CENTRE FOR DISTANCE AND ONLINE EDUCATION
BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI - 620024.

M.Sc. COMPUTER SCIENCE

CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS-LOCF)

(Applicable to the candidates admitted form the academic year 2026-2027 onwards)

Sem.	Course	CourseTitle	Credit	Exam Hrs.	Marks		Total
					Int.	Ext.	
I	Core Course I(CC)	Mathematical Foundation for Computer Science	5	3	25	75	100
	Core Course II(CC)	Problem Solving using Python andR	5	3	25	75	100
	Core Course III(CC)	Advanced Java Programming	5	3	25	75	100
	Core Practical I(CP)	Problem Solving using Python and R	4	3	40	60	100
	Elective Course I(EC)	Computer graphics and Multimedia	3	3	25	100	100
		Total	**22**	**-**		**-**	**500**
II	Core Course IV(CC)	Advanced Database Management System	5	3	25	75	100
	Core Course V (CC)	Compiler Design	5	3	25	75	100
	Core Course VI(CC)	Distributed Technologies	5	3	25	75	100
	Core Practical II(CP)	Advanced Database Management System	4	3	40	60	100
	Elective Course II(EC)	Open Source systems	3	3	25	100	100
	Non-Major Elective-I		2	3	25	100	100
		Total	**24**	**-**		**-**	**600**

PROGRAMMEOBJECTIVES:

- Practiceandgrowascomputingprofessionals,conductingresearchand/or
- leading,designing,developing,ormaintainingprojectsinvarioustechnical areas of computer science.
- Drivesscientificandsocietaladvancementthroughtechnological
- innovationandentrepreneurship
- To enable the students, to understand the core concepts, visualize and to apply them in the real time scenarios

PROGRAMMEOUTCOMES:

AfterthesuccessfulcompletionofM.Sc(ComputerScience)programme,the Graduates will be able to:

- Anabilitytoapplymathematicalmodel,algorithmicprinciples,andcomputer sciencetheoryinthedesignofreal-timeapplications
- Getexpertiseindevelopingsmartapplications
- Apply computer science theory and software development concepts toconstructcomputing-basedsolutions.
- Discover the opportunity for entrepreneurship and create and add value forthebettermentofanindividualandsocietyatlarge.
- Useresearch-basedknowledgeandresearchmethodstodesign,analyze,and interpret data and synthesize information to provide valid findings to serve thecommunity.

First Year **CORE COURSE I** **Semester I**

MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE

(Theory)

COURSE OBJECTIVE:

- Ability to apply mathematical logic to solve problems.
- Understand Propositions, tautologies, and inference rules.
- Able to formulate problems and apply the test of hypothesis.

UNIT - I — MATRICES:

Determinants, inverse of matrix. System of equations, Linear transformation - rank and nullity, Consistency and inconsistency of linear system of equations, rank-nullity theorem, Echelon form of a matrix, and Row reduced echelon form of matrix. Eigenvalues and Eigenvectors.

UNIT – II — POWER METHOD TO FIND THE DOMINANT EIGENVALUES, NUMERICAL LINEAR ALGEBRA:

Gauss elimination method, Gauss Jordan Method, Jacobi Method for solving linear systems.

UNIT – III — SETS:

Operations on sets, Venn Diagrams, Multi Sets, Binary Relations, Equivalence Relations, Ordering Relations, Operations on Relations, Partial Orders. Statements and Notation, Connectives, Quantified Propositions, Logical Inferences, Methods of Proof of an Implication, First Order Logic and other Methods of Proof, Rules of Inference for Quantified Propositions, Proof by Mathematical Induction.

UNIT – IV — GENERATING FUNCTIONS OF SEQUENCES:

Calculating Coefficients of Generating Functions, Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, the Method of Characteristic Roots, Solutions of Inhomogeneous Recurrence Relations.

UNIT – V — INTRODUCTION TO PROBABILITY:

Random variables - discrete and continuous, probability functions, density and distribution functions, mean and variance, special distributions (Binomial, Hypergeometric, Poisson, Uniform, exponential and normal). Testing of Hypothesis, Null and alternative hypothesis, level of significance, one-tailed and two-tailed tests, tests for small samples - T-test, Chi-square test.

UNIT – VI — CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned.

REFERENCES:

1. Kenneth H. Rosen, “Discrete Mathematics And Its Applications”, 7th Ed, Mc Graw Hill, 2012.
2. Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley India, 9th Edition, 2011.
3. Bernard Kolman, Robert Busby and Sharon Cutler Ross, “Discrete Mathematical Structures for Computer Science”, 6th Ed, PHI, 2013.
4. Walpole, R. E., Myers, R. H., Myers, S. L. & Keying Ye, “Probability and Statistics for Engineers and Scientists”. 8th ed., Pearson Education, 2007.

5. Eric Lehman, F. Thomson Leighton, Albert R. Meyer, "Mathematics for Computer Science", MIT, 7th Ed, 2015.
6. William Stein, "Elementary Number Theory: Primes, Congruences, and Secrets": A Computational Approach, Springer, 2008.
7. Sipser, "Introduction to the Theory of Computation", CENGAGE Learning, 2014.
   Ernest Davis, "Linear Algebra and Probability for Computer Science Applications", 1st Edition, CRC Press, 2012.
8. Tom M. Apostol, "Introduction to Analytic Number Theory", Springer, 1998.
9. https://mrcet.com/downloads/digital_notes/IT/MATHEMATICAL%20FOUNDATIONS%20OF%20(R17A0503).pdf
10. https://stattrek.com/tutorials/probability-tutorial
11. https://www.tutorialspoint.com/discrete_mathematics/discrete_mathematics_sets.htm
12. https://repositorio.uci.cu/jspui/bitstream/123456789/9433/1/Mathematical%20Foundation%20of%20Computer%20Science%20%28%20PDFDrive%20%29.pdf

COURSE OUTCOMES:

On successful completion of this course, students will be able to:

- Apply the basis of the mathematical applications.
- Apply iterative methods (Gauss Jordan, Gauss Elimination and Jacobi) to solve systems of linear equations.
- Understand Propositions, tautologies and inference rules.
- Use sets and operations on sets.
- Formulate problems and apply testing of hypothesis.

First Year **CORE COURSE II** **Semester I**

PROBLEM SOLVING USING PYTHON AND R (Theory)

COURSE OBJECTIVES:

- To understand Computational thinking using Python.
- To develop simple Python programs for solving problems.
- To make students exercise the fundamentals of statistical analysis in R environment.

UNIT – I — INTRODUCTION TO PYTHON:

Introduction – Python overview – Getting started – Comments – Python identifiers – Reserved keywords – Variables – Standard data types – Operators – Statements and Expressions – String operations – Boolean expressions. Control Statements: The for loop – while statement – if-elif-else statement – Input from keyboard. Functions: Introduction – Built-in functions – User defined functions – Function Definition – Function Call – Type conversion – Type coercion – Python recursive function.

UNIT – II — STRINGS:

Strings – Compound datatype – len function – String slices – String traversal – Escape characters – String formatting operator – String formatting functions.

Tuples: Tuples – Creating tuples – Accessing values in tuples – Tuple assignment – Tuples as return values – Basic tuple operations – Built-in tuple functions.

Lists: Values and accessing elements – Traversing a list – Deleting elements from list – Built-in list operators & methods.

Dictionaries: Creating dictionary – Accessing values in dictionary – Updating dictionary – Deleting elements from dictionary – Operations in dictionary – Built-in dictionary methods.

UNIT – III — FILES AND EXCEPTIONS:

Introduction to File Input and Output – Writing Structures to a File – Using loops to process files – Processing Records – Exception.

Classes and Objects in Python: Overview of OOP – Data encapsulation – Polymorphism – Class definition – Creating objects – Inheritance – Multiple inheritances – Method overriding – Data encapsulation – Data hiding.

UNIT – IV — DATA MANIPULATION TOOLS & SOFTWARES:

NumPy: Installation – Ndarray – Basic Operations – Indexing, Slicing, and Iterating – Shape Manipulation – Array Manipulation – Structured Arrays – Reading and Writing Array Data on Files.

Pandas: The pandas Library: An Introduction – Installation – Introduction to pandas Data Structures – Operations between Data Structures – Function Application and Mapping – Sorting and Ranking – Correlation and Covariance – Not a Number Data – Hierarchical Indexing and Leveling – **Reading and Writing Data:** CSV or Text File – HTML Files – Microsoft Excel Files.

UNIT – V — PROGRAMMING WITH R:

Variables – Vector, matrix, arrays – List – DataFrames – Functions – Strings – Factors – Loops – Packages – Date and Time – Files – Making packages.

UNIT – VI — CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned.

REFERENCES:

1. Python: The Complete Reference, Martin C. Brown, McGraw-Hill, 2018.
2. Python Programming: A Modular Approach with Graphics, Database, Mobile, and Web Applications – Sheetal Taneja, Naveen Kumar – Pearson Publication, 2018.
3. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, Wes McKinney, 2nd Edition, O'Reilly Media, 2017.
4. Data Analytics Using Python, Bharti Motwani, Wiley, 2020.
5. Richard Cotton, "Learning R", O'Reilly, 2013.
6. Python for Everybody: Exploring Data Using Python 3, Dr. Charles R. Severance, 2016.
7. E. Balagurusamy, "Introduction to Computing and Problem Solving Using Python", McGraw Hill Publication, 2016.
8. Mark Summerfield, Programming in Python 3: A Complete Introduction to the Python Language, 2nd Ed., Addison-Wesley Professional, 2010.
9. Mark Lutz, "Learning Python", 5th Ed., 2013.
10. Wesley J. Chun, "Core Python Programming", Prentice Hall, 2001.
11. https://realpython.com/python-practice-problems/
12. https://freepdf-books.com/impractical-python-projects-playful-programming-activities-to-make-you-smarter-book-of-2019/
13. https://freepdf-books.com/fundamentals-of-python-first-programs-second-edition-book-of-2019
14. https://docs.python.org
15. https://www.learnpython.org/
16. https://www.javatpoint.com/python-tutorial
17. https://www.tutorialspoint.com/r/index.htm

COURSE OUTCOMES:

On successful completion of this course, students will be able to:

- Write Python programs using Python data structures.
- Develop object-oriented programs in Python.
- Manipulate files using Python.
- Apply the Python libraries NumPy and Pandas for problem solving.
- Write R programs for data visualization.

First Year **CORE COURSE III** **Semester I**

ADVANCED JAVA PROGRAMMING

(Theory)

COURSE OBJECTIVES:

- To deepen student's programming skills by analyzing the real world problem in a programmer's point of view.
- To implement the concepts in real time projects.
- To enable the students to learn the ethical, historical, environmental and technological aspects of Advanced Java Programming.

UNIT – I: DESIGN PATTERNS:

Design Patterns: Introduction to Design patterns - Catalogue for Design Pattern - Factory Method Pattern - Prototype Pattern - Singleton Pattern - Adapter Pattern - Proxy Pattern - Decorator Pattern - Command Pattern - Template Pattern - Mediator Pattern - Collection Framework – ArrayList class – LinkedList class – ArrayList vs. LinkedList - ListIterator interface - HashSet class - LinkedHashSet class - TreeSet class - PriorityQueue class - Map interface - HashMap class - LinkedHashMap class – TreeMap class - Comparable interface - Comparator interface - Comparable vs. Comparator.

UNIT – II: APPLETS AND AWT:

Applet Fundamentals - Applet Class - Applet lifecycle - Steps for Developing Applet Programs - Passing Values through Parameters - Graphics in Applets - GUI Application - Dialog Boxes - Creating Windows - Layout Managers – AWT Component classes – Swing component classes - Borders – Event handling with AWT components - AWT Graphics classes - File Choosers - Color Choosers – Tree – Table – Tabbed panels – Progressive bar - Sliders.

UNIT – III: JDBC AND JAVA NETWORKING:

JDBC - Introduction - JDBC Architecture - JDBC Classes and Interfaces – Database Access with MySQL - Steps in Developing JDBC application - Creating a New Database and Table with JDBC - Working with Database Metadata; Java Networking Basics of Networking - Networking in Java - Socket Program using TCP/IP - Socket Program using UDP - URL and Inet address classes.

UNIT – IV: SERVLETS AND JSP:

Servlet: Advantages over Applets - Servlet Alternatives - Servlet Strengths - Servlet Architecture - Servlet Life Cycle – GenericServlet, HttpServlet - First Servlet - Invoking Servlet - Passing Parameters to Servlets - Retrieving Parameters - Server-Side Include – Cookies - JSP Engines - Working with JSP - JSP and Servlet - Anatomy of a JSP Page - Database Connectivity using Servlets and JSP.

UNIT – V: INTERFACE:

Lambda Expressions - Method Reference - Functional Interface - Streams API, Filters - Optional Class - Nashorn - Base64 Encode Decode - JShell (RPEL) - Collection Factory Methods - Private Interface Methods - Inner Class Diamond Operator - Multiresolution Image API.

UNIT – VI: CURRENT CONTOURS

(For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned.

REFERENCES:

1. Bert Bates, Karthy Sierra, Eric Freeman, Elisabeth Robson, “Head First Design Patterns”, O’REILLY Media Publishers. (1st Unit).
2. Herbert Schildt, “Java: A Beginner Guide”, Oracle Pres - Seventh Edition. (2nd and 3rd Unit).
3. Murach’s, “Java Servlets and JSP”, 2nd Edition, Mike Murach & Associates Publishers; 3rd Edition. (4th Unit).
4. Warburton Richard, “Java 8 Lambdas”, Shroff Publishers & Distributors Pvt Ltd. (5th Unit).
5. Paul Deitel and Harvey Deitel, “Java: How to Program”, Prentice Hall Publishers; 9th Edition.
6. Jan Graba, “An Introduction to Network Programming with Java - Java 7 Compatible”, 3rd Edition, Springer.
7. https://www.youtube.com/watch?v=Ae-r8hsbPUo
8. https://enos.itcollege.ee/~jpoial/allalaadimised/reading/Advanced-java.pdf
9. https://www.udemy.com/course/advanced-java-programming/
10. https://www.edureka.co/blog/advanced-java-tutorial

COURSE OUTCOMES:

After completion of this course, the students will be able to:

- Understand the design patterns.
- Develop a Graphical User Interface (GUI) with Applet.
- Develop a Client-Server Application with Database Maintenance.
- Develop a program using Servlet and JSP.
- Develop programs that use interfaces. Work on search engine, JSP Engines, etc.

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First Year **CORE PRACTICAL I** **Semester I**

PROBLEM SOLVING USING PYTHON AND R

(Practical)

a). Implement the following concepts using Python

1. Decision Making and Looping statements.
2. Function Definition & Function call.
3. Create and Access Lists.
4. Built-In Tuple Functions.
5. Create and Access Dictionaries.
6. Files and Exceptions.

(b). Implement the following concepts using R

1. Loops with different examples.
2. Implement data frames in R.
3. Implement different data structures in R (Vectors, Lists, Data Frames).
4. Write a program to read a CSV file and analyze the data in the file.
5. Create pie charts and bar charts using R.

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First Year **CORE ELECTIVE I** **Semester I**

3) COMPUTER GRAPHICS AND MULTIMEDIA
(Theory)

UNIT I: GRAPHICS HARDWARE

Basics of Computer Graphics, display technology, Raster Scan & Random Scan display systems, Input devices.

UNIT II: BASIC RASTER GRAPHICS FOR DRAWING 2-D PRIMITIVES

Scan converting lines, circles, ellipse; filling rectangles, polygons, generating characters; antialiasing. Matrix representation and Homogeneous coordinates, two dimensional transformations, 2D line clipping, polygon clipping algorithms, window to viewport transformation.

UNIT III: VIEWING IN 3D

Three dimensional transformation, projections: Parallel, prospective, viewpoints.

UNIT IV: REPRESENTATION OF CURVES & SURFACES

Bezier method, B-spline methods. Visible surface determination: Z-buffer, Algos, List priority algorithms, Scan line algorithms. Light and shading models: Illumination models, shading models for polygons, shading algorithms, Gouraud & Phong, color models like RGB, YIU, copy, HSV etc.

UNIT V: INTRODUCTION TO MULTIMEDIA

Multimedia components; multimedia hardware, SCSI, IDE, MCI, Multimedia data and file formats, RTF, TIFF, MIDI, JPEG, DIB, MPEG, Multimedia tools, presentation tools, Authoring tools, presentations. Graphics animation: Tweeking, Morphing, simulating accelerator, motion specification.

UNIT VI: CURRENT CONTOURS (For continuous internal assessment only)

Contemporary Developments Related to the Course during the Semester Concerned.

REFERENCES

1. Foley, Van Dam, *Fundamentals of Interactive Computer Graphics*, Addison Wesley
2. Hearn and Baker, *Computer Graphics*, Prentice Hall of India
3. Rogers D.F., *Procedural Elements of Computer Graphics*, McGraw Hill
4. R. Steinmetz, K. Nahrstedt, *Multimedia Computing, Communications & Appl.*, PHI
5. John F.K. Buford, *Multimedia System*, Addison Wesley
6. Prabhat K. Andleigh and Kiran Thakkar, *Multimedia System Design*, PHI
7. Roger S. David, *Mathematical Elements for Computer Graphics*, McGraw Hill
8. https://www.tutorialspoint.com/computer_graphics/computer_graphics_curves.htm
9. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=2479
10. https://www.tutorialspoint.com/computer_graphics/index.htm

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COURSE OUTCOMES

On completion of this course, the students will be able to:

- Understand the graphics hardware
- Get knowledge about Raster Graphics for drawing 2-D primitives
- Understand 3D Transformations
- Gain knowledge about different types of curves
- Understand Multimedia components

1. https://www.tutorialspoint.com/computer_graphics/computer_graphics_curves.htm
2. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=2479
3. https://www.tutorialspoint.com/computer_graphics/index.htm

COURSE OUTCOMES:

On completion of this course,the students will be able to:

- Understand the graphic shardware
- Get knowledge about Raster Graphics for drawing 2_D primitives
- Understand 3D Transformations
- Gain knowledge about different types of curves
- Understand Multimedia components.

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