RTMNU B.TECH. SCHEME OF EXAMINATION

Scheme of Teaching & Examination of Bachelor of Technology III Semester B.Tech. Computer Science & Engineering [NEP]

Sr. No.	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
				Th	TU	P		Theory				Practical			BOS
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	CS
1	PCC-II	Data Structure and Algorithms	BCSE3T09	3	-	-	3	3	70	30	45	-	-	-	CS
2	PCC-II	Data Structure and Algorithms Lab	BCSE3P09	-	-	2	1	-	-	-	-	25	25	25	CS
3	PCC-III	Object Oriented Programming using Java	BCSE3T10	3	-	-	3	3	70	30	45	-	-	-	CS
4	PCC-III	Object Oriented Programming using Java Lab.	BCSE3P10	-	-	2	1	-	-	-	-	25	25	25	CS
5	MDM-I	Probability Theory and Statistics	BMD3T11	2	-	-	2	2	70	30	45	-	-	-	AS&H
6	OE-I	Refer Open Elective –I Basket	BOE3T01	3	-	-	3	3	70	30	45	-	-	-	CS
7	OE-I	Refer Open Elective-I Basket	BOE3P01	-	-	2	1	-	-	-	-	-	50	25	CS
8	HSSM-I	Entrepreneurship and Startups	BHM3T01	2	-	-	2	2	70	30	45	-	-	-	CS
9	VEC-I	Constitution of India	BVE3T01	2	-	-	2	2	70	30	45	-	-	-	AS&H
10	CEP	Community Engagement Project	BCE3P01	-	-	4	2	-	-	-	-	-	100	50	AS&H
Total				15	-	10	20		420	180		50	200		

Open Elective I : 1. Data Structure 2. Python Programming 3. Object Oriented Concepts

Third Semester B. Tech. (Computer Science & Engineering)

Data Structure and Algorithms (TH+P)	
Total Credits: 03 T + 01 P	**Subject Code :** BCSE3T09
Teaching Scheme :	**Examination Scheme :**
Lectures: 3 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 30 Marks
Practical: 02 Hours/Week	University Assessment:70 Marks
Course Category : PCC - II	**BoS :** CSE

Course Objectives	
1	To learn the concept of Data Structure using efficient algorithms
2	To solve real world problem using Data Structure Concepts.

Course Outcomes	
After completion of syllabus, students would be able to	
CO 1	Understand the efficiency of an algorithm based on time and space complexity and classify an appropriate searching and sorting techniques to solve given problems.
CO 2	Apply the concepts of stack and queues to solve real world problem.
CO 3	Apply the Linked List Concept to evaluate the expression.
CO 4	Analyze the different traversing techniques using tree.
CO 5	Use various methods to represent graph and utilize graph concepts to solve real world problems and implement concept of hashing.

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT 1: Introduction to Algorithm			
Introduction to Algorithm General Concepts of Data Structures; Types of Data Structures with its properties and operations; Time and Space Analysis of Algorithms, Big Oh, theta and omega notations; Average, Best and Worst Case Analysis; **Sorting & Searching** : Selection Sort, Insertion Sort, Heap Sort, Shell Sort; Linear Search, Binary Search	8	-	1
UNIT 2: Stacks and Queues			
Stack ADT: Concept, primitive operations, implementation of stacks, multiple stacks, applications of stack, need for prefix and postfix expressions, conversion from infix to prefix and postfix expression, evaluation of prefix and postfix expression using stack. **Queue ADT:** Concept, operations, simple queue, circular queue, double-ended and priority queue, applications of queue.	7	-	2
UNIT 3: Linked Lists			
Concept, primitive operations, representation of linked lists, types of linked list- singly linked list, circular linked list and doubly linked	7	-	3

list, polynomial manipulations: addition and multiplication using linked list.			
UNIT 4: Trees			
Basic Tree terminologies, tree definition and properties, binary tree and its operations, binary search tree (BST) and its operations, threaded binary trees, AVL tree and its rotation, red black tree, B-tree, B+ tree, tree traversal techniques, applications of tree traversal techniques.	7	-	4
UNIT 5: Graphs and Hashing			
Graphs: Graphs Representation, application of graphs, graph traversals techniques- DFS and BFS. **Hashing:** Hash functions and hash tables, properties, simple hash function, methods for collision handling.	7	-	5

Text Books:

1. Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahani& Susan Anderson-Freed, 2nd Edition, 2012, Universities Press.
2. Data Structures and Algorithms: Concepts, Techniques and Application, G.A.V. Pai, 3rd Edition, 2012, Tata McGraw-Hill Education.

Reference Books:

1. Algorithms in a Nutshell, George T. Heineman, Gary Pollice& Stanley Selkow, 2nd Edition, 2016, O'Reilly Media, Inc.
2. Introduction to the Design and Analysis of Algorithms, AnanyLevitin, 3rd Edition, 2017, Pearson Education.
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, 3rd Edition, 2015, MIT Press.

Data Structure and Algorithms Lab			
Course Code:BCSE3P09	**Credits:**01		
Teaching Hours / Week : 02 P	**SEE :** 25 M	**CIE :** 25 M	**Total :** 50 M
Total number of teaching hours: 24	**Course Category :** PCC - II		
BoS : CSE			

List of Practical (Any 10-performance based and 1 virtual lab experiment)

Course Objective
The course develops programming skills to analyze and apply linear and non-linear data structures to solve real-world problems that enhance employability.

Course Outcomes	
After successful completion of this course the students will be able to:	
CO1	**Analyze:**Analyze the performance of various algorithms based on time and space complexity.
CO2	**Apply:** Apply appropriate searching and sorting techniques for a given problem statement.
CO3	**Create:** Design applications using linear and nonlinear data structures to solve engineering problems.
CO4	**Evaluate**: Choose appropriate data structures to solve given problems efficiently.

A minimum of Ten practical to be performed based on the theory course Data Structures and Algorithms [BCSE3T09].

Suggested References:
1. Algorithms in a Nutshell, George T. Heineman, Gary Pollice& Stanley Selkow, 2nd Edition, 2016, O'Reilly Media, Inc.
2. Introduction to the Design and Analysis of Algorithms, AnanyLevitin, 3rd Edition, 2017, Pearson Education.
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, 3rd Edition, 2015, MIT Press.

Third Semester B. Tech. (Computer Science & Engineering)

Object Oriented Programming using Java (TH+P)	
Total Credits: 03 T + 01 P	**Subject Code:** BCSE3T10
Teaching Scheme :	**Examination Scheme :**
Lectures: 3 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 30 Marks
Practical: 02 Hours/Week	University Assessment:70 Marks
Course Category : PCC - III	**BoS :** CSE

Course Objectives	
1	Develop a strong foundation in Object-Oriented Programming (OOP) concepts, including abstraction, encapsulation, inheritance, and polymorphism.
2	Effectively apply Java programming constructs, such as control flow, arrays, exception handling, and multithreading, to solve complex real-world problems.
3	Leverage Java's built-in libraries and frameworks, including the collection framework and package management, to enhance code organization and functionality.
4	Understand and implement advanced Java concepts, such as interfaces and multithreading, to build robust, concurrent applications with efficient resource management.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	**Understand** the structure, syntax, and core components of the Java programming language to develop foundational programming skills.
CO2	**Utilize** control flow mechanisms, arrays, and string manipulation techniques to design efficient Java programs that solve complex problems.
CO3	**Implement** inheritance hierarchies, manage class relationships, and organize code effectively using packages, enhancing modularity and reusability.
CO4	**Demonstrate** the ability to handle errors and manage program flow by utilizing user-defined exceptions and Java's exception handling keywords
CO5	**Apply** effective problem-solving strategies by using the collection framework and multithreading techniques to develop real-world, robust Java applications.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1: Object Oriented Programming Fundamentals			
Object Oriented Programming features: Object Oriented Programming features: objects and classes, Abstraction, Encapsulation, Inheritance, Polymorphism, Characteristics of Java, Java Source File Structure – Compilation. Fundamental Programming Structures in Java, features of Java, Introduction of JDK, JRE and JVM, Operators and Data Types.	7	-	1
UNIT 2: Control Statements, String Handling & Arrays			
Control Statements: Selection statement**,** Looping/Iterative statements, Jump/ Transfer statements. **Arrays:** Declaration and initialization of an array, One Dimensional Array, Two-Dimensional Array. **String Handling:** String constructors, toString methods, Methods for String Comparison, Searching String and Modifying String. Command line arguments, static modifier, this keyword, Garbage collection, Method overloading.	8	-	2
UNIT 3: Inheritance and Package			
Inheritance: Inheritance fundamentals, Types of inheritance, Advantages and disadvantages of inheritance. Use of abstract modifiers, Method Overriding, super keyword, final modifier **Packages:** Package Fundamental, Types of Packages, importing packages.	7	-	3
UNIT 4: Interface and Exception Handling			
Interface: Concept of interface, advantages of interface, relationship between classes and interface, **Exception Handling:** Fundamental Exception type: Checked, Unchecked Exceptions, throw and throws keywords, creating user defined exceptions, Built-in Exceptions.	7	-	4
UNIT 5: Multithreading and Collection Fundamentals			
Threads and Multithreading: Fundamentals, Thread Life Cycle, Ways of creating threads, Thread priorities, Interthread Communication. **Collection Framework:** Difference between Array and Collection, List interface and its classes, Set interface and its classes, Map interface and its classes	7	-	5

Text Books:
1. The Complete Reference, Herbelt Schildt, 8th Edition, Tata McGraw-Hill publications
2. Head First Java, Kathy Sierra, Bert Bates, 2nd Edition, O'Reilly Media
3. Programming in Java, E Balguruswami, 5th edition, McGraw Hill Education
Reference Books:
1. Sun Certified Java Programmer for Java 6 by Kathy Sierra.
2. The JavaTM Programming Language, Arnold, Holmes, Gosling, Goteti, 4th Edition, Addison-Wesley professional publication

3.	Core Java for Beginners, Rashmi Kanta Das, 3rd Edition, Vikas Publication
4.	Java A Beginner's Guide, Fifth Edition, Tata McGraw Hill Education

Object Oriented Programming using Java Lab			
Course Code: BCSE3P10	**Credits:** 01		
Teaching Hours / Week : 02 P	**SEE :** 25 M	**CIE :** 25 M	**Total :** 50 M
Total number of teaching hours: 24	**Course Category :** PCC - III		
BoS : CSE			

Note:

- Practicals are based on Object Oriented Programming Course
- Minimum ten practical's have to be performed and 1 virtual lab experiment
- IDE (e.g. Eclipse, NetBeans or VS Code) etc.
- Do not include study experiment

Course Objective
The course develops programming skills to analyze and apply Object-Oriented Programming (OOP) concepts to solve real-world problems that enhances employability.

Course Outcomes	
After successful completion of this course the students will be able to:	
CO1	**Analyse and Apply:** Object-Oriented Programming (OOP) concepts like classes, objects, inheritance, polymorphism, and encapsulation in Java to solve real-world problems
CO2	**Apply:** compile-time and runtime polymorphism to enhance code flexibility and reusability
CO3	**Evaluate:** the use of inheritance and packages in Java to design modular and loosely coupled applications.
CO4	**Create and Apply**: Design applications using interfaces and abstract classes to promote loose coupling and enhance modularity, Multithreading to create real time applications

Suggested References:
1. Sun Certified Java Programmer for Java 6 by Kathy Sierra.
2. The JavaTM Programming Language, Arnold, Holmes, Gosling, Goteti, 4th Edition, Addison-Wesley professional publication
3. Core Java for Beginners, Rashmi Kanta Das, 3rd Edition, Vikas Publication
4. Java A Beginner's Guide, Fifth Edition, Tata McGraw Hill Education

Sample Practical List:

1. Write a Java program to demonstrate the use of classes and object concepts with a real-world example (e.g., a simple banking system with account details and operations like deposit and withdrawal).
2. **Write a Java program to illustrate the concept of compile-time polymorphism** (method overloading) by creating a calculator that can add integers, doubles, and arrays.
3. **Write a Java program to illustrate the concept of dynamic polymorphism** (method overriding) using a real-world example, such as a vehicle system where different types of vehicles have their own implementation of a start method.
4. **Write a Java program to demonstrate the working of the final modifier** on classes, methods, and variables by creating a program that ensures a constant value cannot be changed and a class cannot be extended.
5. **Write a Java program to illustrate the need for inheritance with a real-time example**, such as a company employee hierarchy where different types of employees (full-time, part-time) inherit common attributes from a base Employee class.
6. **Write a Java program to demonstrate the working of both abstract and final modifiers**, showcasing the restriction on class extension and the need for abstract methods in a base class (e.g., an abstract class Shape with abstract method draw).
7. **Write a Java program to demonstrate the purpose of interfaces**, by implementing a payment gateway system where different payment methods (credit card, PayPal) use a common Payment interface.
8. **Write a Java program to demonstrate the purpose of user-defined packages**, organizing a program into multiple packages for better modularity, such as creating a package for mathematical operations and another for user interaction.
9. **Write a Java program to demonstrate the notion of multiple catch blocks**, by handling different types of exceptions such as ArrayIndexOutOfBoundsException, NullPointerException, and ArithmeticException.
10. **Write a Java program to implement a thread-based multitasking system**, where multiple threads perform tasks like printing numbers, calculating sums, and sorting an array concurrently.
11. **Write a Java program to demonstrate the working of the List interface and its classes**, by creating a task manager application where tasks are added, removed, and displayed using ArrayList or LinkedList.
12. **Write a Java program to illustrate the working of the Set interface and its classes**, by developing a program that manages a collection of unique student IDs, demonstrating HashSet and TreeSet.
13. **Write a Java program to illustrate the working of the Map interface and its classes**, by implementing an employee database where employee IDs are mapped to their respective names, using HashMap and TreeMap.

Third Semester B. Tech. (Computer Science & Engineering)

Probability Theory and Statistics (TH)	
Total Credits: 02 T	**Subject Code : BMD3T11**
Teaching Scheme :	**Examination Scheme :**
Lectures: 2 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 Category : MDM-I	**BoS :** AS&H

Course Objectives	
1	. The aim is the process of managing the random events including the collection of data, its analysis and interpretation.
2	The topic covered enhances the analytical thinking power of the students dealing with the real life problems.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Analyze the concept of Discrete and Continuous random variable, conditional probability and able to solve the problems of Probability and probability distribution.
CO2	Apply the concept of probability to analyze the various parameters of probability.
CO3	To solve the various types of problems having statistical data.
CO4	To solve the problems having statistical data and analyze the various parameters.

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Unit-1 Theory of Probability & Probability Distribution:			
Axioms of Probability, Conditional Probability, Baye's theorem and its examples, Review of Discrete and Continuous random variables, Joint distribution, Independent random variables, Conditional Distributions. Binomial distribution, Poisson's distribution, Normal distribution, Uniform distribution and Exponential distribution.	5		1
UNIT 2:Mathematical Expectations:			
Introduction to Correlation and Regression, Multiple correlation and its properties, Multiple regression analysis, Regression equations of three variables.	5		2

Measures of central tendency: Mean Median, Quartile, Decile, Percentile and Mode.			
UNIT 3: Statistics I			
Pure applied probability (data in an uncertain world, perfect knowledge of the uncertainty) Bayesian inference with known priors, probability intervals Conjugate priors.	5		3
UNIT 4: Statistics-II			
Measures of Dispersion: Range, Quartile deviation, Mean deviation, Variance, Standard deviation. Coefficient of dispersion. **Skewness:** Tests and uses of skewness and types of distributions, Measures of skewness, Karl Pearson's coefficient of skewness, Measure of skewness based on moments.	5		4

Text Books:

(1) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

(2) Probability and Statistics (Schaum's Outline Series), Murray Spiegel, Jhon Schiler, R.A.Srinivasan.

(3) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi

Publications, Eight edition 2011.

(4) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010. ncy

(5) Probability, Statistics and Random Process (TMH), T. Veerarajan. P. N. Wartikar and J. N. Wartikar, Applied Mathematics, Volume I and II.

(6) H.K Dass Advanced Engineering Mathematics Reprint 2016, S. Chand.

Reference Books:

1. William Feller: Introduction to Probability theory and its applications, (Vol-I), Wiley

2. V. K. Kapoor and S. C. Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

3. Hogg,Tanis, Rao: Probability and Statistical Inference, (7th edition), Pearson

Third Semester B. Tech. (Computer Science & Engineering)

Open Elective – I - Data Structure (TH)	
Total Credits: 03 T + 01 P	**Subject Code :** BOE3T01
Teaching Scheme :	**Examination Scheme :**
Lectures: 2 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 Category : OE-I	**BoS :** CSE

Course Objectives	
1	To learn the concept of Data Structure using efficient algorithms
2	To solve real world problem using Data Structure Concepts.

Course Outcomes	
After completion of syllabus, students would be able to	
CO 1	Understand the efficiency of an algorithm based on time and space complexity and classify an appropriate searching and sorting techniques to solve given problems.
CO 2	Apply the concepts of stack and queues to solve real world problem.
CO 3	Apply the Linked List Concept to evaluate the expression.
CO 4	Analyze the different traversing techniques using tree.
CO 5	Use various methods to represent graph and utilize graph concepts to solve real world problems and implement concept of hashing.

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT 1: Introduction to Algorithm			
Introduction to Algorithm General Concepts of Data Structures; Types of Data Structures with its properties and operations; Time and Space Analysis of Algorithms, Big Oh, theta and omega notations; Average, Best and Worst Case Analysis; **Sorting & Searching** : Selection Sort, Insertion Sort, Heap Sort, Shell Sort; Linear Search, Binary Search	8	-	1
UNIT 2: Stacks and Queues			

Stack ADT: Concept, primitive operations, implementation of stacks, multiple stacks, applications of stack, need for prefix and postfix expressions, conversion from infix to prefix and postfix expression, evaluation of prefix and postfix expression using stack. **Queue ADT:** Concept, operations, simple queue, circular queue, double-ended and priority queue, applications of queue.	7	-	2
UNIT 3: Linked Lists			
Concept, primitive operations, representation of linked lists, types of linked list- singly linked list, circular linked list and doubly linked list, polynomial manipulations: addition and multiplication using linked list.	7	-	3
UNIT 4: Trees			
Basic Tree terminologies, tree definition and properties, binary tree and its operations, binary search tree (BST) and its operations, threaded binary trees, AVL tree and its rotation, red black tree, B-tree, B+ tree, tree traversal techniques, applications of tree traversal techniques.	7	-	4
UNIT 5: Graphs and Hashing			
Graphs: Graphs Representation, application of graphs, graph traversals techniques- DFS and BFS. **Hashing:** Hash functions and hash tables, properties, simple hash function, methods for collision handling.	7	-	5

Text Books:

1. Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahani& Susan Anderson-Freed, 2nd Edition, 2012, Universities Press.
2. Data Structures and Algorithms: Concepts, Techniques and Application, G.A.V. Pai, 3rd Edition, 2012, Tata McGraw-Hill Education.

Reference Books:

1. Algorithms in a Nutshell, George T. Heineman, Gary Pollice& Stanley Selkow, 2nd Edition, 2016, O'Reilly Media, Inc.
2. Introduction to the Design and Analysis of Algorithms, AnanyLevitin, 3rd Edition, 2017, Pearson Education.
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, 3rd Edition, 2015, MIT Press.

Open Elective – I - Data Structure Lab			
Course Code:BOE3P01	**Credits:**01		
Teaching Hours / Week : 02 P	**SEE :** 25 M	**CIE :** 25 M	**Total :** 50 M
Total number of teaching hours: 24	**Course Category :** OE - I		
BoS : CSE			

List of Practical (Any 10-performance based and 1 virtual lab experiment)

Course Objective
The course develops programming skills to analyze and apply linear and non-linear data structures to solve real-world problems that enhance employability.

Course Outcomes	
After successful completion of this course the students will be able to:	
CO1	**Analyze:**Analyze the performance of various algorithms based on time and space complexity.
CO2	**Apply:** Apply appropriate searching and sorting techniques for a given problem statement.
CO3	**Create:** Design applications using linear and nonlinear data structures to solve engineering problems.
CO4	**Evaluate**: Choose appropriate data structures to solve given problems efficiently.

A minimum of Ten practical to be performed based on the theory course Data Structure [BOE3T01].

Suggested References:
1. Algorithms in a Nutshell, George T. Heineman, Gary Pollice& Stanley Selkow, 2nd Edition, 2016, O'Reilly Media, Inc.
2. Introduction to the Design and Analysis of Algorithms, AnanyLevitin, 3rd Edition, 2017, Pearson Education.

3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, 3rd Edition, 2015, MIT Press.

Third Semester B. Tech. (Computer Science & Engineering)

Open Elective – I - Python Programming (TH)	
Total Credits: 03 T + 01 P	**Subject Code :** BOE3T01
Teaching Scheme :	**Examination Scheme :**
Lectures: 2 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 Category : OE-I	**BoS :** CSE

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 completion of syllabus, students would be able to	
CO1	Understand and implement the basic concept of python programming language.
CO2	Develop Code and test conditional statements of moderate size using the python language.
CO3	Implement the concept of Function and modules in programming language
CO4	Understand and Implement the concept of object oriented programming in python programming language

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit-I			
UNIT I: 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.	6		1
Unit -2			
UNIT II: 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.	6		2
Unit -3			
UNIT III: 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.	6		3
Unit -4			
UNIT IV: Introduction to Object Oriented Programming (OOP), Features of OOP, Python Class and Objects, Classes and methods, Constructor and Destructor, Simple and Multiple Inheritance.	6		4
Unit -5			
UNITV: Working with Files: File Input Output, Read and Write Operations, Set File offset in Python, Python File object methods.	6		5

Text Books:

1. Let Us Python- 2nd Revised & Updated Edition By Yashavant Kanetkar, Aditya Kanetkar , ISBN: 9789389845006, Edition: 2020/ 2nd.
2. Core Python Programming Kindle Edition by Dr. R. Nageswara Rao.

Open Elective – I - Python Programming Lab			
Course Code: BOE3P01	**Credits:** 01		
Teaching Hours / Week : 02 P	**SEE :** 25 M	**CIE :** 25 M	**Total :** 50 M
Total number of teaching hours: 24	**Course Category :** OE-I		
BoS : CSE			

A minimum of Ten practical to be performed based on the theory course Python Programming [BOE3T01].

Text Books:
1. Let Us Python- 2nd Revised & Updated Edition By Yashavant Kanetkar, Aditya Kanetkar , ISBN: 9789389845006, Edition: 2020/ 2nd.
2. Core Python Programming Kindle Edition by Dr. R. Nageswara Rao.

Third Semester B. Tech. (Computer Science & Engineering)

Open Elective – I - Object Oriented Concepts (TH)	
Total Credits: 03 T + 01 P	**Subject Code : BOE3T01**
Teaching Scheme :	**Examination Scheme :**
Lectures: 3 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 30 Marks
Practical: 02 Hours/Week	University Assessment:70 Marks
Course Category : OE-I	BoS :CSE

Course Objectives	
1	Learning to program in an object-oriented programming language, focusing those who already have some experience with another programming language, and who now wish to move on to an object-oriented one

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Develop programs efficiently using basic features of C++.
CO2	Employ object oriented concepts using classes and objects.
CO3	Explain advanced features of C++ specifically Polymorphism and Inheritance.
CO4	Design programs with dynamic binding to handle the memory efficiently.
CO5	Apply standard templates available in C++

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1:			
Introduction to Objects, Encapsulation, Polymorphism, Inheritance, Dynamic binding, Message Passing, Abstract Classes, Access Modifiers. Basics of a Typical C++ Environment, Pre-processor Directives, Header Files and Namespaces, Library files.	**8**		**1**
UNIT 2:			
Classes and Data Abstraction: Introduction, Structures - Class - Constructors - Destructors, Const Object And Const Member Functions - Friend Function and Friend Classes, Using This Pointer, Dynamic Memory Allocation, Static Class Members, Container Classes And Integrators, Proxy Classes.	**8**		**2**
UNIT 3:			
Polymorphism and Inheritance: Polymorphism - Function Overloading, Operator Overloading, Inheritance and its types, Casting - Overriding.	**6**		**3**
UNIT 4:			
Virtual Functions and Files handling: Introduction to Virtual Functions - Abstract Base Classes and Concrete Classes - virtual base class - dynamic binding - pure virtual functions. Streams and formatted I/O- File handling - object serialization, namespaces - String - STL.	**7**		**4**
UNIT 5:			

Templates and Exception Handling: Function Templates, Overloading Template Functions, Class Template. Exception Handling: Try, Throw, Catch, Rethrow - Exception specifications.	**7**		**5**

Text Books:
1. Bjarne Stroustrup, "The C++ Programming Language", Third Edition, Pearson Education, 2000.
2. Robert Lafore, "Object Oriented Programming in C++", Fourth Edition, Sams Publishers, 2001.
3. P.J. Deitel, "C++ How to Program", Prentice-Hall of India Pvt Ltd., Sixth edition, 2013.

Reference Books:
1. E. Balagurusamy, "Object Oriented Programming with C++", McGraw Hill Company Ltd., 2013.
2. B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2012.
3. Ira Pohl, "Object Oriented Programming using C++", Pearson Education, Second Edition, Reprint 2013.

Web link(s):

1. https://nptel.ac.in/courses/106/105/106105151/

2. www.w3schools.com

Open Elective – I - Object Oriented Concepts Lab			
Course Code: BOE3P01	**Credits:** 01		
Teaching Hours / Week : 02 P	**SEE :** 25 M	**CIE :** 25 M	**Total :** 50 M
Total number of teaching hours: 24	**Course Category :** OE-I		
BoS : CSE			

Course Objective

Learning to program in an object-oriented programming language, focusing those who already have some experience with another programming language, and who now wish to move on to an object-oriented one

Course Outcomes	
After successful completion of this course the students will be able to:	
CO1	Develop programs efficiently using basic features of C++.
CO2	Employ object oriented concepts using classes and objects.
CO3	Explain advanced features of C++ specifically Polymorphism and Inheritance.
CO4	Design programs with dynamic binding to handle the memory efficiently.
CO5	Apply standard templates available in C++

A minimum of ten practical to be performed based on the theory course on Object Oriented Concepts {BOE3T01]

Third Semester B. Tech. (Computer Science & Engineering)

Entrepreneurship and Startups (TH)	
Total Credits: 02 T	**Subject Code : BHM3T01**
Teaching Scheme :	**Examination Scheme :**

Lectures: 2 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 Category :	**BoS :** CSE

Course Objectives	
1	To impart theoretical and practical know-how to the learners on various intrinsic and essential fundamental
2	Advanced knowledge pertaining
3	Advanced knowledge pertaining to Entrepreneurship and start-ups.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	**Understand** a know-how on entrepreneurship development
CO2	**Acquire** the knowledge of various types of startups
CO3	**Remember** the concept of ideation
CO4	**Apply** the funding for startups

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT 1			
Concept of entrepreneurship, characteristics of an Entrepreneur, types of Entrepreneurship, Functions of Entrepreneurs, Women entrepreneurship in India, Problems and challenges of women entrepreneurs, Government's support system to develop women entrepreneurship.	6		1
UNIT 2			
Concept of startup, Types of startups: Scalable startup, small business startup, lifestyle startup, buyable startup, social startup, big business startup, Startup ecosystem	6		2
UNIT 3			
Concept of ideation, ideation process, idea incubation, design thinking approach, ideation techniques (brainstorming, sketching, SCAMPER, and prototyping), success factors for ideation.	6		3
UNIT 4:			
Funding for startups, angel funding, venture funding, difference between angel and venture funding, private equity fund, ownership of startups, causes of startups failures, Startup success case studies: Instagram, Linkedin, Snapchat, Whatsapp	6		4

Text Books:

1. Entrepreneurial Development By, S. S. Khanka S. Chand & Co. Ltd. New Delhi, 1999.

2. Entrepreneurial Development. By, S.Anil Kumar. New Age International.

3. Small- Scale Industries and Entrepreneurship, By, Dr. Vasant Desai, Himalaya Publication.

Reference Books:

1. Entrepreneurship Development by Monica Loss F.L. Bascunan, Global Academic Publishers & Distributors, 2015

2. Management of Entrepreneurship. By, N.V.R. Naidu, I.K. International Pvt Ltd.

3. Industrial Economics and Entrepreneurship development by A.M. Sheikh, Nawaz Khan & M.A. Tongo, S.Chand Publication

Constitution of India (TH)	
Total Credits: 02 T	**Subject Code :** BVE3T01
Teaching Scheme :	**Examination Scheme :**
Lectures: 2 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 Category : VEC-I	**BoS :** AS&H

Course Objectives	
1	To know about the basic structure of the Indian constitution.
2	To know the Fundamental rights, and fundamental duties.
3	To know about our DPSP's and Political structure.
4	To know function of Parliament (Lok Sabha and Rajya Sabha) and Judiciary
5	To know the State executive and Election system in India.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	**Analyze** the basic structure of Indian Constitution.
CO2	**Remembe**r the Fundamental rights and duties.
CO3	**Know** DPSP's and Nation's political structure.
CO4	**Understand** the function of Parliament and Judiciary.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1:			
Introduction to the Indian Constitution, Preamble of the Indian Constitution and key concepts, Salient features of the Indian Constitution, Role and objective of Constituent Assembly.	7		1
UNIT 2:			
Fundamental rights meaning, significance, restrictions and limitations Fundamental duties and its scope, difference between Fundamental rights and Fundamental duties	8		2
UNIT 3:			
Directive Principles of State Policy (DPSP's) and its present relevance in India, Union Executive- President, Prime Minister and Union cabinet.	8		3
UNIT 4:			
Parliament - role and function, Lok Sabha and Rajya Sabha, Judiciary system in India, Supreme Court of India and other courts.	8		4

Text Books:	
1.	Introduction to the Constitution of India by D D Basu.
2.	Outlines of Indian Legal and Constitutional History by M P Jain.

Reference Books:	
1.	Constitution of India by P M Bakshi

Third Semester B. Tech. Computer Science & Engineering

Community Engagement Project (P)	
Course Code: BCE3P01	**Credits:** 01
Teaching Hours / Week : 04 P	**CIE :** 100 M
Total number of teaching hours: 48	**Course Category :** CEP
BoS : AS&H	

Course Outcomes	
After completion of the course, students will be able to	
CO1	Gain an understanding of rural life, Indian culture and ethos and social realities.
CO2	Develop a sense of empathy and bonds of mutuality with the local community
CO3	Appreciate significant contributions of local communities to Indian society and economy.
CO4	Learn to value the local knowledge and wisdom of the community
CO5	Identify opportunities for contributing to the community's socio-economic improvements.

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO**
	Class Room	**Field Visit**	**CO**
UNIT 1 Appreciation of Rural Society:			

Rural lifestyle, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages" (Gandhi), rural infrastructure. **Task to perform -** Prepare a map (physical, visual or digital) of the village you visited and write an essay about interfamily relations in that village. Classroom discussions – Field visit# – Assignment Map # Refer recommended list given below for field visits.	2 + Post Visit discussion -2	4	1
UNIT 2 Understanding rural and local economy and livelihood:			
Agriculture, farming, land ownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets, migrant labour. **Task to perform -** Describe your analysis of the rural house hold economy, its challenges and possible pathways to address. Circular economy and migration patterns. Classroom – Field visit # – Group discussions in class on Assignment # Refer recommended list given below for field visits.	3 + Post Visit discussion -1	4	2
UNIT 3 Rural and local Institutions:			
Traditional rural and community organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), Nagarpalikas and municipalities, local civil society, local administration. **Task to perform -** How effectively are Panchayati Raj and Urban Local Bodies (ULBs) institutions functioning in the village? What would you suggest to improve their effectiveness? Present a case study (written or audio-visual). Classroom – Field visit# – Group presentation of assignment # Refer recommended list given below for field visits.	2 + Post Visit discussion -2	4	3,4
UNIT 4 Rural and National Development Programmes:			

History of rural development and current national programmes in India: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swachh Bharat, PM Awaas Yojana, Skill India, Gram Panchayat Decentralised Planning, National Rural Livelihood Mission (NRLM), Mahatma Gandhi National Rural Employment Guarantee Act 2005 (MGNREGA), SHRAM, Jal Jeevan Mission, Scheme of Fund for Regeneration of Traditional Industries (SFURTI), Atma Nirbhar Bharat, etc **Task to perform -** Describe the benefits received and challenges faced in the delivery of one of these programmes in the local community; give suggestions about improving the implementation of the programme for the poor. Special focus on the urban informal sector and migrant households. Classroom – Each student selects one program for field visit. Written assignment based on visit. # Refer recommended list given below for field visits.	2 + Post Visit discussion -2	4	4,5

Assessment: Readings from e-content and reflections from field visits should be maintained by each student in a Field Diary. Participation in Field Visits should be allocated 30% marks; group field project should have 40% of total marks; presentation of field project findings to the community institution should have 30% of total marks.

**** Recommended field-based practical activities:**

- Interaction with Self Help Groups (SHGs) women members, and study their functions and challenges; planning for their skill-building and livelihood activities;
- Visit Mahatma Gandhi National. Rural Employment Guarantee Act 2005 (MGNREGS) project sites, interact with beneficiaries and interview functionaries at the work site;
- Field visit to Swachh Bharat project sites, conduct analysis and initiate problem-solving measures;
- Conduct Mission Antyodaya surveys to support under Gram Panchayat Development Plan (GPDP);
- Interactive community exercise with local leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource mobilization;
- Visit Rural Schools/mid-day meal centres, study academic and infrastructural resources, digital divide and gaps;
- Participate in Gram Sabha meetings, and study community participation;
- Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries;
- Visit to local Nagarpalika office and review schemes for urban informal workers and migrants;
- Attend Parent Teacher Association meetings, and interview school drop outs;
- Visit local Anganwadi Centre and observe the services being provided;
- Visit local NGOs, civil society organisations and interact with their staff and beneficiaries;

- Organize awareness programmes, health camps, Disability camps and cleanliness camps; • Conduct soil health test, drinking water analysis, energy use and fuel efficiency surveys and building solar powered village;
- Raise understanding of people's impacts of climate change, building up community's disaster preparedness; 10 Guidelines for Fostering Social Responsibility & Community Engagement in Higher Education Institutions in India 2.0
- Organise orientation programmes for farmers regarding organic cultivation, rational use of irrigation and fertilizers, promotion of traditional species of crops and plants and awareness against stubble burning;
- Formation of committees for common property resource management, village pond maintenance and fishing;
- Identifying the small business ideas (handloom, handicraft, khadi, food products, etc.) for rural areas to make the people self-reliant.

Teaching and Learning Methods:

- A large variety of methods of teaching must be deployed.
- An ICT based online module needs to be prepared for self-paced learning by students for one credit which can be supplemented through discussions in the classroom.
- Reading and classroom discussions, Participatory Research Methods and Tools, Community dialogues, Oral history, social and institutional mapping, interactions with elected panchayat leaders and government functionaries, Observation of Gram Sabha, Field visits to various village institutions (see Section -3 Implementation Strategy).

RTMNU B.TECH. SCHEME OF EXAMINATION

Scheme of Teaching & Examination of Bachelor of Technology IV Semester B.Tech. Computer Science & Engineering [NEP]

Sr. No.	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
				Th	TU	P		Theory				Practical			
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	BOS
1	PCC-IV	Operating System	BCSE4T12	3	-	-	3	3	70	30	45	-	-	-	CS
2	PCC-IV	Operating System Lab	BCSE4P12	-	-	2	1	-	-	-	-	25	25	25	CS
3	PCC-V	Artificial Intelligence	BCSE4T13	3	-	-	3	3	70	30	45	-	-	-	CS
4	PCC-V	Artificial Intelligence Lab	BCSE4P13	-	-	2	1	-	-	-	-	25	25	25	CS
5	MDM-II	Quantum Computing	BMD4T14	2	-	-	2	3	70	30	45	-	-	-	CS
6	OE-II	Refer Open Elective-II Basket	BOE4T02	2	-	-	2	3	70	30	45	-	-	-	CS
7	VSC-II	Hardware and Networking	BVE4P02	-	-	4	2	-	-	-	-	50	50	50	CS
8	AEC-II	Technical Report Writing	BAE4T02	2	-	-	2	3	70	30	45	-	-	-	AS&H
9	HSSM-II	Economics and Entrepreneurship	BHM4T02	2	-	-	2	3	70	30	45	-	-	-	Civil
10	VEC-II	Universal Human Values	BVE4T02	2	-	-	2	3	70	30	45	-	-	-	AS&H
Total				16	-	08	20		490	210		100	100		

Open Elective II : 1. Computer Networks 2. Cyber Laws 3. Operating System

Exit option; Award of UG Diploma in Major and Minor with 80 credits and an additional 8 credits as per exit basket

Exit Basket (Skill Based Courses, Internship, Mini Projects) 4 Sem

Sr. No.	Exit Sem	Subjects
1	4	Online Course from certified agencies on Dynamic website development/ software development/ Sy maintenance approved by the BoS OR Technical Mini Project OR One Month Internship at Industry

Fourth Semester B. Tech. (Computer Science & Engineering)

Operating System (TH)	
Total Credits: 03 T	**Subject Code :** BCSE4T11
Teaching Scheme :	**Examination Scheme :**
Lectures: 3 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 30 Marks
Practical: 02 Hours/Week	University Assessment:70 Marks
Course Category : PCC IV	**BoS :** CSE

Course Objectives	
1	To learn and understand the concept of Operating System
2	To learn and understand the services of Operating System
3	To understand the design principles, core structure and functions of Operating System
4	To understand the process synchronization and coordination handled by operating system.
5	To understand the memory management and its allocation policies

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	**Describe** the important computer system resources and the role of operating system in their management policies and algorithms.
CO2	**Understand** the process management policies and scheduling of processes by CPU.
CO3	**Evaluate** the requirement for process synchronization and coordination handled by operating system.
CO4	**Describe** and **Analyse** the memory management and its allocation policies
CO5	**Identify** use and **Evaluate** the storage management policies with respect to different storage management technologies.

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT 1: OVERVIEW OF OPERATING SYSTEM			
OVERVIEW OF OPERATING SYSTEM: Operating System Objectives and Functions, Evolution of Operating System Characteristics of Modern OS. **Basic Concepts:** Processes, Files System Calls, Shells Kernel Architectures: Monolithic, Micro-Kernel, Layered Kernel, Kernel Mode of Operations.	8	-	1
UNIT 2:			
PROCESS MANAGEMENT: Process Description: Process Process States Process Control Block Threads, Thread Management.	7	-	2

Process Scheduling: Types & Comparison of different scheduling policies.			
UNIT 3:			
PROCESS CO-ORDINATION: Principles of Concurrency, Race Condition and Critical Section, Mutual Exclusion-Hardware and Software Approaches, Semaphores, Monitors Message Passing **Deadlock:** Principles of Deadlock, Producer Consumer Problem, Deadlock Detection, Deadlock Avoidance, Deadlock Prevention.	7	-	3
UNIT 4:			
MEMORY MANAGEMENT: Memory Management, Requirements Memory Partitioning, Virtual Memory Paging; Segmentation; Page Replacement Policies, Page Faults.	7	-	4
UNIT 5:			
INPUT OUTPUT MANAGEMENT: I/O Devices Organization of the I/O Function, Operating System Design Issues, I/O Buffering, Disk Scheduling and Disk Scheduling Algorithms, Disk Cache, Producer Consumer Problem.	7	-	5

Text Books:
1. Operating System Concepts, 9th edition, Peter B. Galvin, Greg Gagne, Abraham Silberschatz, John Wiley & Sons, Inc.
2. Operating System - Achyut Godbole, Third Edition , Tata McGraw-Hill Publications.

Reference Books:
1. Modern Operating System – Andrew S. Tanenbaum
2. Operating System, 5th edition, William Stallings, Pearson Education India.

Operating System Lab	
Course Code:BCSE4P11	**Credits:**01
Teaching Hours / Week : 02 P	**SEE :** 25 M
Total number of teaching hours: 24	**Course Category :** PCC - IV
BoS : CSE	

Credits: 01 **Marks: 50**

List of Practical (Any 10-performance based)

Course Objective
The course develops programming skills to analyze and apply linear and non-linear data structures to solve real-world problems that enhances employability.

Course Outcomes	
After successful completion of this course the students will be able to:	
CO1	**Analyze:**Analyze the performance of various Job scheduling algorithms.
CO2	**Apply:** Apply appropriate CPU scheduling techniques for a given problem statement.
CO3	**Create:** System to solve Process synchronization problems.
CO4	**Evaluate**: Choose appropriate policy to solve given problems efficiently.

A minimum of Ten practical to be performed based on the theory course Operating System [BCSET12].

Suggested References:
1. Operating System Concepts, 9th edition, Peter B. Galvin, Greg Gagne, Abraham Silberschatz, John Wiley & Sons, Inc.
2. Operating System - Achyut Godbole, Third Edition , Tata McGraw-Hill Publications.
3. Operating System Concepts, 9th edition, Peter B. Galvin, Greg Gagne, Abraham Silberschatz, John Wiley & Sons, Inc.

Fourth Semester B. Tech. (Computer Science & Engineering)

Artificial Intelligence (TH+P)	
Total Credits: 03 T + 01 P	**Subject Code :** BCSE4T12
Teaching Scheme :	**Examination Scheme :**
Lectures: 3 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 30 Marks

Practical: 02 Hours/Week	University Assessment:70 Marks
Course Category : PCC - V	**BoS :** CSE

	Course Objectives
1	Introduce students to the fundamental concepts and history of Artificial Intelligence.
2	Explore various problem-solving techniques and search algorithms used in AI.
3	Familiarize students with knowledge representation methods and reasoning techniques.
4	Develop an understanding of handling uncertainty and probability in AI systems.
5	Introduce the concept of intelligent agents and their applications.

Course Outcomes	
After completion of the syllabus, students would be able to	
CO1	Define Artificial Intelligence and explain its historical development and current applications
CO2	Formulate problems using state space representation and apply appropriate search techniques to solve them
CO3	Implement and compare uninformed and informed search algorithms for problem-solving
CO4	Utilize various knowledge representation techniques such as predicate logic, semantic nets, and frames.
CO5	Apply probabilistic reasoning and Bayesian networks to handle uncertainty in AI systems.

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT 1: Introduction to Al			
Introduction: What is Al? History & Applications, Artificial intelligence as representation & Search, Production system, Basics of problem solving: problem representation paradigms, defining problem as a state space representation, Characteristics.	8	-	1
UNIT 2: Search Techniques			
Search Techniques: Uninformed Search techniques, Informed Heuristic Based Search, Generate and test, Hill-climbing. Best-First Search, Problem Reduction, and Constraint Satisfaction.	7	-	2
UNIT 3: Knowledge representation			
Knowledge representation: Knowledge representation Issues, First order logic, Predicate Logic, Structured Knowledge Representation: Backward Chaining. Resolution, Semantic Nets, Frames, and Scripts, Ontology. Backward Chaining.	7	-	3
UNIT 4: Uncertain knowledge & Intelligent Agents			
Uncertainty: Handling uncertain knowledge, rational decisions, basics of probability, axioms of probability, Baye's Rule and conditional independence, Bayesian networks, Exact and Approximate inference in Bayesian Networks, Fuzzy Logic. **Intelligent Agents:** Introduction to Intelligent Agents, Rational Agents, their structure, reflex, model-based, goal-based, and utility-	7	-	4

based agents, behaviour and environment in which a particular agent operates.			
UNIT 5: Knowledge and learning			
Learning: What is learning? Knowledge and learning. Learning in Problem Solving. Learning. For example, learning probabilistic models **Expert Systems:** Fundamental blocks, Knowledge Engineering. Knowledge Acquisition. Knowledge-Based Systems, Basic understanding of Natural language**.**	7	-	5

Text Books:
1.E.Rich and K. Knight, Artificial Intelligence, Tata McGraw Hill, 2008.
2.S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd edition

Reference Books:
1. Introduction to Artificial Intelligence – Charniak (Pearson Education)
1. Artificial intelligence and soft computing for beginners by Anandita Das Bhattachargee, Shroff Publishers

Artificial Intelligence Lab	
Course Code: BCSE4P12	**Credits:** 01
Teaching Hours / Week : 02 P	**SEE :** 25 M
Total number of teaching hours: 24	**Course Category :** PCC - V
BoS : CSE	

Credits: 01 **Marks: 50**

A minimum of Ten practical to be performed based on the theory course (BCSE4T12).

Course Objectives	
1	Introduce students to the fundamental concepts and history of Artificial Intelligence.
2	Explore various problem-solving techniques and search algorithms used in AI.
3	Familiarise students with knowledge representation methods and reasoning techniques.
4	Develop an understanding of handling uncertainty and probability in AI systems.
5	Introduce the concept of intelligent agents and their applications.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	Define Artificial Intelligence and explain its historical development and current applications
CO2	Formulate problems using state space representation and apply appropriate search techniques to solve them
CO3	Implement and compare uninformed and informed search algorithms for problem-solving

CO4	Utilize various knowledge representation techniques such as predicate logic, semantic nets, and frames.

Suggested References:
1.Introduction to Artificial Intelligence – Charniak (Pearson Education)
2.Artificial intelligence and soft computing for beginners by Anandita Das Bhattachargee, Shroff Publishers

Fourth Semester B. Tech. Computer Science & Engineering

Quantum Computing (TH)	
Total Credits: 03 T	**Subject Code :** BMD4T14
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 Category : MDM-II	**BoS :**CSE

Course Objectives	
1	To know the background of classical computing and quantum computing.
2	To learn the fundamental concepts behind quantum computation.
3	To study the details of quantum mechanics and its relation to Computer Science
4	To gain knowledge about the basic hardware and mathematical models of quantum computation
5	To learn the basics of quantum information and the theory behind it

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	**Understand** the basics of quantum computing
CO2	**Understand** the background of Quantum Mechanics.
CO3	**Analyze** the computation models.
CO4	**Understand** the quantum operations such as noise and error–correction

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT 1: Quantum Computing Basic Concepts			

Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits - Superpositions	8		1
UNIT 2: Quantum Gates And Circuits			
Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction	7		2
UNIT 3: Quantum Algorithms			
Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm	8		3,4
UNIT 4: Quantum Information Theory			
Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels	8		4,5

Text Books:
1. Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition (1 November 2020).
3. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.
2. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), "Quantum Computing for Everyone".

Reference Books:
1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007.

Fourth Semester B. Tech. Computer Science & Engineering

Hardware and Networking Lab	
Course Code:BVE4PO2	**Credits:** 02
Teaching Hours / Week : 04 P	**SEE :** 50 M
Total number of teaching hours: 48	**Course Category :** VSC - II
BoS : CSE	

Credits: 02 **Marks: 100**

List of Practical (Any 10-performance based and 1 virtual lab experiment)

Course Objective
The course develop an understanding of various protocols used at different layers of OSI and TCP/IP reference model and explains the implementation of protocols using network simulators.

Course Outcomes	
After successful completion of this course the students will be able to:	
CO1	**Explain** the protocols of OSI and TCP/IP reference model.
CO2	**Discuss** Transport Layer Protocols and its application.
CO3	**Implement** the different static and dynamic routing protocols like RIP, OSPF.
CO4	**Apply** Networking layer concepts of IP addressing and Subnetting.
CO5	**Design** and **Discuss** issues regarding WiFi and 802.11 networks.

List of Experiments

Exp No.	Title of Experiment	CO
1	Switch Configuration - Basic Commands for Switch Configuration - Switch Port Security, Setting up of Passwords	CO1
2	Router Configuration - Basic Commands for Router Configuration	CO1
3	Configuration of IP Address for a Router & Default Route.	CO2
4	Implementation of Dynamic Host Configuration Protocol.	CO2
5	Implementation of DNS Server.	CO3
6	Configuration of Static Routing	CO3
7	Configuration of Dynamic Routing (OSPF, RIP)	CO3
8	Implementation of FTP and HTTP.	CO4
9	VLAN Configuration, Inter VLAN, VTP & Switch Troubleshooting	CO4
10	To Configure a Wireless LAN. i) Using a wireless access point ii) Using a wireless router.	CO4
11	Configuration of Access-lists - Extended ACLs	CO5
12	Implementation of Network Address Resolution	CO5

Fourth Semester B. Tech. (Computer Science & Engineering)

Technical Report Writing(TH)	
Total Credits: 02 T	**Subject Code :** BAE4T02
Teaching Scheme :	**Examination Scheme :**
Lectures: 2 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 Category : AEC	**BoS :** AS&H

Course Objectives	
1	Students will have increase confidence to face competitive examinations (IELTES/ TOEFL/CAT/ MAT/ XAT/SNAP/GMAT/GATE etc.)to pursue masters degree.
2	Students will also acquire language skills required to write their Reviews/Projects/Reports.
3	Students will be able to organize their thoughts in English
4	Students will be able to face job interviews more confidently.
5	Students will enhance effective technical writing skill

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	**Acquire** knowledge of structure of language.
CO2	**Build** vocabulary and face interview process and can become employable.
CO3	**Develop** business writing skills.
CO4	**Understand** technical and scientific writing skills.

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT 1: Functional Grammar:			
Common errors, Transformation of Sentences (Change the voice, Change the narration, transformation of Simple , Compound, Complex sentences), Use of Phrases, Idioms & Proverbs.	6		1
UNIT 2: English for Competitive Exams			
Prefix, Suffix, Word building processes, **English** words /phrases derived from other languages, Technical Jargons, Synonyms/Antonyms, Verbal Analogies, Give one word for.	7		2
UNIT 3:Professional writing skills:			
Business letters, email, minutes of meeting, notices, blog writing, virtual message drafting, e-mail etiquettes, one page report.	6		3
UNIT 4: Job placement techniques:			
Job application letter, Resume writing, Group discussion, types of interview, interview techniques, telephonic interview etiquettes	7		4

Text Books:

Effective technical Communication by Barun K. Mitra, Oxford University Press,
Technical Communication-Principles and Practice by Meenakshi Raman & Sharma, Oxford University Press, 2011, ISBN-13-978-0-19-806529-
How to Prepare a Research Proposal: Guidelines for Funding and Dissertations in the Social and Behavioral Sciences by Krathwohl & R David

Reference Books:
1. Technical Writing- Process and Product by Sharon J. Gerson & Steven M. Gerson, 3rd edition, Pearson Education Asia, 2000
2. Developing Communication skills by Krishna Mohan & Meera Banerjee
3. Functional English by Dr. P. Mahato and Dr. Dora Thompson, Himalaya publication

Fourth Semester B. Tech. Computer Science & Engineering

Economics and Entrepreneurship (TH)	
Total Credits: 02 T	**Subject Code :** BHM4T02
Teaching Scheme :	**Examination Scheme :**
Lectures: 2 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 Category : HSMC-II	**BoS :** Civil

Course Objectives	
1	To aware about air and water pollution and its control techniques
2	To get students acquainted with environment pollution, waste management and laws related to it.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	**Understand** fundamental economic concepts and their relevance in business and technology.
CO2	**Analyze** market structure, pricing strategies and taxation for business decision-making.
CO3	**Demonstrate** knowledge of entrepreneurship, Challenges and support system.
CO4	**Apply** the funding for startups successful entrepreneurial ventures.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit-I			
Basic concept of economics ,Demand and Supply Analysis, Elasticity of Demand and Its Business Applications , Production and Cost Analysis	**6**		1
Unit -2			
Market and Market Structures, Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly, Pricing strategies and Taxation	6		2
Unit -3			
Concept of entrepreneurship, characteristics of an Entrepreneur, types of Entrepreneurship, Functions of Entrepreneurs, Women entrepreneurship in India, Problems and challenges of women entrepreneurs, Government's support system to develop women entrepreneurship.	6		3
Unit -4			
Funding for startups, angel funding, venture funding, difference between angel and venture funding, private equity fund, ownership of startups, causes of startups failures, Startup success case studies: Instagram, Linkedin, Snapchat, Whatsapp	6		4

Reference Books:
1. Benny Joseph, Environmental Studies, Mc Graw Hill Education (India) Private Limited
2. B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut
3. P Aarne Vesilind, J. Jeffrey Peirce and Ruth F. Weiner, Environmental Pollution and Control, Butterworth-Heinemann.
4. D. D. Mishra, S. S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S. Chand & Company Ltd.
5. Shree Nath Singh, Microbial Degradation of Xenobiotics, Springer-Verlag Berlin Heidelberg
6. Indian Environmental Law: Key Concepts and Principles edited by Shibani Ghosh, Publisher, Orient BlackSwan, 2019. ISBN, 9352875796
7. P. Thangavel & Sridevi, Environmental Sustainability: Role of Green technologies, Springer publications

Fourth Semester B. Tech. Computer Science & Engineering

Universal Human Values (TH)

Total Credits: 03 T	**Subject Code :** BVE4T02
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 Category : VEC-II	**BoS :**AS&H

Course Objectives	
1	Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
2	Students would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
3	Students would understand values in relationships.
4	Students would understand the role of a human being in ensuring harmony in society and nature.
5	Students would distinguish between ethical and unethical practices at workplace and would contribute for making a value based society

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Understand the importance of human values and ethics for a harmonious life and society.
CO2	Develop clarity about relationships, happiness, and prosperity from a holistic perspective.
CO3	Apply universal human values in personal and professional life for ethical decision-making.
CO4	Evaluate the role of human values in sustainable development and social well-being.

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT 1:			
Introduction to Universal Human Values, Need and Importance of Universal Human Values, Understanding Human Aspirations and Purpose of Life, Five Dimensions of Human Values: Individual, Family, Society, Nature, and Existence n.	7		1
UNIT 2:			
Understanding the Self: "I" and the Body, Harmony of Thoughts, Behavior, and Work ,Family as the Fundamental Unit of Society, Trust and Respect in Relationships , Ethical Values in Personal and Professional Life	8		2
UNIT 3:			

Society and Mutual Fulfillment: Humanistic Education, Health, and Justice, Universal Order: Role of Ethics in Social Systems , Coexistence with Nature: Environmental Ethics and Sustainability , Holistic Perspective on Economic and Technological Growth	8		3
UNIT 4:			
Holistic Development and Professional Ethics, Role of Human Values in Education, Science, and Technology , Ethical Dilemmas in Professional Life and Their Resolution, Corporate Social Responsibility (CSR) and Ethical Leadershi	8		4

Text Books:
1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria,ExcelBooks, NewDelhi,2010

Reference Books:
1. **"Essence of Human Values"** – A.N. Tripathi**Publisher**: New Age International
2. **"Human Values"** – Prof. A. Alavudeen, R. Kalil Rahman, and M. Jayakumaran **Publisher**: Laxmi Publications
3. **"Professional Ethics and Human Values"** – M. Govindarajan, S. Natarajan, V.S. Senthilkumar. **Publisher**: Prentice Hall India (PHI Learning)

Fourth Semester B. Tech. Computer Science & Engineering

Computer Networks	
Total Credits: 02 T	**Subject Code :** BOE4T01
Teaching Scheme :	**Examination Scheme :**
Lectures: 2 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 Category : OE-II	**BoS :**CSE

Course Objectives	
1	The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.
2	Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

Course Outcomes	
After completion of syllabus, students would be able to	
1	**Understand** the knowledge of the basic computer network & functions of each layer in the OSI and TCP/IP reference model.
2	**Understand** the knowledge of network protocols & its working.
3	**Understand** the concepts of transport layer and its protocol.
4	**Identify** and gain the working of application layer and its protocol.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1:			
Introduction - Network hardware & software, Reference models- The OSI Reference Model - the TCP/IP, Topologies, Transmission media, Data Link Layer-Ethernet, Token ring, wireless LANs, Issues with data link Protocols, Encoding framing and error detection and correction-sliding window Protocol-Medium access control	7		1
UNIT 2:			
Network layer - Design issues, Routing algorithms, Congestion control algorithms, Internetworking, Internet Protocol (IP), Classful and Classless addresses, ARP, RARP,ICMP,IGMP	7		2
UNIT 3:			
Transport layer - Design issues, Elements of transport protocol, Congestion control, The Internet's Transmission Control Protocol (TCP), User Datagram Protocol (UDP), and Transport Services.	5		3
UNIT 4:			
Application layer - Design issues, DNS, FTP, HTTP, SMTP, POP3, IMAP	5		4

Text Books:
1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI

Reference Books:	
1.	An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education
2.	Data Communications and Networking – Behrouz A. Forouzan. Third Edition TM

Fourth Semester B. Tech. Computer Science & Engineering

Cyber Laws	
Total Credits: 02 T	**Subject Code :** BOE4T02
Teaching Scheme :	**Examination Scheme :**
Lectures: 2 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 Category : OE-II	**BoS :**CSE

Course Objectives	
1	To enable learners to understand, explore, acquire Cyber Law.

2	Develop Competencies For Dealing With Frauds And Deceptions & IT Acts.

Course Outcomes	
After completion of syllabus, students would be able to	
1	**Understand** the intellectual property issues emerging from cyberspace.
2	**Understand** cyber crime at global and Indian perspective
3	**Understanding** of relationship between commerce and cyberspace
4	**Understand** the Information Technology Act and legal frame work of right to privacy.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1:			
Cyber laws and rights in today's digital age; IT Act, Intellectual Property Issues connected with use and management of Digital Data, Emergence of Cyberspace, Cyber Jurisprudence.	6		1
UNIT 2:			
Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber terrorism, Cyber Defamation, Different offenses under IT Act, 2000,Cyber Torts.	6		2
UNIT 3:			
E-commerce- Legal issues, E-commerce- Legal issues, Legal Issues in Cyber Contracts, Cyber Contract and IT Act 2000,The UNCITRAL Model law on Electronic Commerce	6		3
UNIT 4:			
I.P.R. & Cyber Space, Intellectual Property Issues and Cyberspace – The Indian Perspective, Overview of Intellectual Property related Legislation in India, Copyright law & Cyberspace, Trademark law & Cyberspace, Law relating to Semiconductor Layout & Design	6		4

Text Books:
1. The Information Technology act, 2000, Bare Act-Professional Book Publishers, New Delhi.
2. Aparna Viswanathan, “Cyber Law- Indian and International Perspectives On Key Topics Including Data Security, E-Commerce, Cloud Computing and Cyber Crimes”.

Reference Books:
1. "Cyber Law: Legal and Practical Considerations for Computer, E-commerce, and Intellectual Property" by Brett J. Trout. 2. "Cyber law: Management and Entrepreneurship" by Patricia L. Bellia, Paul Schiff Berman, and David G. Post4. Chris Reed & John Angel, Computer Law, OUP, New York, (2007)

3.	Web Link: https://onlinecourses.swayam2.ac.in/cec24_cs14/preview

Fourth Semester B. Tech. Computer Science & Engineering

Operating System	
Total Credits: 02 T	**Subject Code :** BOE4T03
Teaching Scheme :	**Examination Scheme :**
Lectures: 2 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 Category : OE-II	**BoS :**CSE

Course Objectives	
1	Provide basic knowledge of computer operating system structures and functioning.
2	Understand various problems related to concurrent operations and their solutions.
3	Compare several different approaches to memory management, file management and process management

Course Outcomes	
After completion of syllabus, students would be able to	
1	**Outlin**e the basic concept of operating systems
2	**Analyze** the working of operating system in process of scheduling/allocation approaches
3	**Examine** the working of deadlock and memory management.
4	**Identify** the working of File Management System.

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT 1:			
Basics of operating systems: Definition, Types, Structure, Services, System Calls, System Boot, System generation, System Design & implementation	6		1
UNIT 2:			
Process & CPU Scheduling: Process concept, operations on process, Interprocess Communication, Threads, Multithreading Model, Process Scheduling, Scheduling Criteria, Scheduling Algorithms	6		2
UNIT 3:			
Deadlock & Memory Management: Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery form Deadlock, Memory Management basic concept, memory allocation, paging segmentation, virtual memory, page fault, page replacement algorithm: FIFO, LRU, Optimal.	6		3

UNIT 4:			
File Management: File Concept, Access Methods, Directory Structure, File System Structure, Allocation Methods, Disk Structure, Disk scheduling, Disk scheduling algorithms, Disk Management.	6		4

Text Books:

1. Operating System Concepts – Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 8th edition, Wiley-India, 2009.
2. Modern Operating Systems – Andrew S. Tanenbaum, 3rd Edition, PHI 3. Operating Systems: A Spiral Approach – Elmasri, Carrick, Levine, TMH Edition

Reference Books:

1. Operating system Third Edition, Achyut S. Godbole, Atul Kahate,Tata McGrawHill.

2. Operating system concepts & design -2nd Edition ,Milan Milenkovic Tata McGraw Hill.

3. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.