merge sort, Quick sort.

UNIT III 18 hours
The Greedy Method – Knapsack problem, Job sequencing with dead lines, Optimal storage on tapes, Optimal merge patterns.

UNIT IV 18 hours
Basic traversal – Inorder, preorder, postorder traversals, Breadth first search and traversal, Depth first search and traversal Backtracking – Sum of subsets, n-Queens problem (n = 4, 8).

UNIT V 18 hours
NP – Hard and NP – complete problems – Basic Concepts, Cook’s Theorem (Statement only), Conjunctive Normal Form (CNF) – satisfiability reduces to Clique Decision Problem (CDP), The Clique Decision Problem (CDP) reduces to The Node Cover Decision Problem.

Text Book:

Books for Reference:

Prepared by:

Dr. R. Jahir Hussain
Objective:
To introduce topics and techniques of discrete methods and to demonstrate the understanding of Discrete Mathematics by being able to apply logical reasoning to solve a variety of problems.

Prerequisite:
This course requires the basic knowledge on combinations, permutation and recurrence formula.

UNIT I
Computability and Formal Languages: Introduction- Russell’s Paradox and Non computability- Ordered sets – Languages- Phrase structure grammar- Types of grammar and Languages.

UNIT II
Finite state machines: Introduction- Finite state machines- Finite state machines as models of physical systems- Equivalent machines- Finite state machines as Languages Recognizers- Finite state languages and type 3- languages.

UNIT III

UNIT IV

UNIT V

Text Book:

UNIT I Chapter II Sections 2.1-2.6
UNIT II Chapter VII Sections 7.1-7.6
UNIT III  Chapter III  Sections  3.1-3.7
UNIT IV  Chapter IX  Sections  9.1-9.5
UNIT V  Chapter X  Sections  10.1-10.9.

Books for Reference:

Prepared by:
Dr. A. Nagoor Gani
Ms. S. Ameena Banu
Course Code : 17PMA4C13
Max. Marks : 100
Hours/Week : 6
Internal Marks : 25
Credits : 5
External Marks: 75

Objective:
To acquire more knowledge on Banach space through Hahn Banach theorem and Hilbert space through operators. Also obtain the knowledge of finite dimensional spectral theory.

Prerequisite:
This course requires the basic knowledge about norm, linear space, inner product.

UNIT I 18 hours
Banach Space: Definition and some examples - Continuous linear transformations – Hahn Banach theorem.

UNIT II 18 hours
Banach space (continued): Natural imbedding of N IN N**- Open mapping theorem - Conjugate of an operator.

UNIT III 18 hours
Hilbert spaces: Definition and some simple properties - Orthogonal complements - Orthonormal sets - Conjugate space H*.

UNIT IV 18 hours
Hilbert spaces (Continued): Adjoint of an operator - Self-adjoint operators - Normal and unitary operators - #Projections#.

UNIT V 18 hours
Finite Dimensional spectral theory: Matrices - Determinants and the spectrum of an operator - Spectral theorem.
# Self-study portion.

Text Book:

UNIT I Sections 46 - 48
UNIT II Sections 49 - 51
UNIT III Sections 52 - 55
UNIT IV Sections 56 - 59
UNIT V Sections 60 - 62

Books for Reference:

Prepared by:
  Dr. A. Mohamed Ismayil
  Mr. U. Abuthahir
  Ms. K. Prasanna Devi
Objective:
To understand the effect on optimal solution of an LPP due to variations in the parameter; The mathematical techniques to model and analyse decision problems and the mathematical technique to optimize a sequence of interrelated decision over a period of time.

Prerequisite:
This course requires the basic knowledge on LPP, optimization, inventory and decision making.

UNIT I
18 hours
Integer Linear Programming – Types of Integer Programming Problems – Gomory’s All Integer Cutting Plane Method - #Gomory’s Mixed Integer Cutting Plane Method#. Sensitivity Analysis – Change in Objective Function Coefficient – Addition of New Variable – Addition of New Constraint.

UNIT II
18 hours

UNIT III
18 hours

UNIT IV
18 hours
Deterministic Inventory Control models – #Meaning of inventory control – Reasons for carrying inventory – Factors involved in inventory problem analysis# - Inventory cost components – Demand for inventory items - Replenishment lead time - Length of planning period – Inventory model building – Single item inventory control modes without shortages – Model I(a): EOQ model with constant rate of demand , Model I(c): Economic production Quantity model when supply is gradual. Single item inventory control models with shortages – Model II (a): EOQ model with constant rate of demand and variable order cycle time.
UNIT V 18 hours


# Self-study portion.

Text Book:

UNIT I Sections 7.1, 7.2, 7.4, 7.5, 6.1 and 6.2 (6.2.1, 6.2.4, 6.2.5)
UNIT II Sections 8.1 - 8.6
UNIT III Sections 11.1, 11.2, 11.3, 11.4(11.4.1 - 11.4.5), 11.5(11.5.1)
12.1, 12.2, 12.3(12.3.1), 12.4, 12.5, 12.6.4
UNIT IV Sections 14.1, 14.2, 14.4, 14.5(14.5.1–14.5.4), 14.6(14.6.1-14.6.3), 14.7, 14.8(Part)
UNIT V Sections 22.1, 22.2, 22.3, 22.4(Model - I and Model - II), 22.5

Books for Reference:

Prepared by:
Dr. S. Ismail Mohideen
Ms. S. Sharmila Banu
Mr. H. Sheik Mujibur Rahman
Objective:
The aim of the course is to introduce to the students various types of integral equations and how to solve these equations and second to introduce the concept of calculus of variation and its applications.

Prerequisite:
This course requires the basic knowledge in eigen values, eigen functions and methods of successive approximation.

UNIT I 18 hours
Regularity conditions - Special kinds of kernels – Eigen values and Eigen functions – Convolution Integral – Inner or Scalar product of two functions. Integral equations with separable kernels - Reduction to a system of Algebraic Equations - #Examples# - Fredholm Alternative - #Examples#.

UNIT II 18 hours
Method of successive approximations - Iterative scheme - #Examples# - Volterra Integral Equations - #Examples# - Some results about the resolvent Kernel.

UNIT III 18 hours
Applications to ordinary differential equations - Initial value problems – Boundary value Problems - #Examples# - Singular integral equations - Abel Integral Equation - #Examples#.

UNIT IV 18 hours
Calculus of variations and applications - Maxima and Minima – Simplest case - #Illustrative examples#.

UNIT V 18 hours
Natural Boundary conditions and transition conditions – Variational notation - #More general case # - Constraints and Lagrange multipliers.
# Self-study portion.

Text Books:

Books for Reference:

Prepared by:

- Dr. M. Mohamed Jabarulla
- Mr. D. Dhamodharan
- Ms. M. Affrose Begum
Objective:
To study the Markov systems, Poisson Processes, Renewal Processes and Queueing Processes.

Prerequisite:
This course requires the basic knowledge in statistical concepts.

UNIT I  18 hours

UNIT II  18 Hours
Classification of States and Chains – Communication Relations – Class Property – Classifications of Chains – Classification of States: First Passage Time Distribution - Determination of Higher transition probabilities – Aperiodic Chain: Limiting Behavior - Stability of a Markov System – Limiting Behavior - Graph theoretic approach#.

UNIT III  18 Hours

UNIT IV  18 Hours

UNIT V  18 Hours
Queueing Processes – Steady State Distribution – General relationships in Queueing Theory – Little’s Formula – Queueing Model M/M/1: Steady state behavior – Transient behavior of M/M/1 Model.

Self study Portions

Text Book
UNIT I  Chapter 2  Sections 2.1 - 2.3  and Chapter 3  Sections 3.1, 3.2
UNIT II  Chapter 3  Sections 3.4 - 3.7
UNIT III  Chapter 4  Sections 4.1 - 4.2
UNIT IV  Chapter 6  Sections 6.1 - 6.3
UNIT V  Chapter 10  Sections 10.1 - 10.2.2, 10.3

Books for Reference:

Prepared by:
Mr. S. Mohamed Yusuff Ansari
Dr. S. Shajitha Begum
Mr. M. Sathik Jaseen
SEMESTER IV: ELECTIVE - IV
QUEUING THEORY AND NON-LINEAR PROGRAMMING

Course Code : 17PMA4CE4B  Max. Marks : 100
Hours/Week : 6  Internal Marks : 25
Credits : 4  External Marks : 75

Objective:
To study the optimization, Non-linear programming and Queuing Models.

Prerequisite:
This course requires the basic knowledge on LPP and optimization techniques

UNIT I  18 Hours
The Structure of a Queuing System - Performance Measure of a Queuing system - Probability Distributions in Queuing System - Classification of Queuing Models-Single Server Queuing Models.

UNIT II  18 Hours

UNIT III  18 hours
Unconstrained Optimization - Constrained Multivariable Optimization with Equality Constraints - Constrained Multivariable Optimization with inequality Constraints.

UNIT IV  18 Hours
The general Non-linear Programming Problem - #Graphical Solution Method# - Quadratic Programming - Applications of Quadratic Programming.

UNIT V  18 Hours
#  # Self-study portion.

Text Book

UNIT I  Chapter 16  Sections 16.1 - 16.6
UNIT II  Chapter 16  Sections 16.7 - 16.9
UNIT III  Chapter 23  Sections 23.1 - 23.4
UNIT IV  Chapter 24  Sections 24.2-24.5
UNIT V  Chapter 24  Sections 24.6-24.8

Books for Reference:

Prepared by:
Dr. R. Jahir Hussain
**SEMESTER IV: EXTRA CREDIT-II**

**DIFFERENTIAL GEOMETRY**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Max. Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>17PMA4EC2</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hours/Week</th>
<th>Internal Marks</th>
<th>Credits</th>
<th>External Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>5*</td>
<td>100*</td>
</tr>
</tbody>
</table>

**Objective:**
To understand the curvature and torsion of a space curve, Geodesics and the first and second fundamental forms of a surface.

**Prerequisite:**
This course requires the basic knowledge in 2-D and 3-D in graphs.

**UNIT I**
Theory of Space Curve – Arc length – Tangent, Normal, and Binormal – Curvature and torsion of a curve given as the intersection of two surfaces – contact between curves and surfaces – Tangent surfaces, involutes and evolutes – Intrinsic equations – fundamental existence theorem for space curves – Helices

**UNIT II**

**UNIT III**
Geodesics – Canonical geodesic equations – Normal property of geodesics – Existence theorems – Geodesic parallels – Geodesic curvature – Gauss-Bonnet theorem – Gaussian curvature – Surface of constant curvature

**UNIT IV**
The Second fundamental form – Local non-intrinsic properties of a surface – Principal curvatures – Lines of curvatures – Developables – Developables associated with space curves

**UNIT V**

**Text Book:**

**UNIT I**
Chapter I Sections 3 - 9

**UNIT II**
Chapter II Sections 1-9

**UNIT III**
Chapter II Sections 10 - 18

**UNIT IV**
Chapter III Sections 1- 5

**UNIT V**
Chapter III Sections 6 - 10
Books for Reference:

Prepared by:
   Mr. S. Masoothu
   Ms. B. Shafina Banu