



Rayat Shikshan Sanstha's

**Yashwantrao Chavan Institute of Science, Satara (Autonomous)**

**Lead College, Karmaveer Bhaurao Patil University**

**Reaccredited by NAAC (3rd Cycle) with 'A+' grade (CGPA 3.57).**

**ISO 9001:2015 Certified**

# **Bachelor of Science**

## **Part - I**

### **Artificial Intelligence (Entire)**

#### **Syllabus**

**to be implemented**

**w.e. f. June, 2023**

**NEP 2020**

Rayat Shikshan Sanstha's  
**Yashavantrao Chavan Institute of Science, Satara (Autonomous)**  
**Department of Artificial Intelligence (Entire)**  
**Syllabus for Bachelor of Science Part-I**

**1. TITLE:** ARTIFICIAL INTELLIGENCE (ENTIRE)

**2. YEAR OF IMPLEMENTATION:** New Syllabi for the B.Sc. I Artificial Intelligence (Entire) will be implemented from June 2023 onwards.

**3. PREAMBLE:**

Bachelor of Science is an integrated academic degree in the faculty of science. The revision of existing syllabus of Artificial Intelligence subject in Science Faculty is essential. This is a humble endeavor to initiate the process towards an era of knowledge. Intelligent machines have replaced human capabilities in many areas. Artificial intelligence is the intelligence exhibited by machines or software. It is the branch of computer science that emphasizes on creating intelligent machines that work and reacts like humans. This course is designed to span a wide variety of topics in computer science research, including machine learning, Game playing, Expert Systems etc.

**4. GENERAL OBJECTIVES OF THE COURSE:**

- 1) To undertake industry careers involving innovation and problem-solving using software and other information technologies.
- 2) To undertake research careers in Computer Sciences and allied areas.
- 3) To contribute to society by becoming a model professional who can communicate effectively and observes ethical behavior
- 4) To inculcate the software development attitude and generate interest in the field of Technology.
- 5) To develop programming skills, management skills, writing skills, Project Analysis skill among students.

**5. DURATION:**

- The course shall be a full-time course.

**6. PATTERN:** Semester

**7. MEDIUM OF INSTRUCTION:** ENGLISH

## Major Syllabus

### Course Structure for B.Sc. I (Semester- I)

Theory				Practical				
Course Title	Course Code	Lecture per week	Credits	Course	Course Title	Course Code	Lecture per week	Credits
Introduction to Artificial Intelligence	BAIT-111	5	2	Practical -1	Introduction to Artificial Intelligence and Programming in C Lab-I	BAIP -113	4	2
Programming in C	BAIT -112		2					

### Course Structure for B.Sc. I. (Semester- II)

Theory				Practical				
Course Title	Course Code	Lecture per week	Credits	Course	Course Title	Course Code	Lecture per week	Credits
Object Oriented Programming using python	BAIT -121	5	2	Practical - 2	Object Oriented Programming using python and Database Systems Lab-II	BAIP -123	4	2
Database Systems	BAIT -122		2					

**Note:** B: B. Sc. T=Theory and P= Practical

**Structure and Title of Courses of B. Sc. Course:**

**\* B. Sc. I Semester I \***

<b>Course Number</b>	<b>Course Code</b>	<b>Course Name</b>
I	BAIT- 111	Introduction to Artificial Intelligence
II	BAIT - 112	Programming in C
Lab -1	BAIP - 113	Introduction to Artificial Intelligence and Programming in C Lab-I

**\* B. Sc. I Semester II\***

<b>Course Number</b>	<b>Course Code</b>	<b>Course Name</b>
III	BAIT - 121	Object Oriented Programming using python
IV	BAIT - 122	Database Systems
Lab -2	BAIP - 123	Object Oriented Programming using python and Database Systems Lab-II

## Major Syllabus

### B.Sc. I- Semester-I

#### Theory: Course- I: BAIT111: Introduction to Artificial Intelligence

**Course Objectives:** Students should be able to...

1. understand a historical perspective of AI and its foundations.
2. study basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
3. identify to design and program Python applications.
4. learn to use lists, tuples, and dictionaries in Python programs.

Credits=2	SEMESTER-I Course- I: BAIT111: Introduction to Artificial Intelligence	No. of hours per unit/ credits
<b>Unit I</b>	<b>Introduction and Problem-Solving Methods</b>	(8)
	Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems. Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems -Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning	
<b>Unit II</b>	<b>Knowledge Representation</b>	(8)
	Architecture for Intelligent Agents, First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories -Reasoning with Default Information	
<b>Unit III</b>	<b>Basics of Python Programming</b>	(8)
	Introduction to Python - Python Interpreter - Data types - Identifiers and keywords - Integral Types - Floating Point Types – Strings.Case Sensitive - Scripts - Sequence Types - Tuples - Named Tuples - Sets - Mapping Types - Dictionaries-Generators – Iterators.	
<b>Unit IV</b>	<b>Programming Paradigms in Python</b>	(6)
	Array definition and declaration, initialization of arrays, types of arrays, String handling functions, Arrays and functions.	

**Course Outcomes:** Students will be able to...

1. demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
2. evaluate basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
3. apply the structure and components of a Python program.
4. analyse to write loops and decision statements in Python.

**Reference Books:**

1. Stuart Russell, peter Norvig (2020),Artificial Intelligence: A Modern Approach, 4th Edition, University of California at Berkeley, Pearson education.
2. Miguel Grinberg(2018), “Flask Web Development: Developing Web Applications with Python”, 2nd Edition, O'Reilly Media. ISBN-13: 978-1491991732
3. Wesley J Chun, (2015 ),“Core Python Applications Programming”, 3rd Edition, Pearson Education India. ISBN-13: 978-9332555365
4. Gerhard Weiss, (2013),Multi Agent Systems, Second Edition, MIT Press.
5. S. Russell and P. Norvig,( 2009) "Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition.
6. M. Tim Jones,( 2008),Artificial Intelligence: A Systems Approach (Computer Science),Jones and Bartlett Publishers, Inc.; First Edition

**B.Sc. I- Semester-I****Theory: Course II: BAIT112: Programming in C****Course Objectives:** Students should be able to...

1. understand working of hardware and software and the importance of operating systems
2. identify programming languages, number systems, peripheral devices, networking, multimedia and internet concepts
3. study of the syntax and semantics of the C programming language.
4. learn the usage of structured programming approaches in solving problems.

<b>Credits=2</b>	<b>SEMESTER-I</b> <b>Course II: BAIT112: Programming in C</b>	<b>No. of hours per unit/ credits</b>
<b>Unit I:</b>	<b>Introduction to C Programming</b>	(8)
	Overview of C; History and Features of C; Structure of a C Program with Examples; Creating and Executing a C Program; Compilation process in C, Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration & initialization of variables; Symbolic constants, Formatted I/O functions - printf and scanf, control stings and escape sequences, output specifications with printf functions; Unformatted I/O functions to read and display single character and a string - getchar, putchar, gets and puts functions.	
<b>Unit II:</b>	<b>Operators and Control Structures</b>	(8)
	Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment & Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associativity; Evaluation of arithmetic expressions; Type conversion, Decision making Statements - Simple if, if_else, nested if_else, else_if ladder, Switch Case, goto, break & continue statements; Looping, Statements - Entry controlled and exit controlled statements, while, do-while, for loops, Nested loops	
<b>Unit III:</b>	<b>Arrays and functions</b>	(8)
	Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation. Need for user applyd functions; Format of C user applyd functions; Components of user applyd functions - return type, name, parameter list, function body, return statement and function call; Categories of user applyd functions - With and without parameters and return type, Strings: Declaring & Initializing string variables; String handling functions - strlen, strcmp, strcpy and strcat; Character handling functions - toascii, toupper, tolower, isalpha, isnumeric etc.	

<b>Unit IV:</b>	<b>Pointers in C</b>	(6)
	Understanding pointers - Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers and Arrays; Pointer Arithmetic; Advantages and disadvantages of using pointers	

**Course Outcomes:** - Students will be able to...

1. perform input and output operations using programs in C
2. create and Write programs that perform operations on arrays
3. analyse, read, understand and trace the execution of programs written in C language
4. decompose a problem into functions and to develop modular reusable code.

**Reference Books:**

1. P. K. Sinha & Priti Sinha(2022), Foundations of Computing(BPB)
2. Yashwant Kanetkar(2021), Let Us C : Authentic guide to C programming language (18th Edition)
3. V. Rajaraman(2019), Programming in C (PHI – EEE), 2nd edition,PHI Learning Private Limited.
4. S. Byron Gottfried(2018) Programming with C (TMH),4<sup>th</sup> edition.
5. E. Balaguruswamy(2017), Programming in ANSI C (TMH),7th Edition McGrawHill
6. Kamthane(2008), Programming with ANSI and TURBO C ,3<sup>rd</sup> edition,(Pearson Education)



**Practical-I**  
**Lab Course I: BAIP113: Lab based on BAIT111 and BAIT112**

**Course Objectives:** Students should be able to...

1. Study of awareness of fundamental understanding of various applications of AI techniques
2. identify programming skills in core Python.
3. learn an IDE to create, edit, compile, run and debug programs
4. understand the various steps in program development.

Credits=2	SEMESTER-I Lab Course I- Lab based on BAIT111 and BAIT112	No. of hours per unit/ credits(60)
<b>Part A :</b>	<b>Introduction to Artificial Intelligence</b>	
	<ol style="list-style-type: none"> <li>1. Study of basics of Artificial Intelligence and its algorithms.</li> <li>2. Write a program to demonstrate different number data types in Python.</li> <li>3. Write a program to perform different Arithmetic Operations on numbers in Python.</li> <li>4. Write a program to create, concatenate and print a string and accessing sub-string from a given string.</li> <li>5. Write a python script to print the current date in the following format “Sun May 29 02:26:23 IST 2017”</li> <li>6. Write a program to create, append, and remove lists in python.</li> <li>7. Write a program to demonstrate working with tuples in python.</li> <li>8. Write a program to demonstrate working with dictionaries in python.</li> <li>9. Write a python program to find largest of three numbers.</li> <li>10. Write a Python program to construct the following pattern, using a nested for loop  <pre style="margin-left: 40px;">* *</pre> </li> </ol>	
<b>Part B :</b>	<b>Programming in C</b>	
	<ol style="list-style-type: none"> <li>11. Program to read radius of a circle and to find area and circumference.</li> <li>12. Program to read three numbers and find the biggest of three</li> <li>13. Program to read a number, find the sum of the digits, reverse the number and check it for palindrome</li> <li>14. Program to read percentage of marks and to display appropriate message (Demonstration of else-if ladder)</li> <li>15. Program to find the roots of quadratic equation (demonstration of switch Case statement)</li> <li>16. Program to read marks scored by n students and find the average of marks (Demonstration of single dimensional array)</li> <li>17. Program to demonstrate string functions.</li> </ol>	

	<p>18. Program to demonstrate pointers in C</p> <p>19. Program to demonstrate student structure to read &amp; display records of n students.</p> <p>20. Program to demonstrate the difference between structure &amp; union.</p>	
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**Course Outcomes:** - Students will be able to...

1. elaborate problems where artificial intelligence techniques are applicable
2. use of the python programming language to construct basic programs
3. translate given algorithms to a working and correct program and correct syntax errors as reported by the compilers
4. demonstrate and correct logical errors encountered during execution and represent and manipulate data with arrays, strings and structures

**Reference Books:**

1. P. K. Sinha & Priti Sinha(2022), Foundations of Computing(BPB)
2. Yashwant Kanetkar(2021), Let Us C : Authentic guide to C programming language (18th Edition)
3. Stuart Russell, peter Norvig (2020),Artificial Intelligence: A Modern Approach, 4th Edition, University of California at Berkeley, Pearson education.
4. V. Rajaraman(2019), Programming in C (PHI – EEE), 2nd edition,PHI Learning Private Limited.
5. Miguel Grinberg(2018), “Flask Web Development: Developing Web Applications with Python”, 2nd Edition, O'Reilly Media. ISBN-13: 978-1491991732
6. Wesley J Chun, (2015 ),“Core Python Applications Programming”, 3rd Edition, Pearson Education India. ISBN-13: 978-9332555365
7. Gerhard Weiss, (2013),Multi Agent Systems, Second Edition, MIT Press.

## B.Sc.I- Semester-II

### Theory: Course I: BAIT121: Object Oriented Programming using python

**Course Objectives:** Students should be able to...

1. learn fundamental concepts of objects.
2. Study of principles of programming.
3. understand the concept of object-oriented programming like classes, constructors, Polymorphism, inheritance, and file handling.
4. identify the open source libraries.

<b>Credits=2</b>	<b>SEMESTER-II</b>	<b>No. of hours per unit/ credits</b>
	<b>Course I: BAIT121: Object Oriented Programming using python</b>	
<b>UNIT I</b>	<b>Introduction to Object Oriented Programming</b>	(8)
	Features of Object oriented programming system (OOPS) – Classes and Objects, Encapsulation, Abstraction, Inheritance, Polymorphism, Classes and Objects: Creating a class, The Self variable, Constructor, Types of Variable, Namespaces, Types of Methods, Inheritance and Polymorphism – Constructors in inheritance, the super() method, types of inheritance, polymorphism, abstract classes and interfaces	
<b>UNIT II</b>	<b>Strings, functions and Python libraries</b>	(8)
	Strings: Creating strings and basic operations on strings, string-testing methods. Functions: Defining a function, Calling a function, returning multiple values from a function, functions are first class objects, formal and actual arguments, positional arguments, recursive functions, Basics of open-source libraries for data preprocessing, modelling and visualization, Using Python to Access Web Data Regular Expressions, Extracting Data, Sockets, Using the Developer Console to Explore HTTP, Retrieving Web Page, Parsing Web Pages Module	
<b>UNIT III</b>	<b>Exception Handling</b>	(6)
	Exception: Errors in a Python program, exceptions, exception handling, types of exceptions, the except block, the assert statement, user-applyd exceptions	
<b>UNIT IV</b>	<b>Graphical User Interface and databases</b>	(8)
	GUI in Python: The root window, fonts and colors, working with containers, Canvas, Frames, Widgets – Button widget, Label widget, message widget, text widget, radio button widget, entry widget, Using Databases, Single Table CRUD, Designing and Representing a Data Model, Inserting Relational Data, Reconstructing Data with JOIN, Many to Many Relationships.	

**Course Outcomes:** - Students will be able to...

1. evaluate the basic concepts of OOPs.
2. apply different Python library to solve programming problems.
3. explain the advanced concepts of python and apply for accessing databases and web data.
4. analyze APIs and third-party libraries to be used with Python.

**Reference Books:**

1. Robert Sedgewick, Kevin Wayne, Robert Dondero(2016), “Introduction to Programming in Python: AnInter-Disciplinary Approach”, Pearson India Education Services Pvt. Ltd.,
2. Timothy A. Budd,( 2015 ),” Exploring Python”, Mc-Graw Hill Education (India) Private Ltd.,
3. Charles Dierbach,( 2013) “Introduction to Computer Science using Python: A Computational Problem Solving Focus”, Wiley India Edition
4. Kenneth A. Lambert,( 2012), “Fundamentals of Python: First Programs”, CENGAGE Learning.
5. Michael H.Goldwasser, David Letscher,( 2007), “Object Oriented Programming in Python”, Prentice Hall, 1st Edition

**B.Sc. I- Semester-II**  
**Theory: Course II: BAIT122: Database Systems**

**Course Objectives:** Students should be able to...

1. understand various basics of DBMS and query languages.
2. learn different types of database systems and their applications in different scenarios.
3. identify the process of drawing the ER-Diagrams.
4. study of the importance of database analysis and learn any database application.

Credits=2	<b>SEMESTER-II</b> <b>Course II: BAIT122: Database Systems</b>	<b>No. of hours per unit/ credits</b>
<b>UNIT I</b>	<b>Introduction</b>	(8)
	Characteristics and fundamental concepts of Databases, Types of Data Models and Data Modelling, Elements of Database Systems, Classification and comparison of Database Management Systems (Regular and NoSQL Page), concurrency control, Lock based concurrency control, Time stamping methods	
<b>UNIT II</b>	<b>Structured and semi-structured data management</b>	(7)
	Structured data, relational databases, Relational model, Functional Dependencies, normal forms, algorithms for query optimization, Semi-structured data, document-databases, semi-structured data abstraction, representation and search	
<b>UNIT III</b>	<b>Transaction Management</b>	(7)
	Transaction concept, transaction state, ACID properties, serializability, Recoverability, Implementation of Isolation, Testing for serializability	
<b>UNIT IV</b>	<b>Unstructured Data Management and Big Data Management</b>	(8)
	Unstructured text, Information retrieval systems, document retrieval and ranking, Platforms for Big Data, algorithms for Map-Reduce & Hadoop, Platforms for Big Graphs, algorithms for large graphs.	

**Course Outcomes:** - Students will be able to...

1. apply the basics of databases and data management.
2. evaluate various theoretical and practical principles involved in the design and use of databases systems with the help of database
3. design and implement databases for various scenarios.
4. modify database scenario for handling big data.

**Reference Books:**

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan,( 2006), Database System Concepts, Tata McGraw Hill
2. Elmsari and Navathe(2013), Fundamentals of Database Systems, Pearson Education.
3. Ramakrishnan and Gehrke,( 2003), Database Management Systems, McGrawHill
4. C.J.Date, A.Kannan, S.Swamynathan, (2006),“An Introduction to Database Systems”, Pearson Education
5. R.P. Mahapatra(2016), Database Management Systems, Khanna Book Publishing.

**Practical-II**  
**Lab Course-II: BAIP123: Lab based on(BAIT121 and BAIT122)**

**Course Objectives:** Students should be able to...

1. learn principles of programming.
2. understand the concept of object-oriented programming like classes, constructors, Polymorphism, inheritance, and file handling.
3. study of how to implement databases for various scenarios.
4. identify the design a database scenario for handling big data.

Credits=2	SEMESTER-I Lab Course I- BAIP123: Lab based on(BAIT121 and BAIT122)	No. of hours per unit/ credits(60)
<b>Part A :</b>	<b>Object Oriented Programming using python</b>	
	<ol style="list-style-type: none"> <li>1. Write a NumPy program to compute the cross product of two given vectors</li> <li>2. Write a NumPy program to calculate the QR decomposition of a given matrix</li> <li>3. Write a Pandas program to convert a Panda Module Series to Python list and it's type.</li> <li>4. Write a Pandas program to convert a NumPy array to a Pandas series</li> <li>5. Implement the concept of Classes and objects</li> <li>6. Implement the concept of inheritance</li> <li>7. Implement the concept of polymorphism</li> <li>8. Write a menu-driven program to create mathematical 3D objects               <ol style="list-style-type: none"> <li>I. curve</li> <li>II. sphere</li> <li>III. cone</li> <li>IV. arrow</li> <li>V. ring</li> <li>VI. Cylinder.</li> </ol> </li> <li>9. WAP to read n integers and display them as a histogram.</li> <li>10. WAP to plot a graph of people with pulse rate p vs. height h. The values of p and h are to be entered by the user.</li> </ol>	
<b>Part B :</b>	<b>Database systems</b>	
	<ol style="list-style-type: none"> <li>11. Implement normal forms in a database.</li> <li>12. Implement basic SQL commands on a database.</li> <li>13. Programs on relational models</li> <li>14. Implementation of queries and subqueries</li> <li>15. Implement information and raking using any language.</li> <li>16. Implement document retrieval and ranking using any algorithm.</li> <li>17. Programs on serializability.</li> <li>18. Programs on concurrency control.</li> <li>19. Implement different algorithm using Hadoop.</li> <li>20. Implement Map-reduce algorithm on any big data task.</li> </ol>	

**Course Outcomes:** - Students will be able to...

1. explain basic principles of Python programming language
2. implement database and GUI applications.
3. demonstrate normalization techniques with simple examples.
4. describe transaction processing and concurrency control concepts.

**Reference Books:**

1. Robert Sedgewick, Kevin Wayne, Robert Dondero, (2016), "Introduction to Programming in Python: An Inter-Disciplinary Approach", Pearson India Education Services Pvt. Ltd.,
2. Timothy A. Budd (2015), "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,
3. Charles Dierbach, (2013), "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India Edition
4. Kenneth A. Lambert (2012), "Fundamentals of Python: First Programs", CENGAGE Learning.
5. David L. Poole and Alan K. Mackworth, (2010), Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press.

## Minor Syllabus

### Course Structure for B.Sc. I (Semester- I)

Theory				Practical				
Course Title	Course Code	Lecture per week	Credits	Course	Course Title	Course Code	Lecture per week	Credits
Fundamentals of Computers	BAIT-114	5	2	Practical -1	Fundamentals of Computers and Computational Statistics-I Lab-I	BAIP -116	4	2
Computational Statistics-I	BAIT -115		2					

### Course Structure for B.Sc. I. (Semester- II)

Theory				Practical				
Course Title	Course Code	Lecture per week	Credits	Course	Course Title	Course Code	Lecture per week	Credits
Operating Systems	BAIT – 124	5	2	Practical 1 – 2	Operating Systems and Computational Mathematics -I Lab-II	BAIP -126	4	2
Computational Mathematics -I	BAIT -125		2					

**Note:** B: B. Sc. T=Theory and P= Practical



**Structure and Title of Courses of B. Sc. Course:**

**\* B. Sc. I Semester I \***

<b>Course Number</b>	<b>Course Code</b>	<b>Course Name</b>
I	BAIT- 114	Fundamentals of Computers
II	BAIT- 115	Computational Statistics-I
Practical -1	BAIP- 116	Fundamentals of Computers and Computational Statistics -I Lab-I

**\* B. Sc. I Semester II\***

<b>Course Number</b>	<b>Course Code</b>	<b>Course Name</b>
III	BAIT- 124	Operating Systems
IV	BAIT- 125	Computational Mathematics -I
Practical -2	BAIP- 126	Operating Systems and Computational Mathematics -I Lab-II

## Minor Syllabus

### B.Sc. I- Semester-I

#### Theory: Course I-BAIT114: Fundamentals of Computers

**Course Objectives:** - Students should be able to...

1. study the basics of computer.
2. learn algorithm, Flowchart and Pseudo code with Examples.
3. understand the fundamentals of operating systems.
4. identify WebBasics and internet features.

<b>Credits=2</b>	<b>SEMESTER-I</b> <b>Course I-BAIT114: Fundamentals of Computers</b>	<b>No. of hours per unit/ credits</b>
<b>UNIT I</b>	<b>Fundamentals of Computer</b>	(8)
	Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organisation of a Digital Computer; Number Systems – different types, conversion from one number system to another; Computer Codes – BCD, Gray Code, ASCII and Unicode; Boolean Algebra – Boolean Operators with Truth Tables; Types of Software – System Software and Utility Software; Computer Languages - Machine Level, Assembly Level & High Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program- Algorithm, Flowchart and Pseudo code with Examples	
<b>UNIT II</b>	<b>Introduction to computers</b>	(8)
	Input and Output Devices: Keyboard, mouse, touch screen, joystick, scanner, web camera, MICR, OCR, OMR, bar-code reader, monitor, printer, plotter. Memory: Primary, secondary, auxiliary memory; RAM, ROM, cache memory, magnetic tape, magnetic disks, hard disk drives, optical disks, CD-R, DVD, flash drives, blue ray disc, Computer Organization and Architecture: C.P.U., registers, system bus, main memory unit, LOCF - Page: 1 of 35 processors., motherboard, ports and interfaces, expansion cards, ribbon cables, SMPS, memory chips.	
<b>UNIT III</b>	<b>Operating System Fundamentals</b>	(6)
	Operating Systems: Introduction, Functions of an operating System, Classification of Operating Systems, System programs, Application programs, Utilities, The Unix Operating System, Basic Unix commands, Microkernel Based Operating System, Booting	
<b>UNIT IV</b>	<b>Internet Basics</b>	(8)
	Introduction, Features of Internet, Internet application, Services of Internet, Logical and physical addresses, Internet Service Providers, Domain Name System. Web Basics: Introduction to web, web browsers, http/https, URL, HTML5, CSS	

**Course Outcomes:** - Students will be able to...

1. apply Internet basics, features, applications, services, internet service providers, domain name system, browsing, email, searching
2. analyse introduction of computers, classification of computers, anatomy of computer.
3. evaluate the constituents and architecture of computers and microcontrollers.
4. explain Web Programming basics, introduction of HTML and CSS programming

**Reference Books:**

1. J. Glenn Brook shear,(2015),” Computer Science: An Overview”, Addison-Wesley, Twelfth Edition
2. David Riley and Kenny Hunt(2014), Computational thinking for modern solver, Chapman & Hall/CRC
3. Pradeep K. Sinha and Priti Sinha(2010), Computer Fundamentals (Sixth Edition), BPB Publication
4. R.G. Dromey,(2005), “How to solve it by Computer”, PHI.

**B.Sc.I- Semester-I**  
**Theory: Course II-BAIT115: Computational Statistics-I**

**Course Objectives:** Students should be able to...

1. learn to impart adequate knowledge on the need of statistics.
2. identify the need of problem-solving techniques.
3. study the technique of data collection & its presentation, concept of correlation and regression.
4. understand basic concept of probability, distribution probabilities of different events and time series.

Credits=2	SEMESTER-I Course II-BAIT115: Computational Statistics-I	No. of hours per unit/ credits
<b>UNIT I</b>	<b>Data Condensation, Presentation and Central Tendency</b>	(8)
	Introduction to statistics, Primary and secondary data, Classification of primary and secondary data, Tabulation and Diagrammatic Representation of statistical data, Graphical Representation of data – Bar-charts, Pie-diagrams Histograms, Box plots, Measures of central tendency and dispersion, Examples.	
<b>UNIT II</b>	<b>Correlation and Regression</b>	(8)
	Concept of correlation, Karl Pearson's coefficient of correlation, Correlation coefficient for A bivariate frequency distribution, Rank correlation, Concept of Regression, Properties of regression coefficient.	
<b>UNIT III</b>	<b>Probability &amp; Conditional Probability</b>	(8)
	Events and sets, Sample space, Concept of probability, Addition and multiplications Theorem on probability, Conditional probability and independence of events, Baye's Theorem, Concept of random variable, Mathematical Expectation.	
<b>UNIT IV</b>	<b>Time Series</b>	(6)
	Concept of Time series, Analysis of Time Series, Component of time series, Secular and Cyclic Trend, Seasonal and Irregular Variation, Methods of measuring trends, Moving Average Method, Progressive Average Method, Least Square Method.	

**Course Outcomes:** Students will be able to...

1. evaluate the graph and types of graphs, representation of graphs.
2. develop matrices and its types, eigen values and eigen vectors.
3. explain events, sample space, probabilities and conditional probability.
4. analyze the measure trends of time series.

**Reference Books:**

1. Parimal Mukhopadyay(2011), An Introduction to the Theory of Probability (World Scientific Publishing Company).
2. S.P. Gupta(2011),Statistical Methods, Sultan Chand and sons Publications, 4th Edition.
3. Dr. S. Arumugam and A. Dhandapani Issac,( 2002),Statistics, New Gamma Publication house.
4. Kishor S. Trivedi (1997), Probability and statistics with reliability queuing and Computer Science Applications - Prentice Hall of India (P) Ltd., New Delhi.
5. P. S. Grewal(1990), Methods of Statistical Analysis (Sterling Publishers).

## Practical-I

### Lab Course I: BAIP116: Lab based on (BAIT114 and BAIT115)

**Course Objectives:** Students should be able to...

1. learn algorithm, Flowchart and Pseudo code with Examples.
2. understand the fundamentals of operating systems.
3. define computer programming and its role in mathematics problem solving.
4. identify programming skills using the fundamentals and basics of Python Language.

Credits=2	SEMESTER-I Lab Course I- BAIP116: Lab based on (BAIT114 and BAIT115)	No. of hours per unit/ credits (60)
<b>Part A:</b>	<b>Fundamentals of Computer</b>	
	<ol style="list-style-type: none"><li>1. Identification of the peripherals of a computer, components in a CPU and their functions.</li><li>2. Assembling and disassembling the system hardware components of personal computer.</li><li>3. Basic Computer Hardware Trouble shooting.</li><li>4. Study of internet basics</li><li>5. Familiarization of Basic Software – Operating System, Word Processors.</li><li>6. Study of Internet Browsers, Integrated Development Environment (IDE) with Examples.</li><li>7. Verify the components of a typical computer system.</li><li>8. Study of number systems.</li><li>9. Study of HTML tags</li><li>10. Study of table tags, ordered and unordered lists.</li></ol>	
<b>Part B:</b>	<b>Computational Statistics-I</b>	
	<ol style="list-style-type: none"><li>11. Graphical Representation I (Using Python)</li><li>12. Graphical Representation II (Using Python)</li><li>13. Measures of Central Tendency. (Using Python)</li><li>14. Measures of dispersion. (Using Python)</li><li>15. Programs on Correlation</li><li>16. Programs on Regression</li><li>17. Application of Probability and Conditional probability</li><li>18. Application on Baye's Theorem</li><li>19. Time Series trend by progressive averages, moving averages methods.</li><li>20. Time Series trend by least square methods.</li></ol>	

**Course Outcomes:** - Students will able to...

1. evaluate introduction of computers, classification of computers, anatomy of computer.
2. explain Study of constituents and architecture, microcontrollers.
3. learn solve mathematics problems using Python Language.
4. demonstrate simple arithmetic operations using Python.

**Reference Books:**

1. J. Glenn Brook shear,(2015),” Computer Science: An Overview”, Addison-Wesley, Twelfth Edition
2. David Riley and Kenny Hunt(2014), Computational thinking for modern solver, Chapman & Hall/CRC
3. Seymour Lipschutz, Marc Lars Lipson Schaum’s Outlines(2012),Discrete Mathematics, 3rd Edition., Tata McGraw Hill, Education Pvt. Ltd., New Delhi. 5th Reprint.
4. Kenneth. H. Rosen(2012)Discrete Mathematics and its applications, Seventh Edition, Mc Graw Hill Publishing Company.
5. Pradeep K. Sinha and Priti Sinha(2010), Computer Fundamentals (Sixth Edition), BPB Publication
6. M. Venkataraman, N. Sridharan and N. Chandrasekaran(2009),Discrete Mathematics,The National Publishing Company.
7. R.G. Dromey,(2005), “How to solve it by Computer”, PHI.

## B.Sc.I- Semester-II

### Theory: Course I : BAIT124: Operating Systems

**Course Objectives:** - Students should be able to...

1. aware different types of Operating System and their services.
2. learn different process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
3. understand virtual memory concepts.
4. remember the concept of secondary memory management.

Credits=2	SEMESTER-II Course I : BAIT124: Operating Systems	No. of hours per unit/ credits
UNIT I	<b>Concepts of Operating Systems</b> Computer system overview, concept of an operating system, batch system, multiprogramming, multiprocessing, multi user, time sharing, personal system, parallel system, real time system, simplemonitors, general system architecture, System components, operating system services, system calls, system programs, system structure, Approaches to OS design and implementation: Microkernel, Layered, Kernel Approach	(7)
UNIT II	<b>Processes and Threads</b> Concept of process, process states, process state transitions, process control block, operations on processes, threads, concurrent processes, mutual exclusion and synchronization, principles of deadlocks, integrated deadlocks strategy, scheduling levels, scheduling criteria, Inter process synchronization, Inter process communication, Linux, IPC Mechanism, Remote procedure calls, RPC exception handling, security issues	(7)
UNIT III	<b>Memory Management and Data Management</b> Logical and physical address space, storage allocation and management techniques, swappingconcepts of multi programming, paging, segmentation, virtual storage management strategies, demand paging, page replacement algorithm, thrashing, File organization, record blocking, access method, directory structure, protection file system structure, allocation methods, free space management, directory implementation, disk structure, disk scheduling, disk management, buffering, swap space management, RAID levels	(8)
UNIT IV	<b>Case Studies and OS Abstractions</b> Linux/Unix OS design and architecture, Unix shell, Unix operating system services, user perspective, representation of files in Unix system processes and their structure, input-outputsystem, memory management in Unix, Processes: fork, wait, exec, exit, kill, getpid, brk, nice, sleep,trace, Files: open, close, read, write, lseek, stat, sync, Directories: mkdir, rmdir, link, unlink, mount, umount users +, Security: chown, chmod, getuid, setuid, Inter process communication: signals, pipe, Networking: socket, accept, snd, recv, connect	(8)

**Course Outcomes:** - Students will be able to...

1. control access to a computer and the files that may be shared
2. demonstrate the knowledge of the components of computer and their respective roles in computing.
3. recognize and resolve user problems with standard operating environments.
4. apply practical knowledge of how programming languages, operating systems, and architectures interact and how to use each effectively.

**Reference Books:**

1. Ekta Walia(2020),Operating System Concepts, Khanna Book Publishing.
2. Crowley(2017),Operating System A Design Approach-, McGraw Hill Education.
3. Kernighan and Pike(2015),UNIX programming environment, PHI/ Pearson Education
4. Andrew S. Tanenbaum(2014),Modern Operating Systems, 2nd edition, Pearson/PHI
5. William Stallings(2012),Operating systems Internals and design principles,Pearson Education,
6. Abraham Silberchatz, Peter B. Galvin, Greg Gagne(2006) Operating System Principles- 7th Edition, John Wiley Publication
7. W. Stallings(2005),Operating Systems – Internals and Design Principles, Fifth Edition, Pearson Education/PHI
8. W.R. Stevens(2000),Advanced programming in the UNIX environment, Pearson education.



**B.Sc.I- Semester-II**  
**Theory: Course II: BAIT125: Computational Mathematics -I**

**Course Objectives:** Students should be able to...

1. learn to impart adequate knowledge on the need of mathematics.
2. understand the need of problem-solving techniques.
3. introduce the fundamental of logic, relations and counting.
4. identify basic concept of graphs, matrices, different types of graphs and matrices.

Credits=2	SEMESTER-I Course II: BAIT125: Computational Mathematics -I	No. of hours per unit/ credits
<b>UNIT I</b>	<b>The Fundamental of Logic and Relations</b>	(8)
	Propositional logic, Applications of Propositional logic, Propositional equivalences (Exclude Propositional satisfiability, Applications of satisfiability, solving satisfiability problems, and its related problems), Predicates and Quantifiers, Rules of inference, Relations and their properties, representing relations, Closures of relations, Partial orderings (Theorems statement only; Exclude lexicographic ordering - Exclude Lattices)	
<b>UNIT II</b>	<b>Counting</b>	(8)
	The basic of counting, the pigeonhole principle, Permutation and Combinations, Applications of recurrence relations, solving recurrence relations, Divide and Conquer algorithms and recurrence relations. (All theorems and Results statement only)	
<b>UNIT III</b>	<b>Graphs</b>	(8)
	Graphs and Graphs models (Excluding Biological networks; Tournaments; all its related examples and problems), Graph terminology and special types of graphs, representing graphs and Graph isomorphism, Connectivity (paths – connectedness in undirected graphs – paths and isomorphism – counting paths between vertices), Shortest path problems.	
<b>UNIT IV</b>	<b>Matrices</b>	(6)
	Introduction, Operations on Matrices and examples, Inverse of Matrices and examples, Rank of a matrix, Solution of simultaneous linear equations, Eigen values and Eigen Vectors.	

**Course Outcomes:** - Students will be able to...

1. evaluate fundamental of logic, application of logic and relations.
2. explain the pigeonhole principle and applications of recurrence relations.
3. demonstrate graphs and its types, solve problems on it.
4. apply matrices and its types, eigen values and eigen vectors

**Reference Books:**

1. Seymour Lipschutz, Marc Lars Lipson Schaum's Outlines(2012),Discrete Mathematics, 3rd Edition., Tata McGraw Hill, Education Pvt. Ltd., New Delhi. 5th Reprint.
2. Kenneth. H. Rosen(2012)Discrete Mathematics and its applications, Seventh Edition, Mc Graw Hill Publishing Company.
3. M. Venkataraman, N. Sridharan and N. Chandrasekaran(2009),Discrete Mathematics,The National Publishing Company.

## Practical-II

### Lab Course II :BAIP126: Lab based on (BAIT124 and BAIT125)

**Course Objectives:** Students should be able to...

1. understand and implement shell programming.
2. learn how to create and/or modify concurrent programs.
3. identify computer programming and its role in statistics problem solving.
4. study of programming skills using the fundamentals and basics of Python Language.

Credits=2	SEMESTER-II Lab Course II :BAIP126: Lab based on (BAIT124 and BAIT125)	No. of hours per unit/ credits (60)
<b>Part A:</b>	<b>Operating systems</b>	
	<ol style="list-style-type: none"><li>1. Study on different operating systems.</li><li>2. Experiments to understand operating system (Ubuntu) installation process, file system partitioning and dual boot setup.</li><li>3. Experiment to learn command line interface (shell) and exploring various commands of UNIX.</li><li>4. Writing programs to create and execute shell script.</li><li>5. Program to implement various algorithms for process scheduling</li><li>6. Write programs using the I/O system calls of UNIX/LINUX operating system (open, read, write, close, fcntl, seek, stat, opendir, readdir)</li><li>7. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance and Prevention.</li><li>8. Use the following system calls of UNIX operating system: mkdir, rmdir, link, unlink, mount, umount, users +, chown, chmod, getuid, setuid.</li><li>9. Use the following system calls of UNIX operating system: fork, wait, exec, exit, kill, getpid, brk, nice, sleep, trace, open, close, read, write, lseek, stat, sync</li><li>10. Use the following system calls of UNIX operating system: signals, pipe, socket, accept, snd, recv, connect.</li></ol>	
<b>Part B :</b>	<b>Computational Mathematics -I</b>	
	<ol style="list-style-type: none"><li>11. Write a Python Program to Print a Multiplication Table for the given number.</li><li>12. Write a Python Program to check whether the given number is prime or not.</li></ol>	

	<ol style="list-style-type: none"> <li>13. Write a Python Program to display the Fibonacci series for a given number.</li> <li>14. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.</li> <li>15. Write a Python Program to Transpose the Matrix.</li> <li>16. Write a Python Program to Multiply Two Matrices.</li> <li>17. Write a Python Program to Generate the Calendar for the Given Month and Year.</li> <li>18. Write a Python Program to Find factorial of the given number.</li> <li>19. Inverse of Matrix by Cayley Hamilton Method.</li> <li>20. Eigen Values and Eigen Vectors.</li> </ol>	
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**Course Outcomes:** - Students will be able to...

1. evaluate the basics of an operating systems and its major components.
2. apply security as well as recovery features in the design of algorithm.
3. solve statistics problems using Python Language.
4. sketch time series plots using python, find the probabilities of events and conditional probabilities.

**Reference Books:**

1. Dr. Marlapalli Krishna & S. Jaya Prakash Dr. Marlapalli Krishna, K. Varada Rajkumar(2021), Basic Python Programming for Beginners , Bluerose Publishers Pvt. Ltd.
2. Eric Matthes(2019), Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming.
3. S.P. Gupta(2011), Statistical Methods, Sultan Chand and sons Publications, 4th Edition.
4. Dhamdhare(2006), Operating Systems-A Concept Based Approach, TMH
5. John Willey (2004), Operating system, Galvin & Silberschatz, 7th Edition
6. Maurice J. Bach,(1986), The design of Unix Operating system, Pearson Education, India.

## Open Elective (OE) Course Name: Applications of AI and ML

### Semester – I

### OE Course - I: BAIT117: Introduction to AI

**Course Objectives:** Students should be able to...

1. understand the IOT ecosystem.
2. learn the technologies and the standards relating to the Internet of Things.
3. study of skills on IoT technical planning.
4. identify the implementation of web-based services on IoT devices

<b>Credits (Total Credits 2)</b>	<b>SEMESTER – I OE Course – I BAIT117: Introduction to AI</b>	<b>No. of hours per unit</b>
<b>Unit - I</b>	<b>Fundamentals to AI</b> Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems. Problem solving Methods	<b>(08)</b>
<b>Unit – II</b>	<b>Basics of Python</b> Introduction to Python - Python Interpreter - Data types, Identifiers and keywords - Integral Types - Floating Point Types – Strings. Case Sensitive - Scripts - Sequence Types - Tuples - Named Tuples - Sets - Mapping Types - Dictionaries	<b>(08)</b>
<b>Unit – III</b>	<b>Introduction to IOT</b> introduction and its components, IoT building blocks, Sensors and Actuators, IoT Devices, IoT boards (Arduino Uno, ESP 8266-12E Node MCU, and Raspberry Pi 3), IOT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity : An Open source IoT stack	<b>(08)</b>
<b>Unit - IV</b>	<b>WEB OF THINGS</b> Web of Things versus Internet of Things – Two Pillars of the Web Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence	<b>(06)</b>

**Course Outcomes:** Students will be able to...

1. apply the technology and standards relating to IoTs.
2. evaluate the critical ecosystem required to mainstream IoTs.
3. acquire skills on developing their own national and enterprise level technical strategies.
4. explore Market forecast for IoT devices with a focus on sensors.

**Reference Books:**

1. John Paul Mueller(2018),Artificial Intelligence For Dummies,For Dummies Latest Edition: 1st edition
2. Mariya Yao(2018),Applied Artificial Intelligence: A Handbook For Business Leaders, TOPBOTS Latest Edition: 1st edition.
3. Max Tegmark(2017),Being Human in the Age of Artificial Intelligence,Knopf Latest Edition: 1st edition
4. Jeff Heaton(2015),Artificial Intelligence for Humans ,CreateSpace Independent Publishing.
5. Kevin Warwick(2011),Artificial Intelligence: The Basics ,Routledge.
6. Stuart Russell, Peter Norvig(2010),Artificial Intelligence: A Modern Approach,Prentice Hall

## OE Course - II: BAIT118: Applications of AI-I

**Course Objectives:** Students should be able to...

1. understand basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
2. study of applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
3. learn and Experience AI development tools such as an ‘AI language’, expert system shell, and/or data mining tool.
4. identify the current scope, potential, limitations, and implications of intelligent systems.

Credits (Total Credits 2)	SEMESTER – I OE Course – II BAIT118: Applications of AI-I	No. of hours per unit
<b>Unit - I</b>	<b>Introduction</b> Machine Learning, introduction to data, the terminology of AI, what makes an AI company, what machine learning can and cannot do, non-technical explanation of deep learning, basics of neural networks, Examples of AI, Application domains of AI.	<b>(08)</b>
<b>Unit – II</b>	<b>Building AI projects</b> Workflow of a machine learning project, Workflow of a data science project, how to use data, how to choose an AI project, working with an AI team, how to process and visualize data, technical tools for AI teams, use of python in AI related projects	<b>(08)</b>
<b>Unit – III</b>	<b>Building AI in Your Company</b> Case study: Smart speaker, Case study: Self-driving car, Example roles of an AI team, AI pitfalls to avoid, Survey of major AI application areas	<b>(08)</b>
<b>Unit - IV</b>	<b>AI and Society</b> A realistic view of AI, Discrimination / Bias, Adversarial attacks on AI, Adverse uses of AI, AI and developing economies, AI and jobs	<b>(06)</b>

**Course Outcomes:** Students will be able to...

1. recognize the basic concepts of AI and machine learning.
2. evaluate the working of self-driving systems.
3. construct how to build different AI projects.
4. apply AI techniques to any application domain.

**Reference Books:**

1. <https://www.coursera.org/learn/ai-for-everyone#syllabus>
2. Jeff Heaton(2015),Artificial Intelligence for Humans ,CreateSpace Independent Publishing.
3. Kevin Warwick(2011),Artificial Intelligence: The Basics ,Routledge.
4. Stuart Russell, Peter Norvig(2010),Artificial Intelligence: A Modern Approach,Prentice Hall

## OE Practical Course - I: BAIP119: Lab Course based on BAIT117 and BAIT118

**Course Objectives:** Students should be able to...

1. learn the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio- economic impact and issues.
2. understand virtual reality, augmented reality and using them to build Biomedical engineering applications
3. study the intricacies of these platform to develop PDA applications with better optimality.
4. identify skills for interfacing sensors and actuators with different IoT architectures.

Credits (Total Credits 2)	SEMESTER – I OE Practical Course - I BAIP119: Lab Course based on BAIT117 and BAIT118 List of Practical (15)	No. of hours per Practical
1	Study of basics of Artificial Intelligence	2
2	Study of Artificial Intelligence algorithms.	2
3	To develop a native calculator application.	2
4	To develop an application that makes use of database.	2
5	Write a program to demonstrate different number data types in Python.	
6	Write a program to perform different Arithmetic Operations on numbers in Python.	2
7	Write a program to create, concatenate and print a string and accessing sub-string from a given string.	2
8	Write a python script to print the current date in the following format “Sun May 29 02:26:23 IST 2017”	2
9	Write a program to create, append, and remove lists in python.	2
10	Write a program to demonstrate working with tuples in python.	2
11	Study and Install IDE of Arduino and different types of Arduinos	2
12	study and Implement Zigbee Protocol using Arduino / Raspberry Pi	2
13	Sense the Available Networks Using Arduino	2
14	Detect the Vibration of an Object Using Arduino	2
15	Connect with the Available Wi-Fi Using Arduino	2

**Course Outcomes:** Students will be able to...

1. describe different types of AI technologies and account for their evolution.
2. explain the role of AI in organizational value creation.
3. analyze & design a system or process to meet given specifications with realistic engineering constraints.
4. demonstrate the problem statements and function as a member of an engineering design team.

**Reference Books:**

1. <https://www.coursera.org/learn/ai-for-everyone#syllabus>
2. <https://www.edx.org/course/artificial-intelligence-for-everyone>
3. Jeff Heaton(2015),Artificial Intelligence for Humans ,CreateSpace Independent Publishing.
4. Kevin Warwick(2011),Artificial Intelligence: The Basics ,Routledge.
5. Stuart Russell, Peter Norvig(2010),Artificial Intelligence: A Modern Approach,Prentice Hall



**Semester – II**  
**OE Course - III: BAIT127: Applications of AI-II**

**Course Objectives:** Students should be able to...

1. learn the social, political, economic and environmental impact of an enterprise.
2. understand the need to develop ethical and responsible management practices.
3. study of practices for the development, and achievement, of personal career goals.
4. identify automation of both academic and administrative tasks, personalized learning, smart content, and all-time accessibility.

<b>Credits (Total Credits 2)</b>	<b>SEMESTER – II OE Course – III BAIT127: Applications of AI-II</b>	<b>No. of hours per unit/credits</b>
<b>Unit - I</b>	<b>AI and the Customer Journey</b> impact of AI in marketing, and how it affects how your customers interact with your organization and its offerings, how AI is disrupting retail and transforming the way that we conduct business in the digital age, risks and challenges that you might encounter when trying to implement AI, such as privacy issues, and how to make the journey from interest to purchase a much shorter one, how AI influences and also impact customer behavior, and how you can take advantage of the myriad of ways AI can be applied to support your business and align with your customers.	<b>(08)</b>
<b>Unit – II</b>	<b>Personalization</b> different ways that AI can be applied to enhance the consumer experience, deep dive into the realm of personalization algorithms, and how they are utilized in companies such as Pandora, Netflix, and Amazon, challenges that you can face when trying to implement these algorithms or recommendation systems, valuable insight into how AI can enable personalization and in turn drive customer engagement and retention.	<b>(08)</b>
<b>Unit – III</b>	<b>Finance</b> how to mitigate fraud using AI systems, By examining various machine learning methods, different ways to analyze risk assessment using KPIs and the scientific method, credit and the relationship between money borrowed, the price and availability of credit, as well corporate credit ratings and why and how that rating translates to risk. using models versus real-world data, and how you can use AI to conduct error analysis to prevent costly miscalculations, knowledge of different risk assessment methods, how data can be used to analyze and predict credit ratings, as well as the benefits and limitations of different applications used in the industry.	<b>(08)</b>
<b>Unit - IV</b>	<b>Additional AI Applications in Finance</b> How major global brands utilize AI to create a secure shopping environment for their customers and clients, and how AI is instrumental in the data-driven world of finance, risk management and assessment and how AI is playing a more integral role in combating digital fraud.	<b>(06)</b>

**Course Outcomes:** Students will be able to...

1. evaluate and apply a range of sector/role-specific models and concepts within a practice setting.
2. explore potential solutions to complex and ambiguous problems.
3. analyse the basis of an enterprise's value-creating activities and the impact of the external environment on value creation.
4. evaluate informed commentary on the increasing role of AI in business management and our lives.

**Reference Books:**

1. John Paul Mueller(2018),Artificial Intelligence For Dummies,For Dummies Latest Edition: 1st edition
2. Mariya Yao(2018),Applied Artificial Intelligence: A Handbook For Business Leaders, TOPBOTS Latest Edition: 1st edition.
3. Max Tegmark(2017),Being Human in the Age of Artificial Intelligence,Knopf Latest Edition: 1st edition
4. Stuart Russell (2010),Artificial Intelligence : A Modern Approach ,Pearson Latest Edition: 3rd edition

## OE Course - IV: BAIT128: Introduction to Machine Learning

**Course Objectives:** Students should be able to...

1. understand popular ML algorithms
2. study to use state of the art machine learning algorithms in formulating and solving new problems.
3. learn capability to train (or solve optimization problems) ML models with applications in real-world use cases.
4. identify the importance of core CS principles such as algorithmic thinking and systems design in ML

Credits (Total Credits 2)	SEMESTER – II OE Course – IV BAIT128: Introduction to Machine Learning	No. of hours per unit/credits
<b>Unit - I</b>	<b>Introduction to ML:</b> Motivation and role of machine learning in computer science and problem solving, Representation (features), linear transformations, appreciate linear transformations and matrix vector operations in the context of data and representation, Problem formulations (classification and regression), Appreciate the probability distributions in the context of data, Prior probabilities and Bayes Rule, Introduce paradigms of Learning (primarily supervised and unsupervised. Also, a brief overview of others).	<b>(08)</b>
<b>Unit – II</b>	<b>Fundamentals of ML:</b> PCA and Dimensionality Reduction, Nearest Neighbours and KNN, Linear Regression, Decision Tree Classifiers, Notion of Generalization and concern of Overfitting, Notion of Training, Validation and Testing; Connect to generalisation and overfitting.	<b>(08)</b>
<b>Unit – III</b>	<b>Algorithms</b> Assembling and RF ,Linear SVM, ,K Means, Logistic Regression, Naive Bayes	<b>(06)</b>
<b>Unit - IV</b>	<b>Neural Network Learning:</b> Role of Loss Functions and Optimization, Gradient Descent and Perceptron/Delta Learning, MLP, Backpropagation, MLP for Classification and Regression, Regularisation, Early Stopping, Introduction to Deep Learning, CNNs.	<b>(08)</b>

**Course Outcomes:** Students will be able to...

1. explore popular ML algorithms with their associated mathematical foundations for appreciating these algorithms.
2. analyse hands-on experience in applying ML to problems encountered in various domains.
3. construct the role of data in the future of computing, and also in solving real-world problems using machine learning algorithms.
4. solve and connect real-world problems to appropriate ML algorithm(s) for solving them. Enable formulating real world problems as machine learning tasks.

**Reference Books:**

1. Ameet V. Joshi(2019),Machine Learning and Artificial Intelligence, Springer, Cham.
2. Zsolt Nagy(2018),Artificial Intelligence and Machine Learning Fundamentals.
3. Andreas C. Müller, Sarah Guido (2016), Introduction to Machine Learning with Python ,First Edition Publisher – O'Reilly Media, Inc.
4. Machine Learning in Action, Peter Harrington(2012), April, Manning publications,.
5. Jiawei Han and Micheline Kamber(2012)Data Mining Concepts and Techniques, Elsevier Inc.

## OE Practical Course - II: BAIP129: Lab based on BAIT127 and BAIT128

**Course Objectives:** Students should be able to...

1. study the basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
2. learn applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
3. understand the basic theory underlying machine learning.
4. identify machine learning problems corresponding to different applications.

Credits (Total Credits 2)	SEMESTER – II OE Practical Course - II BAIP129: Lab based on BAIT127 and BAIT128 List of Practical (15)	No. of hours per Practical
1	Introduction of Artificial Intelligence and its application.	2
2	Understand the concept Depth First Search using Python.	2
3	Study of Breadth First Search using Python.	2
4	Study of the Tower of Hanoi using Python.	2
5	Write a Program to Implement Tic-Tac-Toe game using Python	2
6	Study of the search problem of 3 x 3 puzzle.	2
7	Machine Learning and its application-oriented algorithms.	2
8	Introduction to Machine Learning using Python and its libraries.	2
9	Installation of pandas and use of pip command.	2
10	Python program using NumPy for some basic mathematical operations	2
11	Study of KNN- classification algorithm using Python on IRIS dataset.	2
12	Python script using Scipy for image manipulation.	2
13	Python program using Theano for computing a Logistic Function.	2
14	Python program using TensorFlow for multiplying two arrays.	2
15	Python program using Pandas for arranging a given set of data into a table.	2

**Course Outcomes:** Students will be able to...

1. formulate the basic principles, techniques, and applications of Artificial Intelligence.
2. implement machine learning techniques and AI computing environment.
3. represent knowledge using AI knowledge representation techniques.
4. design machine learning solution to real life problems and solutions to uncertainty using Fuzzy theory.

### Reference Books:

1. Ameet V. Joshi, Springer, Cham (2019), Machine Learning and Artificial Intelligence.
2. Elaine Rich and Kelvin Knight(2002), Artificial Intelligence, Tata McGraw Hill.
3. Nils J Nilson(2000), Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers,Inc., San Francisco, California.
4. R. Akerkar(2005), Introduction to Artificial Intelligence, Prentice-Hall of India.

**Semester-I**  
**Indian Knowledge System**  
**(IKS)**  
**IKS101: History of Computers in India**

**Course Objectives: Student should be able to...**

- 1) understand design for a steam-powered, mechanical computer.
- 2) learn digital computing replaced analog methods.
- 3) study the evolution of indian programming languages
- 4) identify the story behind the modern computing

Credits=2	SEMESTER-I History of Computers in India	No. of hours per unit/ credits
<b>Unit I</b>	<b>Pre-Independence Era of Computers</b> Introduction: Computing in the Pre-industrial World, Establishment of the Tata Institute of Fundamental Research, Analog Computing in the 19th and early 20th, Introduction of electronic computers in India, Information Technology before 1945	7
<b>Unit II</b>	<b>Early Computing Initiatives</b> Development of the first indigenous electronic computer: HEC-2M, Role of F.C. Kohli in setting up the first computer manufacturing company in India, Computers and Culture in the 1960s, Early Computer Languages and Software	7
<b>Unit III</b>	<b>Era of Mainframes and Minicomputers</b> Introduction of mainframe and minicomputer technologies in India, Role of the Department of Electronics (DoE) in promoting computerization, Evolution of Indian programming languages (FORTRAN, COBOL)	8
<b>Unit IV</b>	<b>Modern Computing</b> Emergence of Indian IT companies and software exports, Role of NRIs in the growth of the Indian IT industry, Internet and Digital Revolution, Mobile computing and smartphone revolution in India, Artificial Intelligence (AI) and Machine Learning (ML) in Indian industries	8

**Course Outcomes: - Student will be able to ...**

- 1) design for a steam-powered, mechanical computer.
- 2) evaluate digital computing replaced analog methods.
- 3) gain the knowledge about evolution of Indian programming languages.
- 4) elaborate the story behind the modern computing.

**Reference Books:**

1. Martin Campbell-Kelly and William Aspray(2004),Computer: A History of the Information Machine
2. Fred Turner(2006), Counterculture to Cyberculture (University of Chicago Press)
3. Martin Campbell-Kelly(2003),Airline Reservations to Sonic the Hedgehog: A Historyof the Software Industry (MIT Press)
4. Janet Abbate(1999), Inventing the Internet, (MIT Press)

**Skill Enhancement Course (SEC)**  
**Semester – II**  
**SEC103: Paper - I: Linux Programming**

**Course Objectives: Students should be able to...**

1. learn principles of operating systems including File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking Commands,
2. study of inter process communication.
3. understand semaphore and shared memory.
4. identify the basic linux commands, scripts and filters.

Credits (Total Credits 1)	SEMESTER – II SEC Paper – I Linux Programming	No. of hours per unit(15)
<b>Unit - I</b>	<b>Introduction to Linux and Linux Utilities:</b> - brief history of LINUX, architecture of LINUX, features of LINUX, introduction to vi editor. Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin. Text Processing utilities and backup utilities , tail, head , sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, difl, tr, awk, cpio	<b>(08)</b>
<b>Unit – II</b>	<b>Introduction to Shells:</b> - Linux Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization. Pipe, process pipes, the pipe call, parent and child processes, and named pipes: fifos, semaphores: semget, semop, semctl, message queues: msgget, msgsnd, msgrev, msgctl, shared memory: shmget, shmat, shmdt, shmctl, ipc status commands.	<b>(07)</b>

**Course Outcomes: Students will be able to...**

1. use various Linux commands that are used to manipulate system operations at admin level.
2. create and write shell programming using linux commands.
3. design and write application to manipulate internal kernel level linux File System.
4. develop Network Programming that allows applications to make efficient use of resources available on different machines in a network.

**Reference Books:**

1. Daniel J. Barrett (2016), Linux Pocket Guide, 3rd edition, O'Reilly Media, 1005 Gravenstein Highway North, Sebastopol, CA 95472.
2. William Shotts (2019), The Linux Command Line, 2nd edition, No Starch Press publication.
3. Jason Cannon (2013), Linux for Beginners, 1st edition, Independently Published
4. Richard Blum (2015), Linux Command Line and Shell Scripting Bible, 3rd edition, Wiley.
5. Kung Fu, Jason Cannon (2014), An Introduction to the Linux Operating System and Command Line, 1st edition, Independently Published

**Semester-II**  
**SEC103 Practical Paper - I: Linux Programming**

**Course Objectives: Students should be able to...**

1. study the principles of operating system including File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking Commands.
2. understand Inter process communication.
3. identify semaphore and shared memory.
4. learn the basic Linux commands, Scripts and filters.

Credits (Credits=1)	SEMESTER – II SEC103 Practical Paper - I Linux Programming List of Practical's	No. of hours per Practical (15)
1	Write a Linux script to find the number of users who have logged in.	
2	Write a Linux script to see the current date, user name and current directory	
3	Write a Linux script to print the numbers 5,4,3,2,1 using While loop.	
4	Write a Linux script to set the attributes of a file.	
5	Write a Linux script to convert lowercase to uppercase using trutility.	
6	Write a Linux script to copy and rename a file.	
7	Write a Linux script to add 5 numbers and find the average.	
8	Write a Linux script to convert a decimal number to hexadecimal conversion.	
9	Write a Linux script to find the factorial of a number.	
10	Write a Linux script to check for palindrome.	

**Course Outcomes: Students will be able to...**

1. use various linux commands that are used to manipulate system operations at admin level.
2. create and write Shell Programming using Linux commands.
3. design and write application to manipulate internal kernel level Linux File System.
4. develop Network Programming that allows applications to make efficient use of resources available on different machines in a network.

**Reference Books:**

1. Daniel J. Barrett (2016), Linux Pocket Guide,3<sup>rd</sup> edition, O'Reilly Media, 1005 Gravenstein Highway North, Sebasto- pol, CA 95472.
2. William Shotts(2019),The Linux Command Line, 2<sup>nd</sup> edition,No Starch Press publication.
3. Jason Cannon(2013),Linux for Beginners,1<sup>st</sup> edition, Independently Published
4. Richard Blum (2015), Linux Command Line and Shell Scripting Bible, 3rd edition, Wiley.
5. Kung Fu, Jason Cannon (2014), An Introduction to the Linux Operating System and Command Line,1st edition, Independently Published.



**Semester-II**  
**Value Education Course**  
**VEC104: Course Title: Environmental Sociology**

**Course objectives: Students should be able to...**

1. have a sound conceptual, theoretical and empirical background to the issues of environment.
2. learn environmental issues in the indian context.
3. understand the concept of sustainable development and resource management.
4. identify opportunities for preparation of further research in the area.

Credits (2)	Theory Paper (VEC104)	No. of hours per unit
<b>Credit – Unit I:</b>	<b>Environment and Sociology</b>	<b>(6)</b>
	1.1 Introduction to Sociology and Environment 1.2 Environment in Classical Sociological Tradition 1.3 Sociology’s response to environmental issues	
<b>Credit – Unit II</b>	<b>Environmental Sociology in India</b>	<b>(8)</b>
	2.1 Environmental Sociology in India. 2.2 Environmentalism and Environmental Movement in India 2.3 Ideological Trends in Indian Environmentalism 2.4 Environmental movements in local perspective	
<b>Credit – Unit III</b>	<b>Environmental Sociology around the world</b>	<b>(8)</b>
	3.1 Environmentalism around the world: Past and Present 3.2 Contemporary Environmental Movements 3.3 Environmental Movements in Global Perspectives	
<b>Credit – Unit IV</b>	<b>Sustainable Development and Sociology</b>	<b>(8)</b>
	4.1 The Concept of Sustainability 4.2 Environment and Sustainable Development 4.3 Resource, Property and Resource Governance Regimes 4.4 Environmental Democracy and Climate Change	

**Course Outcomes: Students will be able to...**

1. explain the main concepts, theories, debates and empirical practices on the interaction between environment and society.
2. describe current theoretical and empirical debate on environmental movements and sustainable resource management practices.
3. evaluate policies and practices concerning environmental governance and sustainable development.
4. apply different theories and methodologies of research in different contexts relevant to environment and sustainable development.

## Reference Books:

1. Gould, Kenneth Alan and Tammy L Lewis(2009), Twenty Lessons in Environmental Sociology. New York: Oxford University Press.
2. Hanningan, John(2006), Environmental Sociology: A Social Constructionist Perspective. Oxan: Routledge.
3. Bell, Michael Mayerfeld(2004), An Invitation to Environmental Sociology. Thousand Oaks, California: Pine Forge Press.
4. Dunlap, R.; Frederick H. Buttel, Peter Dickens and August Gijswijt. (Ed.)(2002), Sociological Theory and the Environment: Classical Foundations, Contemporary Insights. Boston: Rowman& Littlefield.
5. Hanningan, John(1996), Environmental Sociology. Oxan: Routledge.
6. Barry, John(1999), Environment and Social Theory. Oxan: Routledge.