RTM Nagpur University, Nagpur
Four Year B.Tech. Course
(Revised Curriculum as Per AICTE Model)
B.Tech. VII Semester Computer Technology Scheme

Code	Subject	Teaching Scheme			Evaluation Scheme			Credits	Minimum Passing Marks
		L	T	P	CA	UE	Total		
BTCT701T	Cryptography & Network Security (TH)	3	1	0	30	70	100	4	45
BTCT701P	Cryptography & Network Security (PR)	0	0	2	25	25	50	1	25
BTCT702T	Elective – IV	3	0	0	30	70	100	3	45
BTCT703T	Elective – V	3	0	0	30	70	100	3	45
BTCT704T	Open Elective-II	3	0	0	30	70	100	3	45
BTCT705P	Seminar (Project Work Phase -I)	0	0	6	50	50	100	3	50
BTCT706T	Research Methodology	0	0	2	0	0	0	Audit	Grade
	Total	**12**	**1**	**8**	**195**	**355**	**550**	**17**	

BTCT702T **- Elective IV**	BTCT703T **- Elective – V**	BTCT704T **-Open Elective-II**
1. Deep Learning **2.** Optimization Techniques **3.** Data Visualization	1. Parallel Programming **2.** Multimedia Computing **3.** Human Computer Interface	1. Python Programming 2. Java Programming 3. Data Structure

RTM Nagpur University, Nagpur
Four Year B.Tech. Course
(Revised Curriculum as Per AICTE Model)
B.Tech. VIII Semester Computer Technology Scheme

Subject Code	Subject	Teaching Scheme			Evaluation Scheme			Credits	Minimum Passing Marks
		L	T	P	CA	UE	Total		
BTCT801T	Elective VI MOOCS/NPTEL Course #	3	0	0	30	70	100	3	45
BTCT802T	Elective VII MOOCS/NPTEL Course #	3	0	0	30	70	100	3	45
BTCT803P	Project Work * (Phase- II) /Industry Project *	0	0	12	100	100	200	8	100
	Total	**06**	**00**	**12**	**160**	**240**	**400**	**14**	

Program Electives VI & VII can be opted from NPTEL/MOOCS. Final examination will be conducted by RTMNU.

* Industry Project/Project: Students are encouraged to complete this project in industry and one co-guide should be assigned from the institute. Two progress seminars should be arranged at the institute to monitor the progress of the project work.

BTCT801T - **Elective VI**	BTCT802T - **Elective – VII**
1. Social Networks 2. Reinforcement Learning 3. GPU Architectures and Programming	**1.** Predictive Analytics – Regression and Classification 2. Block chain and its Applications **3.** Data Analytics using Python

R.T.M. Nagpur University, Nagpur
Four Year B.Tech. Course
(Revised curriculum as per AICTE Model Curriculum)
B.Tech. VII Semester (Computer Technology) Scheme

Cryptography and Network Security	
Total Credits: 4	Subject Code: BTCT701T
Teaching Scheme : Lectures: 3 Hours/Week Tutorials: 1 Hours/Week Practical: 2 Hours/Week	Examination Scheme : Duration of University Exam: 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives :

1. To develop the student's ability to understand the concept of security goals in various applications and learn classical encryption techniques.
2. To apply fundamental knowledge on cryptographic mathematics used in various symmetric and asymmetric key cryptography.
3. To develop the student's ability to analyze the cryptographic algorithms.
4. To develop the student's ability to analyze the cryptographic algorithms.

Course Outcomes:

1. To understand basics of Cryptography and Network Security and classify the symmetric encryption techniques.
2. Understand, analyze and implement the symmetric key algorithm for secure transmission of data.
3. Acquire fundamental knowledge about the background of mathematics of asymmetric key cryptography and understand and analyze asymmetric key encryption algorithms and digital signatures.
4. Analyze the concept of message integrity and the algorithms for checking the integrity of data.
5. To understand various protocols for network security to protect against the threats in the networks.

Unit I **(08 Hrs)**

Introduction : Attributes of security, OSI Security Architecture**,** Model for network security. Mathematics of cryptography: modular arithmetic, Euclidean and extended Euclidean algorithm. Classical encryption techniques: substitution techniques-Caesar cipher, Vigenère's ciphers, Hill ciphers, Playfair ciphers and transposition techniques.

Unit II **(07 Hrs)**

Symmetric key cryptography: Block Cipher Principles, Data Encryption Standard (DES), Triple DES, Advanced Encryption Standard (AES), RC4, Key Distribution.

Unit III **(07 Hrs)**

Asymmetric key cryptography: Euler's Totient Function, Fermat's and Euler's Theorem, Chinese Remainder Theorem, RSA, Diffie Hellman Key Exchange, ECC, Entity authentication: Digital signature.

Unit IV **(07 Hrs)**

Message Integrity and authentication: Authentication Requirements and Functions, Hash Functions, MD5, Kerberos, Key Management, X.509 Digital Certificate format.

Unit V **(07 Hrs)**

Network Security: PGP, SSL, Firewalls, IDS, Software Vulnerability: Phishing, Buffer Overflow, SQL Injection, Electronic Payment Types,

Text Books:

1. William Stallings, “Cryptography and Network Security: Principles and Standards”, Prentice Hall India, 7th Edition, 2017.
2. Bernard Menezes, “Network Security and Cryptography”, Cengage Learning, 2010.

References:

1. Nina Godbole, “Information System Security”, Wiley India Publication, 2008.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network security, private communication in a public world", Second Edition, Prentice Hall, 2002.
3. Christopher M. King, Curtis Patton and RSA press, "Security architecture, Design Deployment and Operations", McGraw Hill Publication, 2001.
4. Robert Bragge, Mark Rhodes, Heithstraggberg "Network Security, The Complete Reference", Tata McGraw Hill Publication, 2004.
5. Behrouz A. Forouzan, “Cryptography and Network Security”, McGraw-Hill publication, 2nd Edition, 2010.

Cryptography and Network Security(PR)	
Total Credits: 1	Subject Code: BTCT701P
Teaching Scheme : Lectures: 0 Hours/Week Tutorials: 0 Hours/Week Practical: 2 Hours/Week	Examination Scheme : Duration of University Exam: College Assessment : 25 Marks University Assessment: 25 Marks

Minimum ten experiments should be conducted based on the Theory Syllabus.

Elective IV : Deep Learning (TH)	
Total Credits: 03	Subject Code: BTCT702T-1
Teaching Scheme : Lectures: 03 Hours/Week Tutorials: 00 Hours/Week Practical: 00 Hours/Week	Examination Scheme : Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:

1. To introduce basic deep learning algorithms.
2. To understand real world problem which will be solved by deep learning methods.
3. To identify deep learning techniques suitable for a real-world problem.

Course Outcomes:

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

1. Understand basic of deep learning algorithms.
2. Represent feedforward Neural Network
3. Evaluate the performance of different deep learning models with respect to the optimization, biasvariance trade-off, overfitting and underfitting.
4. Apply the convolution networks in context with real world problem solving.
5. Apply recurrent neural networks in context with real world problem solving.

UNIT I **(08 Hrs)**

Basic of Deep Learning - History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm and Convergence, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed forward Neural Networks.

UNIT II **(07 Hrs)**

Training of feedforward Neural Network - Representation Power of Feed forward Neural Networks, Training of feed forward neural network, Gradient Descent, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam.

UNIT III **(07 Hrs)**

Optimization Algorithm - Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Activation Function and Initialization Methods: Sigmoid, Tanh, Relu, Xavier and He initialization, Regularization: Bias and variance, Overfitting, Hyperparameters tuning, L1 and L2 regularization, Data Augmentation and early stopping, Parameter sharing and tying.

UNIT IV **(07 Hrs)**

Convolution Neural Network (CNN) - Convolutional operation, Pooling, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet. Visualizing Convolutional Neural Networks, Guided Backpropagation.

UNIT V **(07 Hrs)**

Recurrent Neural Network (RNN) - Recurrent Neural Networks, Backpropagation through Time (BPTT), Vanishing and Exploding Gradients, Long Short-Term Memory (LSTM) Cells, Gated Recurrent Units (GRUs).

Text Books:

1. Sandro Skansi, "Introduction to Deep Learning" , Springer Publication.
2. Charu C. , Aggarwal.,"Neural Networks and Deep Learning: A Textbook", Springer 2019.
3. Ian Goodfellow , Yoshua Bengio and Aaron Courville," Deep Learning", MIT Press book. 2016.
4. Dr. S Lovelyn Rose, Dr. L Ashok Kumar, Dr.D Karthika Renuka , "Deep Learning using Python", Willey Publication.

References:

1. Yegnanarayana, B., "Artificial Neural Networks" PHI Learning Pvt. Ltd, 2009.
2. A.Ravindran, K. M. Ragsdell , and G. V. Reklaitis, Engineering Optimization: Methods and Applications , John Wiley & Sons, Inc. , 2016.

Elective IV : Optimization Techniques (TH)	
Total Credits: 03	Subject Code: BTCT702T-2
Teaching Scheme : Lectures: 03 Hours/Week Tutorials: 00 Hours/Week Practical: 00 Hours/Week	Examination Scheme : Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objective :

1. To apply the theory of optimization methods and algorithms for developing and solving various types of optimization problems.

2. To apply optimization techniques in research to solve problems of Engineering and Technology

Course Outcome:

At the end of this course Student are able to:

1. Explain the theoretical workings of the graphical, simplex and analytical methods for making effective decision on variables so as to optimize the objective function.
2. Identify appropriate optimization method to solve complex problems involved in various industries.
3. Demonstrate the optimized material distribution schedule using transportation model to minimize total distribution cost.
4. Identify appropriate equipment replacement technique to be adopted to minimize maintenance cost by eliminating equipment break-down.
5. Apply the knowledge of game theory concepts to articulate real-world competitive situations to identify strategic decisions to counter the consequences.

UNIT I **(07 Hrs)**

Introduction of operation research: LP Formulations, Graphical method for solving LP's with 2 variables, Simplex method, Duality theory in linear programming and applications, Integer linear programming, dual simplex method.

UNIT II **(08 Hrs)**

Dynamic Programming : Basic Concepts, Bellman's optimality principles, Dynamics Programming approach in decision making problems, optimal subdivision problem. Sequencing Models: Sequencing problem, Johnson's Algorithm for processing n jobs through 2 machines, Algorithm for processing n jobs through 3 or more machines, Processing 2 jobs through n machines.

UNIT III **(07Hrs)**

Project Management : PERT and CPM : Project management origin and use of PERT, origin and use of CPM, Applications of PERT and CPM, Project Network, Diagram representation, Critical path calculation by network analysis and critical path method (CPM), Determination of floats, Construction of time chart and resource labelling, Project cost curve and crashing in project management, Project Evaluation and review Technique (PERT).

UNIT IV **(07 Hrs)**

Queuing Models : Essential features of queuing systems, operating characteristics of queuing system, probability distribution in queuing systems, classification of queuing models, solution of queuing M/M/1: ∞ /FCFS,M/M/1 : N/FCFS, M/M/S : ∞/FCFS, M/M/S : N/FCFS.

UNIT V **(07Hrs)**

Inventory Models : Introduction to the inventory problem, Deterministic Models, The classical EOQ (Economic Order Quantity) model, Inventory models with deterministic demands (no shortage & shortage allowed), Inventory models with probabilistic demand, multi-item determines models.

Text Books:

1. Gillet B.E," Introduction to Operation Research, Computer Oriented Algorithmic approach", Tata McGraw Hill Publication.
2. P.K. Gupta & D.S. Hira, “Operations Research”, S.Chand & Co.

References:

1. J.K. Sharma, “Operations Research: Theory and Applications”, Mac Millan.
2. S.D. Sharma, “Operations Research”, Kedar Nath , Ram Nath, Meerut.
3. S.S. Rao “Optimization Theory and Application”, Wesley Eastern.

Elective IV : Data Visualization (TH)	
Total Credits: 03	Subject Code: BTCT702T-3
Teaching Scheme : Lectures: 03 Hours/Week Tutorials: 00 Hours/Week Practical: 00 Hours/Week	Examination Scheme : Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:

1. To learn different statistical methods for Data visualization.
2. To learn basics of R and Python.
3. To learn usage of Watson studio.
4. To learn about packages NumPy, pandas and matplotlib.
5. To learn functionalities and usages of Seaborn.

Course Outcomes:

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

1. Apply statistical methods for Data visualization.
2. Gain knowledge on R and Python
3. Understand usage of various packages in R and Python.
4. Demonstrate knowledge of Watson studio.
5. Apply data visualization tools on various data sets.

UNIT I **(10Hrs)**

Introduction to Statistics : Introduction to Statistics, Difference between inferential statistics and descriptive statistics, Inferential Statistics- Drawing Inferences from Data, Random Variables, Normal Probability Distribution, Sampling, Sample Statistics and Sampling Distributions. R overview and Installation- Overview and About R, R and R studio Installation, Descriptive Data analysis using R, Description of basic functions used to describe data in R.

UNIT II **(07 Hrs)**

Data manipulation with R: Data manipulation packages, Data visualization with R. Data visualization in Watson Studio: Adding data to data refinery, Visualization of Data on Watson Studio.

UNIT III **(05 Hrs)**

Python: Introduction to Python, How to Install, Introduction to Jupyter Notebook, Python scripting basics, NumPy and Pandas.

UNIT IV **(08 Hrs)**

Data Visualization Tools in Python- Introduction to Matplotlib, Basic plots using matplotlib, Specialized Visualization Tools using Matplotlib, Advanced Visualization Tools using Matplotlib- Waffle Charts, Word Clouds.

UNIT V **(06 Hrs)**

Introduction to Seaborn: Seaborn functionalities and usage, Spatial Visualizations and Analysis in Python with Folium, Case Study.

Textbooks:

1., R. Nageswara Rao, " Core Python Programming ", 2 nd Edition, Dreamtech Press.

2. Alboukadel Kassambara ," R Graphics Essentials for Great Data Visualization" .

References:

1. Phuong Vo.T.H, Martin Czygan, Ashish Kumar, Kirthi Raman, "Python Data Analytics and Visualization.", A course in three modules, Packt Publishing 2017.

Elective V : Parallel Computing	
Total Credits: 3	Subject Code: BTCT703T-1
Teaching Scheme : Lectures: 3 Hours/Week Tutorials: 0 Hours/Week Practical: 0 Hours/Week	Examination Scheme : Duration of University Exam: 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives :

1. To understand the concepts of parallel computing.
2. To analyze the behavior of high-performance parallel programs for distributed memory architectures.
3. To analyze the behavior of high-performance parallel programs for shared memory architectures.

Course Outcomes:

At the end of the course the students will be able to:

1. Understand the concepts and terminology of parallel computing.
2. Write and analyze the behavior of high-performance parallel programs for distributed memory architectures.
3. Write and analyze the behavior of high-performance parallel programs for shared memory architectures.
4. Study, learn about, and present some aspect of parallel computing.
5. Master skills to measure the performance of parallel and distributed programs.

Unit I **(07 Hrs)**

Abstract parallel models: PRAM models Parallelism approaches - data parallelism, control parallelism. Hierarchical memory structure, Virtual memory system, Memory allocation and management, Cache allocation and management

Unit II **(07 Hrs)**

Pipeline architecture, Array processor, multi-processor architecture, Systolic architecture, Dataflow architecture, Symmetric multiprocessing (SMP).

Unit III **(08 Hrs)**

Data Dependency Analysis: Types of dependencies loop and array dependences, Loop dependence analysis, Program transformations. Shared Memory Programming: General model of shared memory programming, Process model under UNIX.

Unit IV **(07 Hrs)**

Algorithms for Parallel Machines: Parallel reduction, Matrix multiplication, Parallel sorting algorithms. Message Passing Programming and OpenMP.

Unit V **(07 Hrs)**

Performance Metrices: Laws governing performance measurements. Metrices - speedups, efficiency, utilization, communication overheads. Amdahl's law, Gustafson-Barsis's law, Karf Flatt metric, Iso efficiency metric.

Text Books:

1. Shasikumar M., "Introduction to Parallel Processing", PHI, 2006.
2. Hawang Kai and Briggs F. A., "Computer Architecture and Parallel Processing", McGraw Hill,1993.
3. M. J. Quinn, "Parallel Programming in C with MPI and OpenMP", McGraw Hill, 2003.

References:

1. Jorden H. F. and Alaghaband G., "Fundamentals of Parallel Processing", Prentice Hall, 2002.
2. Wilson G. V., "Practical Parallel Programming", MIT Press, 1996.
3. D. E. Culler, J. P. Singh, A. Gupta, "Parallel Computer Architecture", Morgan Kaufman, 1998.

Elective V : Multimedia Computing	
Total Credits: 3	Subject Code: BTCT703T-2
Teaching Scheme : Lectures: 3 Hours/Week Tutorials: 0 Hours/Week Practical: 0 Hours/Week	Examination Scheme : Duration of University Exam: 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objective:

1. To analyze various theories, components and elements of multimedia.
2. To conceptualize and develop effective multimedia projects.
3. To address issues surrounding multimedia design and use and use tools/ software to create multimedia content.

Course Outcomes:

Upon completion of this course, the students should be able to:

1. Discuss the concepts, standards and components of multimedia, Examine multimedia applications against multimedia principles, standards, and techniques.
2. Demonstrate the use of audio as an element of multimedia using the latest tools, technologies, techniques, and standards
3. Demonstrate the use of Image as an element of multimedia using the latest tools, technologies, techniques, and standards.
4. Demonstrate the use of Video as an element of multimedia using the latest tools, technologies, techniques, and standards.
5. Use an appropriate software /tool for multimedia authoring and Acquire knowledge of multimedia databases.

UNIT I: (07 Hrs.)

Multimedia Concepts: Multimedia and components of multimedia, Web and Internet multimedia applications, Transition from conventional media to digital media. Multimedia System Architecture, Defining Objects for Multimedia Systems, The components of multimedia system, Multimedia standards and software tools. Stages of multimedia application development, Multimedia Data Interface Standard. The disadvantages and advantages of multimedia.

UNIT-II : **(**07Hrs.)

Audio fundamentals and representations: Digitization of sound, frequency and bandwidth, decibel system, data rate, audio file format, Sound synthesis, MIDI, wavetable, Compression and transmission of audio on Internet, Adding sound to your multimedia project, Audio software and hardware.

UNIT III : **(** 07 Hrs.)

Image fundamentals and representations: Image representation. Colour Science , Colour, Colour Models, Colour palettes, Dithering, 2D Graphics, Image Compression and File Formats :GIF, JPEG, JPEG 2000, PNG, TIFF, EXIF, PS, PDF, Basic Image Processing and Use of Photoshop, use of image editing software, White balance correction, Dynamic range correction, Gamma correction, Photo Retouching.

UNIT IV : **(**07 Hrs.)

Video and Animation fundamentals and representations: Video Basics, How Video Works, Broadcast Video Standards, Analog video, Digital video, Video Recording and Tape formats, Shooting and Editing Video, Use of Adobe Premier for editing, Video Compression and File Formats. Video compression based on motion compensation, MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21, Animation: Cell Animation, Computer Animation, Morphing.

UNIT V: **(**08 Hrs)

Multimedia Authoring: Multimedia Authoring Basics, Some Authoring Tools, working on various multimedia tools using Macromedia Flash.

Design and Architecture of a Multimedia Database: Media Abstractions, Image databases, Text/document databases, Audio/video databases.

Text Books:

1. Tay Vaughan, "Multimedia making it work", Tata McGraw-Hill, 2008.
2. Prabhat k. Andheigh, Kiran Thakrar, John F, Multimedia Systems Design, Prentice Hall of India
3. Li & Drew, "Fundamentals of Multimedia", Pearson Education, 2009.
4. V.S. Subrahmanian, "Principles of Multimedia Database Systems", Morgan Kauffman, 2nd Edition,2013.

References:

1. Parekh Ranjan, "Principles of Multimedia", Tata McGraw-Hill, 2007.
2. Anirban Mukhopadhyay and Arup Chattopadhyay, "Introduction to Computer Graphics and Multimedia", Second Edition, Vikas Publishing House.
3. Rajneesh Aggarwal & B. B Tiwari, " Multimedia Systems" Excel Publication, New Delhi, 2007.

Elective V : Human Computer Interface (TH)	
Total Credits: 03	**Subject Code: BTCT702T-3**
Teaching Scheme : **Lectures: 03 Hours/Week** **Tutorials: 00 Hours/Week** **Practical: 00 Hours/Week**	**Examination Scheme :** **Duration of University Exam : 03 Hrs.** **College Assessment : 30 Marks** **University Assessment:70 Marks**

Course Objectives:

1. To Understand basic of human computer interaction.
2. To describe interaction design and how it relates to human computer interaction and other fields.
3. To use, adapt and extend classic design standards, guidelines, and patterns.
4. To study types of mobile application along with designing.

Course Outcomes:

On successful completion of the course, students will be able

1. Describe the capabilities of both humans and computers.
2. Design effective dialog for HCI.
3. Identify the stake holder‘s requirements and choose the appropriate models.
4. Develop mobile HCI using mobile elements and tools.
5. Design web interfaces using different techniques.

UNIT I **(07Hrs)**

Foundations of HCI: The Human - I/O channels, Memory, Reasoning and problem solving;
The computer - Devices, memory, processing and networks; Interaction - Models, frameworks, Ergonomics, styles, elements, interactivity Paradigms.

UNIT II **(08Hrs)**

Design & Software Process : Interactive Design basics, process, scenarios, navigation, screen design, Iteration and prototyping. HCI in software process, software life cycle, usability engineering, Prototyping in practice, design rationale. Design rules, principles, standards, guidelines, rules. Evaluation Techniques, Universal Design.

UNIT III **(07Hrs)**

Models and Theories : Cognitive models, socio-organizational issues and stake holder requirements, Communication and collaboration models - Hypertext, Multimedia and WWW.

UNIT IV **(07Hrs)**

Mobile HCI - Mobile Ecosystem: Platforms, application frameworks - Types of Mobile Applications: Widgets, applications, Games - Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of mobile Design, tools.

UNIT V **(07Hrs)**

Web Interface Design - Designing web interfaces, drag and drop, direct selection, contextual tools, overlays, inlays and virtual pages, process flow. case studies.

Text Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004.

2. Brian Fling, "Mobile Design and Development", First Edition , O'Reilly Media Inc., 2009.

3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly,2009.

Open Elective II : Python Programming (TH)	
Total Credits: 03	Subject Code : BTCT704T-1
Teaching Scheme	Examination Scheme
Lectures: 3 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 30 Marks
Practical: 0 Hours/Week	University Assessment:70 Marks

Course Objectives :

1. To explain the basic concept of python , object-oriented programming and illustrate coding in Python Programming Language.
2. To make students capable of Implementing programs and applications using various features of python programming.

Course Outcomes:

After completing the course, students will be able to

1. Understand and implement the basic concept of python programming language.
2. Develop Code and test conditional statement of moderate size using the python language.
3. Implement the concept of Function and modules in programming language.
4. Understand and implement the concept of object-oriented programming in python programming language.
5. Know and demonstrate the working of files for good program design using python language.

UNIT I : (08 Hrs)

Introduction to Python, Domains, Python Basics: Identifiers and Keywords, Comments, Indentation and Multi-lining Python Types, Operations and Conversions, Python Format, Python Operators. Variables and Data Types, String Manipulation: Accessing Strings, Basic Operations, String slices, Lists: Introduction, Accessing list, Operations, Working with lists, Tuple: Introduction, Accessing tuples, Operations, Sets and Dictionaries.

UNIT II : (07 Hrs)

Operator Conditional Statements : If, If- else, Nested if-else, Using NOT, AND, IN, Operator with If Else .Looping : For Loop Syntax, For Loop Workflow, Examples of For, Loop, Range() Function with for loop, Else Clause with For Loop, While Syntax, Examples, Nested loops, Control Statements, Break, Continue, Pass.

UNIT III : (07 Hrs)

Functions : Built-in, Functions, Library Functions, Defining a function, Calling a function, Types of functions, Function, Arguments, Mutable Arguments and Binding of Default Values, Global and local Variables.

UNIT IV : **(08 Hrs)**

Introduction to Object Oriented Programming (OOP), Features of OOP, Python Class and Objects, Classes and methods, Constructor and Destructor, Simple and Multiple Inheritance.

UNIT V : **(06 Hrs)**

Working with Files: File Input Output, Read and Write Operations, Set File offset in Python, Python File object methods.

Text Books:

1. Yashavant Kanetkar, Aditya Kanetkar. " Let Us Python", 2nd Revised Edition.
2. Dr. R. Nageswara Rao, "Core Python Programming".

Open Elective II : Java Programming (TH)	
Total Credits: 03	Subject Code: BTCT704T-2
Teaching Scheme Lectures: 3 Hours/Week Tutorials: 0 Hours/Week Practical: 0 Hours/Week	Examination Scheme Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assesment:70 Marks

Course Objectives:

1. To make students to understand elements of JAVA programming language.
2. To make students to understand concepts of object-oriented programming.
3. To make students to write programs in Java to solve variety of problems.

Course Outcomes:

After completing the course, students will be able to -

1. Explain various data types, operators, control flow statements and apply it to develop a Java program.
2. Describe concepts of objects, classes, interface and inheritance and to apply them to develop an object oriented and Java program.
3. Describe the memory management, constructors and intricacies of constructors and apply it to develop a Java program.
4. Describe polymorphism, method overloading, function overloading and apply it to develop a Java program.
5. Describe exception handling, input-output streams and apply it to develop Java program.

Unit I **(06 Hrs)**

Data types and Operators: Primitive Data types, Variables, Literals, Arrays, Enumerated Data types, Non-Primitive Data types, operators in java, Operator Precedence, Implicit Type Conversions, Type casting .
Control Flow statements: if, if-else, Nested if and if-else, switch case, for loops, while and do-while loops, continue and break Statement, labeled break statement etc. , programs based on operators and control statements.

Unit II **(08 Hrs)**

Object Oriented Concepts: Classes and Objects, defining a class, encapsulation ,access modifiers, variables and methods in Java, Method Signature, instance variables, creating objects of a class, call a user-defined method ,Interfaces and Abstract classes, Abstract and non-abstract methods, Inheritance and its types, program based on single inheritance.

Unit III **(08 Hrs)**

Static variables and methods, static block, Memory management in java: JVM, stack and heap memory, garbage collector.

Constructors: Properties and rules of Constructors, Types of Constructors, Default and Parameterized Constructors, this and super keyword, programs based on types of constructors, super and this keyword.

Unit IV **(07 Hrs)**

Polymorphism: concepts of polymorphism, Compile-time polymorphism, run-time polymorphism, Method Overriding and method overloading, rules of Method Overriding and Method overloading, Object class and to String() method.

Packages: Need of packages, package declaration, types of packages, Programs based on packages

Unit V **(07 Hrs)**

Exceptions: Need for exceptions, Exceptions hierarchy, Types of Exceptions, try, catch, finally, throw, throws, program based on exception handling.

Input-Output: Introduction to Stream, Byte Stream, Character stream, Readers and Writers, File Class, File Input Stream, File Output Stream, Input Stream Reader, Output Stream Writer, FileReader, FileWriter, Buffered Reader

Text Books :

1. E.Balaguruswamy, "Programming with Java A Primer", Tata McGraw Hill Publications.
2. Herbert Schild, "The Complete Reference, Java 2" ,Tata McGraw Hill Publications.

References:

1. Daniel Liang, "Introduction to Java Programming (Comprehensive Version)",Pearson Education Publication.
2. Sachin Malhotra , Saurabh Chaudhary,"Programming in Java", Oxford University Press.
3. Horstmann and Cornell, "Core Java Volume-I Fundamentals", Pearson Education Publication.

Open Elective II : Data Structures (TH)	
Total Credits: 03	Subject Code: BTCT704T-3
Teaching Scheme: Lectures: 3 Hours/Week Tutorials: 0 Hours/Week Practical: 0 Hours/Week	Examination Scheme: Duration of University Exam: 03 Hrs. College Assessment: 30 Marks University Assesment:70 Marks

Course Objectives:

1. To make students to understand essential fundamentals of various data structures.
2. To make students to understand characteristics of algorithms, time complexity and space complexity analysis.
3. To make students to understand program design methodologies and application of various data structures in program design.

Course Outcomes:

After completing the course, students will be able to -

1. Describe abstract data types, types of data structures, characteristics of an algorithm, time and space complexity.
2. Explain and carry out time and space complexity of various sorting, searching, hashing techniques.
3. Describe linear data structures, application of linear data structures to develop a program and their analysis.
4. Describe nonlinear data structures, application of nonlinear data structures to develop a program and their analysis.
5. Explain graphs as data structure, representation of graphs, graph traversal algorithms, applications of graph and analysis of these algorithms.

Unit I **(08 Hrs)**

Fundamentals of Data Structures, Classification of Data Structures, Algorithm analysis, average and worst-case analysis, asymptotic notation.

Searching and Sorting techniques: Searching algorithms, Analysis of Sequential Search, The Binary Search, Analysis of Binary Search Sorting Algorithms: Bubble Sort, Selection Sort, The Insertion Sort, Analysis of sorting algorithms.

Unit II **(07 Hrs)**

Stacks and Queues: stacks, basic operations on stack, application of stacks such as, Evaluation of expressions, Polish expressions their compilation using stacks, Circular Queue and priority queues.

Unit III **(08 Hrs)**

Linked Lists: Basics of Linked List, Singly Linked List using dynamic memory allocation method, doubly linked list, circular linked list, Implantation of Stacks and Queues using Linked list,

Unit IV **(06 Hrs)**

Trees: Basic Terminology, Binary tree representations, binary tree traversals, binary search trees, threaded binary trees.

Unit V **(07 Hrs)**

Graphs: Definition & terminology, An Adjacency Matrix, An Adjacency List, multi list, Breadth First Search Analysis, Depth First Search Analysis, Minimum cost spanning trees, Prim's Algorithm.

Text Books:

1. Horowitz and Sahani," Fundamentals of Data Structures".
2. George H & Garry," Algorithms in a Nutshell", O'reilly Publication.
3. Rance D. Necaise, "Data Structures and Algorithms Using Python" Wiley Student Edition, 2016.
4. John Hubbard , "Data Structures with Java", McGraw Hill Publications.

References:

1. Tanenbaum," Data Structures using C" , Pearson Education.

Research Methodology	
Total Credits: 00	Subject Code: BTCT706T
Teaching Scheme: Lectures: 2 Hours/Week Tutorials: 0 Hours/Week Practical: 0 Hours/Week	Examination Scheme: College Assessment: Grade

Course Objectives:

1. To impart knowledge and skills required for research methodology.
2. Problem formulation, analysis and solution.
3. Technical paper writing.

Course Outcomes:

After completing the course, students will be able to

1. Understand the basics of research methodology.
2. Formulate research problem.
3. Collect, analyze data.
4. Write and publish technical paper.
5. Follow research ethics.

Unit I **(08 Hrs)**

Foundations of Research: Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method - Understanding the language of Research - Concept, Construct, Definition, Variable. Research Process.

Problem Identification & Formulation - Research Question - Investigation Question - Measurement Issues - Hypothesis - Qualities of a good Hypothesis - Null Hypothesis & Alternative Hypothesis. Hypothesis Testing - Logic & Importance.

Unit II **(06 Hrs)**

Qualitative and Quantitative Research: Qualitative research , Quantitative research , Literature Survey - importance of literature Survey, sources of information, assessment of quality of journals and articles, effective approaches of literature studies.

Unit III **(04Hrs)**

Data Analysis: Data Preparation - Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis- Cross tabulations and Chisquare test including testing hypothesis of association.

Unit IV **(06 Hrs)**

Paper Writing- Layout of a Research Paper, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Use of tools / techniques for Research, Reference Management Softwares, Software for paper formatting like LaTeX/ MS Office, Software for detection of Plagiarism.

Text Books:

1. Donald Cooper & Pamela Schindler, "Business Research Methods", 9th editions Tata Macgraw Hill.
2. Alan Bryman & Emma Bell, " Business Research Methods ", Oxford University Press.
3. C. R. Kothari, " Research Methodology".