



Bachelor of Computer Applications

(Artificial Intelligence & Machine Learning)

Session: 2025-26

Faculty of Computing

Graduate Attributes of the Programme:

Type of learning outcomes	The Learning Outcomes Descriptors
Graduates should be able to demonstrate the acquisition of:	
Learning outcomes that are specific to disciplinary/in terdisciplinary areas of learning	Apply foundational computer science knowledge for developing computational solutions.
	Design and implement AI and ML algorithms to solve domain-specific problems.
	Utilize mathematical and statistical techniques in AI model building and evaluation.
	Integrate AI/ML methods in real-world applications like NLP, computer vision, and robotics.
Generic learning outcomes	Communicate effectively in technical and non-technical contexts using oral and written forms.
	Work collaboratively in teams and demonstrate leadership and responsibility in project settings.
	Apply critical thinking and analytical reasoning to real-life computing challenges.

Programme Learning outcomes: An Undergraduate Certificate is awarded to students who have demonstrated the achievement of the outcomes located at level 5.5:

Program Specific Outcomes	Element of the Descriptor	Programme learning outcomes relating to Undergraduate Certificate
The graduates should be able to demonstrate the acquisition of:		
PSO1	Knowledge and understanding	Develop foundational knowledge in programming, computer systems, and mathematics.
		Gain introductory knowledge in web technologies and management principles.
		Understand human values and professional ethics.
		Develop an awareness of the latest trends and emerging technologies
PSO2	General, technical and professional skills required to perform and accomplish tasks	Acquire practical skills in programming, computer operations, and system troubleshooting.
		Develop technical skills in assembling, troubleshooting, and basic internet-based applications.
		Demonstrate effective communication and collaboration skills to work efficiently in team environments and multidisciplinary projects.
PSO3	Application of knowledge and skills	Apply knowledge to solve computational problems and implement concepts in practical environments.Utilize web and technical skills to address basic business and IT-related scenarios.
PSO4	Generic learning outcomes	Strengthen problem-solving abilities, logical thinking, and analytical skills.Enhance communication and interpersonal skills.

PSO5	Constitutional, humanistic, ethical, and moral values	Learn the importance of ethical conduct and values in personal and professional spheres.
PSO6	Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Develop entry-level technical and entrepreneurial skills applicable to IT and management roles.

Semester 1st									
Course Code	Course Title	Type of Course							
			L	T	P	Credits	Int	Ext	Total Marks
BCA1100	Programming in C	Core	3	0	0	3	30	70	100
BCA1101	Computer Fundamentals	Core	3	0	0	3	30	70	100
BCA1102	Fundamentals of Math	Core	4	0	0	4	30	70	100
BCA1103	Programming in C Lab	Core	0	0	2	1	30	70	100
BCA1104	Computer Fundamentals Lab	Core	0	0	2	1	30	70	100
BCA1105	Introduction to Web Technologies - I	Vocational	0	0	4	2	30	70	100
BCA1106	PC Assembling and Trouble Shooting	Skill Enhancement Course	0	0	6	3	30	70	100
BCA1107	Principles and Practice of Management	Multidisciplinary Course	3	0	0	3	30	70	100
VAC0002	Human Values & Professional Ethics	Value Added Course	2	0	0	2	30	70	100
BCA1108	Communication Skills - I	Ability Enhancement Course	2	0	0	2	30	70	100
Total			17	0	14	24	300	700	1000

Semester 2nd									
Course Code	Course Title	Course Type							
			L	T	P	Credits	Int	Ext	Total Marks
BCA2150	Programming Using C++	Core	3	0	0	3	30	70	100
BCA2151	Operating System	Core	3	0	0	3	30	70	100
BCA2152	Discrete Structures	Core	4	0	0	4	30	70	100
BCA2153	Programming using C++ Lab	Core	0	0	2	1	30	70	100
BCA2154	Operating System Lab	Core	0	0	2	1	30	70	100
BCA2155	Introduction to Web technologies - II	Vocational	0	0	4	2	30	70	100
BCA2156	Multilingual Typing and Stenography	Skill Enhancement Course	0	0	6	3	30	70	100
BCA2157	Human Resource Management	Multidisciplinary	3	0	0	3	30	70	100
VAC0001	Environment Education	Value Added Course	2	0	0	2	30	70	100
BCA2158	Communication Skills - II	Ability Enhancement Course	2	0	0	2	30	70	100
Total			17	0	14	24	300	700	1000

Programme learning outcomes: An Undergraduate Diploma is awarded to students who have demonstrated the achievement of the outcomes located at level 5.5:

Program Specific Outcomes	Element of the D descriptor	Programme learning outcomes relating to Undergraduate Certificate
The graduates should be able to demonstrate the acquisition of:		
PSO1	Knowledge and Understanding	Demonstrate understanding of fundamental concepts in Artificial Intelligence, Machine Learning, Data Structures, Computer Graphics, and Database Management Systems.
		Acquire knowledge of programming languages such as Python and Java, and apply them in AI/ML contexts.
		Understand the principles of E-Commerce, Digital Electronics, Computer Architecture, and Data Science.
		Gain insight into the applications of AI and data science across domains like healthcare, business, and automation.
PSO2	General, technical and professional skills required to perform and accomplish tasks	Write and debug programs using Python and Java to implement AI/ML and data structure solutions.
		Design, test, and execute machine learning models using real-world datasets.
		Create graphical applications using computer graphics tools and libraries.
PSO3	Application of knowledge and skills	Develop intelligent systems and visual simulations using acquired programming and graphical skills.
PSO4	Generic learning Outcomes	Analyze and interpret data using tools and libraries in data science.

PSO5	Constitutional, humanistic, ethical, and moral values	Recognize ethical concerns in data usage, AI decision-making, and privacy in computing.
PSO6	Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Acquire technical and analytical skills for roles such as AI Developer, Data Analyst, and Software Engineer.

Semester 3 rd									
Course Code	Course Title	Course Type							
			L	T	P	Credits	INT	EXT	Total Marks
BCA3200	Data Structure	Major Core Course	3	0	0	3	30	70	100
BCA3203	Data Structure Lab	Major Core Course	0	0	2	1	30	70	100
BCA3210	Introduction to Artificial Intelligence	Major Core Course	4	0	0	4	30	70	100
BCA3211	Python Programming	Major Core Course	3	0	0	3	30	70	100
BCA3214	Python Programming Lab	Major Core Course	0	0	2	1	30	70	100
BCA3212	Computer Graphics	Vocational	2	0	0	2	30	70	100
BCA3213	Computer Graphics Lab	Vocational	0	0	4	2	30	70	100
BCA3215	E-Commerce (MOOC)	Multidisciplinary Course	3	0	0	3	30	70	100
BCA3216	Soft Skills Development	Ability Enhancement Course	2	0	0	2	30	70	100
Discipline Elective-I(Select any one)									
BCA3217	Disaster Risk Reduction and Management: Skills for Safety and Resilience	Skill Enhancement Course	2	0	2	3	30	70	100
BCA3218	Basics of Cyber Security		3	0	0	3			
Total			20	0	10	24	300	700	1000

Semester 4th									
Course Code	Course Title	Course Type							
			L	T	P	Credits	INT	EXT	Total Marks
BCA4251	Programming using Java	Major Core Course	3	0	0	3	30	70	100
BCA4253	Programming using Java Lab	Major Core Course	0	0	2	1	30	70	100
BCA4260	Machine Learning	Major Core Course	3	0	0	3	30	70	100
BCA4261	Machine Learning Lab	Major Core Course	0	0	2	1	30	70	100
BCA4262	Relational Data Base Management System	Major Core Course	3	0	0	3	30	70	100
BCA4263	Relational Data Base Management System Lab	Major Core Course	0	0	2	1	30	70	100
BCA4264	Fundamentals of Data Science	Vocational	2	0	0	2	30	70	100
BCA4265	Fundamentals of Data Science Lab	Vocational	0	0	4	2	30	70	100
IKS0006	Indian Health Sciences	Value Added Course	2	0	0	2	30	70	100
Discipline Elective II (Select any one)									
BCA4266	Digital Electronics	Discipline Elective I	4	0	0	4	30	70	100
BCA4267	Computer System Architecture								
Total			17	0	10	22	300	700	1000

Programme learning outcomes: The Bachelor's degree is awarded to students who have demonstrated the achievement of the outcomes located at level 5.5

Program Specific Outcomes	Element of the Descriptor	Programme learning outcomes relating to Undergraduate Certificate
The graduates should be able to demonstrate the acquisition of:		
PSO1	Knowledge and understanding	Understand core concepts of Artificial Intelligence, Natural Language Processing, Neural Networks, and Software Engineering.
		Gain familiarity with multimedia systems, social media analytics, and software project management principles.
		Develop theoretical knowledge of Big Data technologies and Data Visualization techniques.
		Understand mathematical foundations including probability and statistics critical to machine learning and AI models.
PSO2	General, technical and professional skills required to perform and accomplish tasks	Build and evaluate NLP applications such as text classification, sentiment analysis, and chatbots. Design and simulate neural network models using appropriate tools and frameworks.
		Design and simulate neural network models using appropriate tools and frameworks.
		Apply data visualization tools to interpret and present data insights effectively.
PSO3	Application of knowledge and skills	Solve real-world challenges using AI, neural networks, and big data analytics.
PSO4	Generic learning outcomes	Demonstrate critical thinking in identifying, analyzing, and solving technical problems.
PSO5	Constitutional, humanistic, ethical, and	Apply ethical standards in AI applications, especially in areas involving privacy, bias, and

	moral values	misinformation.
PSO6	Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Demonstrate technical proficiency for careers in NLP, AI development, data science, and software project management.

Semester 5 th									
Course Code	Course Title	Course Type							
			L	T	P	Credits	INT	EXT	Total Marks
BCA5308	Natural Language Processing	Major Core Course	3	0	0	3	30	70	100
BCA5309	Natural Language Processing Lab	Major Core Course	0	0	2	1	30	70	100
BCA5310	Software Engineering	Major Core Course	4	0	0	4	30	70	100
BCA5311	Minor Project	MIN	0	0	4	2	30	70	100
BCA5312	Data Visualization	Vocational	2	0	0	2	30	70	100
BCA5313	Data Visualization Lab	Vocational	0	0	4	2	30	70	100
BCA5304	Internship	Skill Based	0	0	0	4	30	70	100
Discipline Elective II (Select any one)									
BCA5314	Social Media Analytics	Discipline Elective II	4	0	0	4	30	70	100
BCA5315	Probability and Statistics								
Total			13	0	10	22	240	560	800

Semester 6 th									
Course Code	Course Title	Course Type							
			L	T	P	Credits	INT	EXT	Total Marks
BCA6360	Artificial Intelligence	Major Core Course	3	0	0	3	30	70	100
BCA6361	Neural Networks	Major Core Course	3	0	0	3	30	70	100
BCA6362	Artificial Intelligence Lab	Major Core Course	0	0	2	1	30	70	100
BCA6363	Neural Networks Lab	Major Core Course	0	0	2	1	30	70	100
BCA6364	Multimedia & its Applications	Vocational	2	0	0	2	30	70	100
BCA6365	Multimedia & its Applications Lab	Vocational	0	0	4	2	30	70	100
BCA6354	Major Project	MIN	0	0	8	4	30	70	100
IKS0002	Indian Education	Value Added Course	2	0	0	2	30	70	100
Discipline Elective III (Select any one)									
BCA6366	Big Data	Discipline Elective III	4	0	0	4	30	70	100
BCA6367	Software Project Management								
Total			14	0	16	22	270	630	900
Grand Total			97	0	76	136	1710	3990	5700

Semester – I

Course Title: Programming in C	L	T	P	Cr.
Course Code: BCA1100	3	0	0	3

Total Hours: 45**Course Learning Outcomes:** After completion of this course, the learner will be able to:

- CO1. Develop confidence for self-education and ability for life-long learning needed for Computer language.
- CO2. Handle possible errors during program execution.
- CO3. Build logic used in Programming.
- CO4. Design and develop Computer programs, analyses, and interprets the concept of pointers, declarations, initialization, operations on pointers and their usage.

Course Content**Unit I****10 hours**

Basics of 'C' Language: History, Structure of a C program, Data types, Constants and variables, Operators and Expressions, I/O functions: Formatted & Unformatted Input/Output.

Control constructs: If, If-else, nested if-else, else-if ladder, switch, goto, for, while, do... while, jumps in loops: break and continue.

Unit II**15 hours**

Preprocessor: #define, #include, #undef, #conditional compilation directives (#if, #else, #elif, #endif, #ifdef and #ifndef), Storage classes, Header files (stdio.h, ctype.h, string.h, math.h, stdlib.h, time.h); Type casting, Type conversion, Scope Rules: Local and Global variables. Functions: library functions, user defined functions, scope rule of functions, Parameter passing: call by value and call by reference, calling functions with Arrays, Recursion: Basic concepts, Design examples (Tower of Hanoi).

Unit III**10 hours**

Arrays: Creating and using one dimensional and two-dimensional arrays Strings: Introduction to strings, declaring and initializing string variables, reading and writing strings, string handling functions.

Pointers: & and * operators, Declaring and initializing pointers, Pointer expression, Pointer assignments, Pointer arithmetic. The dynamic memory allocation functions – malloc and

calloc, Pointer vs Arrays, Passing Array to functions, Arrays of pointers, and Functions with variable number of arguments.

Unit IV

10 hours

Structures: Basics of Structures, declaring a structure, referencing structure elements, Array of structures, passing structures to functions. Unions: Declaration, Uses; Enumerated data types.

File Handling: Introduction, creating a data file, opening and closing a data file, file Pointers, file accessing functions (fopen, fclose, putc, getc, fprintf); argc and argv; File opening modes: Text mode, Binary mode.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning. Interactive lectures.

Suggested Reading:

- Balaguruswami, *Programming with C Language*, Tata McGraw Hill, New Delhi
- Schaum Series, *Programming in C*, McGraw Hills Publishers, New York.
- Salaria, R. S., *Application Programming in C*, Khanna Book Publishing. New Delhi.
- Yashavant P. Kanetkar, *Let us C*, BPB Publications, New Delhi.
- Salaria, R.S. : *Test Your Skills in C*, Salaria Publications, New Delhi.
- Byron S. Gottfried, *Programming in C*, McGraw Hills Publishers, New York.
- M.T. Somashekara, *Programming in C*, Prentice Hall of India.

WebSources

- <https://hamrocsit.com/note/c-program/problem-solving-computer/>
- [https://learnprogramo.com/problem-solving-through-programming-in-c- 1/](https://learnprogramo.com/problem-solving-through-programming-in-c-1/)
- <https://www.includehelp.com/c-programming-examples-solved-c-programs.aspx>
- <https://www.studocu.com/in/document/bengaluru-north-university/bca/problem-solving-techniques-using-c/16264070>

Course Title: Computer Fundamentals	L	T	P	Cr.
Course Code: BCA1101	3	0	0	3

Total Hours:45

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Classify binary, hexadecimal and octal number systems and their arithmetic operations.
- CO2. Analyze the concept of computer devices and the recognition of the basic terms used in computer programming.
- CO3. Identify and learn the details of the components of a personal computer system.
- CO4. Demonstrate the functions of computer programming languages.

Course Content

UNIT I

10 Hours

Computer Fundamentals: Block diagram of a computer, characteristics of computers, and generations of computers.

Number System: Non-positional and positional number systems, Base conversion, Concept of Bit and Byte, binary, decimal, hexadecimal, and octal systems, conversion from one system to another. Binary Arithmetic: Addition, subtraction, and multiplication

UNIT II

10 hours

Input Devices: Keyboard, Mouse, Joy Stick, Track Ball, Touch Screen, Light Pen, Digitizer, Scanners, Speech Recognition Devices, Optical Recognition devices – OMR, OBR, OCR

Output Devices: Monitors, Impact Printers - Dot matrix, Character and Line printer, Non-Impact Printers – Desk Jet and Laser printers, Plotter.

UNIT III

15 hours

Memories: Memory Hierarchy, Primary Memory – RAM, ROM, Cache memory. Secondary Storage Devices - Hard Disk, Compact Disk, DVD, Flash memory.

Software: Types of Software- System Software, Application Software, Firmware. Type of System Software: Operating Systems, Language Translators

UNIT IV

10 hours

Computer Languages: Machine language, assembly language, high-level language, 4GL.

Internet Related Concepts: Internet, World Wide Web, Hypertext, Uniform Resource Locatr, Web Browsers, IP Address, Domain Name, Internet Security, Web Search Engine.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning. Interactive lectures

Suggested Readings

Sinha P.K. and Sinha P. (2002). Foundations of Computing, First Edition, BPB.

Sanders D.H. (1988). Computers Today, Fourth Edition, McGraw Hill.

Rajaraman V. (1996). Fundamentals of Computers, Second Edition, Prentice Hall of India, New Delhi.

Jain Satish (1999). Information Technology, Paperback Edition, BPB.

Web Sources

<https://byjus.com/govt-exams/computer-fundamentals/>

<https://www.chtips.com/computer-fundamentals/what-is-computer-fundamentals/>

https://www.tutorialspoint.com/computer_fundamentals/index.htm

Course Title: Fundamentals of Math	L	T	P	Cr.
Course Code: BCA1102	4	0	0	4

Total Hours:60

Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Have a clear understanding of mathematical functions.
- CO2. Develop an in-depth knowledge of mathematical theories.
- CO3. Develop skills to get employment IT and Analysis field.
- CO4. Solve first order linear and non-linear differential equation and linear differential equations of higher order using various techniques.

Course Content

UNIT I

15 hours

Set Theory: Introduction, Sets and Elements, Subsets, Venn Diagrams, Set Operations, Algebra of Sets, Duality, Finite Sets, Counting Principle.

UNIT II

15 hours

Relations: Types of relations: reflexive, symmetric, transitive, and equivalence relations.
Functions: One-to-one and onto functions.

UNIT III

15 hours

Matrices: Types of Matrices (Row, column, square, rectangular, identity, zero, diagonal etc), addition, subtraction, multiplication, transpose of a matrix. Symmetric matrix and skew-symmetric matrix, minors and cofactors.

UNIT IV

15 hours

Determinants: Definition and notation of determinants, Expansion of determinants (2x2,3x3), Determinant of the identity matrix and triangular matrix.

Transactional Mode

Lecture Method, E-Team Teaching, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, and Collaborative Learning.

Suggested Readings

- *Mathematics for Class 12" by NCERT*
- *Epp, S. S. (2010). Discrete mathematics with applications. Cengage learning.*
- *Biggs, N. L. (2002). Discrete mathematics. Oxford University Press*
- *Ross, K. A., & Wright, C. R. (1985). Discrete Mathematics. Prentice-Hall, Inc.*

Course Title: Programming in C Lab	L	T	P	Cr.
Course Code: BCA1103	0	0	2	1

Total Hours: 30

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Identify the difference between the top-down and bottom-up approach.
- CO2. Develop a given program using the basic elements like control statements.
- CO3. Implement the Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor.
- CO4. Analyze an algorithmic solution for a given problem.

Course Content

1. Write a program to display your name.
2. Write another program to print a message with an inputted name.
3. Write a program to add two numbers.
4. Write a program to find the square of a given number
5. Write a program to calculate the average of three real numbers.
6. Write a program to find ascii value of a character
7. Write a program to find the size of int, float, double and char
8. Write a program to compute quotient and remainder
9. Write a program to accept the values of two variables.
10. Write a program using various unformatted input functions
11. Write a program to find area of rectangle and print the result using unformatted output functions
12. Write a program to find the larger of two numbers.
13. Write a program to find greater of three numbers using nested if.
14. Write a program to find whether the given number is even or odd.
15. Write a program to generate multiplication table using for loop

16. Write a program to generate multiplication table using while loop
17. Write a program to make a simple calculator using switch...case
18. Write a program to find whether the given number is a prime number.
19. Write a program using function to find the largest of three numbers
20. Write a program using a function to print the first 20 numbers and its squares.
21. Write a program to find the factorial of a given number.
22. Write a program to print the sum of two matrices
23. Write a program to find the length of a string
24. Write a program to copy string using strcpy()
25. Write a program to compare a string
26. Write a program to reverse a string
27. Write a program to check whether entered string is palindrome or not.
28. Write a program to check whether entered number is Armstrong or not.
29. Write a program to check prime numbers from a user entered range.
30. Write a program to multiply two numbers using pointers.
31. Write a program to display address of variable using pointers
32. Write a program to show the memory occupied by structure and union.
33. Write a program to create student i-card using a structure
34. Write a program to read data from a file from a file
35. Write a program to save employee details in a file using file handling

Course Title: Computer Fundamentals Lab	L	T	P	Cr.
Course Code:BCA1104	0	0	2	1

Total Hours: 30

Course Learning Outcomes: After the completion of the course the learner will be able to
Compose, format and edit a word document.

- CO1. Edit and forward email messages (with or without attachments).
- CO2. Utilize the MS PowerPoint with custom animation and slide orientation.
- CO3. Perform coding in different programs with practical knowledge.

Course Content

Experiment 1:Operating System Basics

- Booting and shutting down the computer.
- Exploring the desktop, taskbar, start menu, and control panel.

Experiment 2:File and Folder Management

- Creating, renaming, moving, copying, and deleting files and folders.
- Using USB drives and external media.

Experiment 3:Text Editing Using Notepad/WordPad

- Basic text editing: cut, copy, paste, and format text.

Experiment 4: Word Processing using Microsoft Word

- Creating, formatting, saving, and printing documents.
- Using tables, headers, footers, and templates.

Experiment 5:Spreadsheets using Microsoft Excel

- Creating and formatting spreadsheets.
- Using basic formulas and functions (SUM, AVERAGE).
- Creating simple charts and graphs.

Experiment 6: Presentation using Microsoft PowerPoint

- Create engaging presentations in Microsoft PowerPoint.
- Experiment with different slide layouts and designs.
- Add transitions and animations to enhance the presentation.
- Insert multimedia elements like images, videos, and audio.
- Practice presenting using the built-in Presenter View.

Course Title: Introduction to Web Technologies I	L	T	P	Cr.
Course Code: BCA1105	0	0	4	2

Total Hours:60

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Describe the Internet, its architecture, services and protocol.
- CO2. Implement a simple search engine.
- CO3. Implement a web crawler.
- CO4. Use JavaScript technologies to make a website highly responsive,
- CO5. more efficient and user friendly

Course Contents

1. Create simple Forms in HTML5 and demonstrate the use of various form elements like input box, text area, submit and radio buttons etc.
2. Demonstrate the use of Links, Lists and Tables in HTML5. You should be able to link separate pages and create named links within a document, using them to build a “table of contents”.
3. Demonstrate the use of cascading style sheets (CSS) (inline, internal and external) to specify various aspects of style, such as colours and text fonts and sizes, in HTML5 document.
4. Create an html file to implement the concept of document object model, different operations and event handling using JavaScript.
5. Demonstrate the use of various selectors, filters and event handling in jQuery.
6. Demonstrate the use of AJAX to retrieve and manipulate the web page content.
7. Demonstrate the use of GET and POST methods of AJAX.
8. Setup of development server like Xampp in windows. . Create database and tables in My SQL.
9. Create a web page to show use of all data types in PHP.
10. Fetch and display data from My SQL table in a web page using PHP
11. Implement Regular Expression, Array, Math, Date functions in PHP.
12. Handling database queries with PHP & MYSQL.

13. Working with files using PHP.
14. Write a program to manage the sessions & cookies using PHP.
15. Write an angular jsprogram which displays your name, college name and age.

CourseTitle:PC Assembly & Troubleshooting	L	T	P	Cr.
CourseCode:BCA1106	1	0	6	3

Total Hours:90

Course Learning Outcomes:After completion of this course, the learner will be able to:

- CO1. Knowledge about the motherboard, bios and storage device features and its functions.
- CO2. Install OS (Linux/windows) on their systems.
- CO3. Get knowledge about ports and wires.
- CO4. Install system and software applications.
- CO5. Get knowledge about Create disk partitioning.

Course Content

1. Introduction of Hardware and Software/components of computer.
2. Mother boards, Chipsets & Microprocessor concept & latest available in market.
3. Basics &Types of Floppy drive/HDD/DVD/RAM /SMPS//BIOS.
4. Assembling of different parts of computers.
5. Knowing ports, wires attached in the Computer.
6. Installation of OS(Linux/Windows).
7. Installation of application and utility software.
8. Networking Basics: Different types of Topologies and their configuration.
9. Types of Switches, I/O Sockets.
10. Creation of Cross Wires and Direct Cables.
11. IP &Setting up a computer on LAN.

CourseTitle: Principles and Practices of Management	L	T	P	Cr.
CourseCode:BCA1107	3	0	0	3

Total Hours:45

Course Learning Outcomes:After completion of this course, the learner will be able to:

- CO1. Understand the fundamental principles and functions of management in organizational contexts.
- CO2. Apply management practices to plan, organize, lead, and control effectively.
- CO3. Analyze real-world business scenarios to develop problem-solving and decision-making skills.
- CO4. Demonstrate the ability to manage resources and foster teamwork for achieving organizational goals.

Course Content

Unit -I

Hours 10

Forms of Business Organizations and Ownership: Sole Proprietorship, Partnership, Joint Stock Company, Public & Private undertakings, Government Companies. Management: Meaning & Definition of Management, Nature, Scope and its various functions. Evolution of management thoughts: classical and new classical systems, contingency approaches, Scientific management.

Unit – II

Hours 15

Planning: nature, purpose and functions, types of plan, Management by Objective (MBO), steps in planning. Decision Making: Meaning, Steps in Decision Making, Techniques of Decision Making. Strategic planning – concepts, process, importance and limitations; Growth strategies- Internal and external.

Unit – III

Hours 10

Organizing: Concept, formal and informal organizations, task force, bases of departmentation, different forms of organizational structures, avoiding organizational inflexibility. Teamwork – meaning, types and stages of team building. Concept of staffing– Recruitment and Selection.

Motivation – concept, importance and theories.

Unit- IV

Hours 10

Authority: definition, types, responsibility and accountability, delegation, decentralization v/s centralization, determinants of effective decentralization. Line and staff authority.

Control: function, process and types of control, nature, process, significance and span of control. Direct control v/s preventive control. Trends and challenges of management in global scenario, emerging issues in management: Introduction to Total Quality Management (TQM), Just in Time (JIT).

Transactional Mode

Lecture Method, E-Team Teaching, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, and Collaborative Learning.

Suggested Readings:

- *Principles and practices of management: L. M. PRASAD (S. Chand publishers)*
- *Essentials of Management: Koontz H. & Weihrich H. (Tata Mc Graw Hill Publishers)*
- *Management: Stephen Robbins (Pearson publishers)*
- *VSP Rao & V H Krishna, Management, Excel books*

Course Title: Human Values and Professional Ethics	L	T	P	Cr.
Course Code: VAC0002	2	0	0	2

Total Hours:30

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Develop an understanding of core human values and their role in decision-making.
- CO2. Demonstrate ethical behavior in personal and professional environments.
- CO3. Analyze the impact of ethical practices on societal and organizational well-being.
- CO4. Cultivate a responsible attitude towards sustainability and social justice.

Course Content

UNIT-1

Hours 7

Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration-what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT-2

Hours 8

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

UNIT-3

Hours 8

Understanding harmony in the Family- the basic unit of human interaction , Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding

the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!.

UNIT-4

Hours 7

Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

Transactional Mode

Lecture Method, E-Team Teaching, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, and Collaborative Learning.

Suggested Reading:

- R R Gaur, R Sangal, G P Bagaria, 2009, *A Foundation Course in Human Values and Professional Ethics*.
- Ivan Illich, 1974, *Energy & Equity*, The Trinity Press, Worcester, and Harper Collins, USA
- E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
- Susan George, 1976, *How the Other Half Dies*, Penguin Press. Reprinted 1986, 1991
- Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *Limits to Growth – Club of Rome's report*, Universe Books.
- A Nagraj, 1998, *Jeevan Vidya Ek Parichay*, Divya Path Sansthan, Amarkantak.
- P L Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Publishers.
- A N Tripathy, 2003, *Human Values*, New Age International Publishers.
- Subhas Palekar, 2000, *How to practice Natural Farming*, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
- E G Seebauer & Robert L. Berry, 2000, *Fundamentals of Ethics for Scientists &*

Engineers , Oxford University Press

- *M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.*
- *B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.*
- *B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.*

Course Title: Communication Skills I	L	T	P	Cr.
Course Code: BCA1108	2	0	0	2

Total Hours:30

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Formulate an outline for effective Organizational Communication.
- CO2. Summarize the information, ideas, concepts and opinions from a variety of sources.
- CO3. Attain the competence in oral, written, and visual communication.
- CO4. Learn the correct practices about the strategies of Effective Business writing.

Course Content

UNIT-I

07hours

Communication: Objectives & Process of Communication, Essential components of the Process of Communication, Importance and Objectives of Communication. Differences between general and technical communication. Types of Communication (Extra-personal, Intrapersonal, Interpersonal, Organizational & Mass communications).

UNIT-II

08hours

Basic Grammar: Parts of Speech, Articles, Tenses, Active\ passive voice, Auxiliaries and modals.

UNIT-III

08hours

Verbal & Non-verbal Communication: Listening, Speaking, Reading and Writing. Verbal and Non-verbal Communication.

Overcoming Communication Barriers: Identifying common communication barriers, Strategies for overcoming barriers

UNIT-IV

07hours

Listening Skills: Active Listening, Importance of active listening, Giving and receiving feedback.

TransactionalMode

Lecture Method, E-Team Teaching, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, and Collaborative Learning.

Suggested Reading:

- *English Online, Mohanraj & Mohanrah, Orient Longman.*
- *The Good Grammar Book Swan M & Catherine Walter, Oxford.*
- *English Grammar Composition and Effective Business Communication, Pink and Thomas, S Chand.*
- *Business Communication, Meenakshi Raman & Sangeeta Sharma, Oxford.*
- *Oxford Business English Dictionary, Oxford.*
- *Technical Communication: Principles and Practice, Meenakshi Raman & Sangeeta Sharma, Oxford.*
- *Developing Communication Skills, Krishna Mohan & Meera Benarji, MacMilan Pub.*
- *Personality development and soft skill, Baran Mitra, Oxford.*

SEMESTER II

Course Title: Programming using C++	L	T	P	Cr.
Course Code: BCA2150	3	0	0	3

Total Hours:45

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Discuss about the programming techniques to solve problems or errors in the C++ programming language.
- CO2. Attain the conceptual knowledge of array and string.
- CO3. Describe the constructor and class member function.
- CO4. Analyze the inheritance with the understanding of early binding and late binding.

Course Content**UNIT I****10 hours**

Evolution of OOP: Procedure Oriented Programming. OOP Paradigm. Advantages and disadvantages of OOP over its predecessor paradigms.

Characteristics of Object-Oriented Programming: Abstraction, Encapsulation. Data hiding, Inheritance. Polymorphism, code Extensibility, and Reusability.

C++ Basics: Tokens, keywords, Identifiers, data types, constants, operators in C++, I/O streams, Control structures.

UNIT II**10 hours**

Functions in C++: Prototyping, Definition and Call, Scope Rules, Parameter Passing Value, by address and by reference, inline functions, function overloading, and Friend functions.

Arrays and Strings: creating and manipulating arrays within a class, arrays of objects, creating and manipulating String Objects, and Accessing Characters in strings.

UNIT III**10 hours**

Classes and Objects: Classes, Objects, and Members: Class Declaration and Class Definition, defining member functions, Defining Objects, making functions inline, Member Access Control, Nested Classes, This Pointer.

Constructors: Properties, types of constructors (Default, parameterized, and copy). Dynamic constructors, Multiple constructors in classes.

Destructors: Properties, Virtual destructors, Destroying objects. Rules for constructors and destructors.

Dynamic memory allocation using new and delete operators.

UNIT IV

15 hours

Inheritance: Defining derived classes, inheriting private members, single inheritance, types of derivation, and constructors in derived classes.

Types of inheritance: Single, Multiple, Multi-level, and Hybrid.

Types of base classes: Direct, Indirect, Virtual, Abstract, and Code Reusability.

Polymorphism: Methods of achieving polymorphic behavior, virtual functions, late binding, pure virtual functions, and abstract base classes, Operator overloading. Difference between function overloading and overriding. Open/ Close Files commands. Read/write operations on files.

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Balagurusamy, E., Balagurusamy, E., & Balagurusamy, E. (2001). *Object oriented programming with C++*. Tata McGraw-Hill Publishing Company.
- Pohl, I. (1993). *Object-oriented programming using C++*. Benjamin-Cummings Publishing Co., Inc.
- Dewhurst, S. C., & Stark, K. T. (1989). *Programming in C++*. Prentice- Hall, Inc.
- Lafore, R. (1997). *Object-oriented programming in C++*. Pearson Education.

Course Title: Operating Systems	L	T	P	Cr
Course Code: BCA2151	3	0	0	3

Total Hours: 45

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Describe the fundamental concepts of Operating System.
- CO2. Solve the various types of Scheduling Algorithms for better utilization of external memory.
- CO3. Attain the knowledge about deadlock detection algorithms.
- CO4. Demonstrate the components and aspects of concurrency management.

Course Content

UNIT I

10 hours

Fundamentals of Operating system: Introduction to Operating system, Functions of an operating system. Operating system as a resource manager. Structure of operating system (Role of kernel and Shell). Views of the operating system. Evolution and types of operating systems.

Process & Thread Management: Program vs. Process; PCB, State transition diagram, Scheduling Queues, Types of schedulers, Concept of Thread, Benefits, Types of threads, Process synchronization.

CPU Scheduling: Need of CPU scheduling, CPU I/O Burst Cycle, Preemptive vs. Non-preemptive scheduling, Different scheduling criteria, scheduling algorithms (FCFS, SJF, Round-Robin, Multilevel Queue).

UNIT II

15 hours

Memory Management: Introduction, address binding, relocation, loading, linking, memory sharing and protection; Paging and segmentation; Virtual memory: basic concepts of demand paging, page replacement algorithms.

UNIT III

10 hours

I/O Device Management: I/O devices and controllers, device drivers; disk storage. File Management: Basic concepts, file operations, access methods, directory structures and management, remote file systems; file protection.

UNIT IV

10 hours

Advanced Operating systems: Introduction to Distributed Operating system, Characteristics, & Synchronization; Introduction Multiprocessor Operating system, architecture, Issues, Communication, & Synchronization; Introduction Multiprocessor Operating system, Architecture, Structure, Synchronization & Scheduling; Introduction to Real-Time Operating System, Characteristics, Structure & Scheduling. Case study of Linux operating system.

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Tanenbaum, A. (2009). *Modern operating systems*. Pearson Education, Inc.,.
- Coffman, E. G., & Denning, P. J. (1973). *Operating systems theory* (Vol. 973). Englewood Cliffs, NJ: prentice-Hall.
- Madnick, S. E., & Donovan, J. J. (1974). *Operating systems* (Vol. 197, No. 4). New York: McGraw-Hill.
- Deitel, H. M. (1990). *An introduction to operating systems*. Addison-
- Wesley Longman Publishing Co., Inc..

Course Title: Discrete Structures	L	T	P	Cr.
Course Code: BCA2152	4	0	0	4

Total Hours: 60

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Implement the Logical and Algebraic operations.
- CO2. Demonstrate the basic principles of relation in a set.
- CO3. Solve the various methods of Recurrence relations.
- CO4. Perform operations on sets, functions, relations, and sequences.

Course Content

UNIT I

15 hours

Set Theory: Introduction, Sets and Elements, Subsets, Venn Diagrams, Set Operations, Algebra of Sets, Duality, Finite Sets, Counting Principle, Classes of Sets, Power Sets, Partitions, Mathematical Induction. Relations: Introduction, Product Sets, Relations, Pictorial Representations of Relations, Composition of Relations, Types of Relations, Closure Properties, Equivalence Relations, Partial Ordering Relations. Functions: Introduction, Functions, One-to-One, Onto, and Invertible Functions, Mathematical Functions, Exponential and Logarithmic Functions.

UNIT II

15 hours

Combinations: Rule of products, permutations, combinations. Algebra of Logic: Propositions and logic operations, truth tables and propositions generated by set, equivalence and implication laws of logic, mathematical system, and propositions over a universe, mathematical induction, quantifiers.

UNIT III

15 hours

Recursion and recurrence: The many faces of recursion, recurrence, relations, and some common recurrence relations, generating functions.

UNIT IV

15 hours

Graph Theory: Introduction, Data Structures, Graphs and Multigraphs, Subgraphs, Isomorphic and Homeomorphic Graphs, Paths, Connectivity, Traversable and Eulerian Graphs, Labeled and Weighted Graphs, Complete, Regular, and Bipartite Graphs, Planar Graphs, Graph Colorings, Representing Graphs in Computer Memory and Graph

Algorithms. Directed Graphs, Sequential Representation of Directed Graphs, Warshall's Algorithm, Shortest Paths

Trees: Introduction, Binary Trees, Complete and Extended Binary Trees, Representing Binary Trees in Memory, Traversing Binary Trees, Binary Search Trees

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Epp, S. S. (2010). *Discrete mathematics with applications*. Cengage learning.
- Biggs, N. L. (2002). *Discrete mathematics*. Oxford University Press
- Ross, K. A., & Wright, C. R. (1985). *Discrete Mathematics*. Prentice-Hall, Inc.
- <https://www.javatpoint.com/discrete-mathematics-tutorial> h
- <https://www.geeksforgeeks.org/discrete-mathematics-tutorial/>
- https://www.tutorialspoint.com/discrete_mathematics/index.htm

Course Title: Programming using C++ Lab	L	T	P	Cr.
Course Code: BCA2153	0	0	2	1

Total Hours:30

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. After the completion of the course the learner will be able to
- CO2. Classify the object-oriented concepts and their implementation.
- CO3. Use the concepts of array and string using C++.
- CO4. Implement a given program solved by C++.
- CO5. Grasp the concept of implementing the constructors with classes.

CourseContent

1. Write a program to find whether the number is even or odd.
2. Write a program to find the greatest number out of three numbers.
3. Write a program to find whether the number is a palindrome or not.
4. Write a program to print a prime number of Series.
5. Write a program to find the reverse of a number.
6. Write a program to find the factorial of a number.
7. Write a program to implement switch case in C++.
8. Write a program to enter a record of 50 students.
9. Write a program to print
 - i.1
 - ii.12
 - iii.123
 - iv.1234
 - v.12345
10. Write a program to implement call by value.
11. Write a program to show call by reference in C++.
12. Write a program to create classes in C++.
13. Write a program that uses a class where the member functions are defined inside a class.
14. Write a program to demonstrate the use of static data members.
15. Write a program to demonstrate the use of keyword const data members.
16. Write a program using constructors in C++.
17. Write a program using destructors in C++.

18. Write a program using multiple constructors in C++.
19. Write a program using the Copy constructor in C++.
20. Write a program to demonstrate single inheritance.
21. Write a program to demonstrate multilevel inheritance.
22. Write a program to demonstrate multiple inheritance.
23. Write a program showing hierarchical inheritance in C++.
24. Write a program to implement function overloading.
25. Write a program to demonstrate the overloading of binary arithmetic operators.
26. Write a program showing operator overloading in C++.
27. Write a program to read and write data from a file in C++.

Course Title: Operating System Lab	L	T	P	Cr.
Course Code: BCA2154	0	0	2	1

Total Hours: 30

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Get expertise on the Unix OS platform.
- CO2. Develop and debug C programs created on UNIX platforms.
- CO3. Install the standard libraries of the Operating System.
- CO4. Classify Shell Programming in Linux.

Course Content

1. Write down the Steps to Install Linux Operating System.
2. Write down the Steps to Install XP Operating System.
3. Write and explain the File Related commands.
4. Write and explain the Directory Related commands.
5. Write and explain the Process and status information commands.
6. Write and explain the Text related commands.
7. Write and explain the command to set the File Permissions.
8. Write a shell Program for Numerical Calculations in Linux.
9. Write a shell program to create a table in Linux.
10. Write a shell program to identify Even and Odd Number in Linux.

Course Title: Introduction to Web technologies – II	L	T	P	Cr.
Course Code: BCA2155	0	0	4	2

Total Hours:60

Course Learning Outcomes:After the completion of the course the learner will be able to

- CO1. Students are able to develop a dynamic webpage by the use of java script and DHTML.
- CO2. Students will be able to write a well formed / valid XML document.
- CO3. Students will be able to connect a java program to a DBMS and perform insert, update and delete operations on DBMS table.
- CO4. Students will be able to write a server-side java application called Servlet to catch form data sent from client, process it and store it on database.
- CO5. Students will be able to write a server-side java application called JSP to catch form data sent from client and store it on database.

Course Content

1. Create a simple webpage using HTML.
2. Use frames to Include Images and Videos.
3. Add a Cascading Style sheet for designing the web page.
4. Design a dynamic web page with validation using JavaScript.
5. Design an HTML having a text box and four buttons viz Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate javascript function should be called to display
Factorial of that number Fibonacci series up to that number Prime numbers up to that number.Is it palindrome or not
6. Write java script programs to demonstrate
 - Math Object with at least five methods.
 - String Object with at least five methods.
 - Array Object with at least five methods.
 - Date Object with at least five methods.
7. Write JavaScript programs on Event Handling
 - Validation of registration form
 - Open a Window from the current window
 - Change color of background at each click of button or refresh of a page
 - Display calendar for the month and year selected from combo box
 - On Mouse over even
8. Write a java program to connect to a database server using JDBC and insert 10 student's

information of user choice in to student table.

9. Write a java program to display all records in the student table.
10. Develop a simple Servlet to display Welcome to Servlet.
11. Develop a Servlet to validate user name and password with the data stored in Servlet configuration file. Display authorized user if she/he is authorized else display unauthorized user.
12. Develop a Servlet to validate user name and password stored in database. Display authorized user is she/he is authorized else display unauthorized user.
13. Write a Servlet program to store student details sent from registration form in to database table.
14. Write JSP Program to store student information sent from registration page into database table.
15. Develop a program to validate username and password that are stored in Database table using JSP.
16. Write appropriate JSP pages to insert, update and delete data in student table in a single application with proper linking of JSP pages and session management.

Suggested Readings

- Chris Bates, “Web Programming-Building Internet Applications”, 2nd ed., Wiley Publishers, 2006.
- Diet eland Nieto, “Internet and World Wide Web-How to Program”, 4th ed., PHI/ Pearson Education Asia,2007.
- Hans Bergsten, “Java Server Pages”, 1st ed., O'REILLY Publications,2000.
- Jennifer Niederst, Robbins, “Learning Web Design”, 3rd ed., SPD O'REILLY Publications, 10.
- Firuza Aibara, “HTML for Beginners”, 2nd ed., SPD O'REILLY Publications, 2010.
- . Marty Hall, “Core Servlets and Java Server Pages”, 1st ed., Prentice Hall PTR, 2000.
- The complete Reference Java 2 Fifth Edition by Patrick Naughton and Herbert Schildt. TMH

Course Title: Multilingual Typing and Stenography	L	T	P	Cr.
Course Code: BCA2156	0	0	6	3

Total Hours:90 Hours

1. Introduction to Hindi Fonts,Matra and sentences
2. Basic training in Hindi Typing:Home Row Keys practice,Practice of Shift+Home row letters,Practice upper row letters,Practice Shift+upper row letters.
3. Indtroduction to English Fonts. Basic Typing Techniques.
4. Home Row Keys.
5. Finger Exercises.
6. Typing Drills.
7. Shorthand (Stenography)
8. English and Hindi Shorthand.
9. Phraseography
10. Transcription
11. Speed Building

Course Title: Human Resource Management	L	T	P	Cr.
Course Code:BCA2157	3	0	0	3

Total Hours:45

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Understand the significance of HRM, distinguish it from Personnel Management (PM), and identify HR challenges.
- CO2. Apply HRM principles to practical situations such as recruitment, selection, and induction.
- CO3. Analyze performance appraisal methods and training programs.
- CO4. Evaluate the effectiveness of HR policies like promotion and transfer. Develop HR strategies and procedures.

Course Content

UNIT I

12 hours

Introduction to HRM: Definition and Concept of HRM and Personnel Management, Difference between PM and HRM, Importance of HRM, Activities and Functions of HRM, Challenges before HRM, HRD, HRP, Concept of Recruitment –Sources of Recruitment.

UNIT II

12 hours

Performance Appraisal, Training and Development: Meaning and Definition-Need- Objective –Importance of Training, Training Method – Evaluation of Training Program, Concept and Objective Performance Appraisal-Process of Performance Appraisal Method –Uses and Limitation of Performance Appraisal, Promotion and Demotion Policy, Transfer Policy.

UNIT III

11 hours

Method of Wage Payment – Employee Remuneration Factors Determining the Level of Remuneration-Profit Sharing –Fringe Benefit Nature of E- HRM, E-HR Activity, E-Recruitment, E-Selection, E-Learning, E- Compensation.

UNIT IV

10 hours

Grievance and Discipline: Meaning, Definition and Nature of Grievance Procedure-Grievance Machinery. Definition of Discipline-Aim and Objective of Discipline. Principle of Discipline.

Transactional Mode:

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Reading:

- *Fundamentals of Human Resource Management by David A.DeCenzo, Stephen P. Robbins, and Susan L. Verhulst.*
- *Effective Human Resource Management: A Global Analysis by Edward Lawler, John Boudreau, and Susan Albers Mohrman.*
- *Human Resource Management: Gaining a Competitive Advantage by Raymond Noe, John Hollenbeck, Barry Gerhart, and Patrick Wright*

Course Title: Environmental Education	L	T	P	Cr.
Course Code: VAC0001	2	0	0	2

Total Hours: 30

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Acquire the basic knowledge of Environment study.
- CO2. Attain the information about the ecosystem and its functioning.
- CO3. Discuss the role of individuals in prevention of pollution.
- CO4. Elaborate the role of information technology in the environment and human health.

Course Content

UNIT-I

8 hours

The Multidisciplinary nature of environmental studies Definition, scope and importance, Need for public awareness.

Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems.

Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-Utilization of surface and ground water, floods, drought, conflicts and water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

UNIT-II

7 hours

E-Concept of an ecosystem: Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.

Biodiversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: consumptive use,

productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation.

UNIT-III

7 hours

Environmental Pollution Definition: Causes, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards, ill-effects of fireworks, Solid waste Management: Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Disaster management: floods, earthquake, cyclone and landslides.

UNIT-IV

8 hours

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns, Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Presentation and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation. Human Population and the Environment: Population growth, variation among nations, Population explosion – Family Welfare Programme, Environment and human health, Human Rights, Value Education, HIV / AIDS, Women and Child Welfare

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Agarwal K.C. (2001). *Environment Biology*, Nidi Publ. Ltd. Bikaner.
- Jadhav H & Bhosale (1995). *Environment Protection and Laws*, Himalaya Pub House, Delhi.
- Rao M. N. & Datta A.K. (1987). *Waste Water, Treatment Oxford & IBH Publ. Co. Pvt. Ltd.*

Course Title: Communication Skills-II	L	T	P	Cr.
Course Code:BCA2158	2	0	0	2

Total Hours: 30

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Formulate an outline for effective Organizational Communication.
- CO2. Summarize the information, ideas, concepts and opinions from a variety of sources.
- CO3. Attain the competence in oral, written, and visual communication.
- CO4. Learn the correct practices about the strategies of Effective Business writing.

Course Content

UNIT-I **6hours**

Writing Skills: Formal & Informal writings, report writing, creative writing. Composition, Resume Writing, Cover letters.

UNIT-II **9hours**

Business Letter Writing, Persuasive Letters, Job Applications and Official Correspondence, E-Mail, Precise writing.

UNIT-III **7hours**

Basic Writing and Reading Skills: Principles of Effective Writing, Writing Emails, Letters, and Memos. This involves clarity, concision, and proper tone to convey messages effectively in professional settings.

UNIT-IV **8hours**

Writing: Biographical writing about one place or person, Free writing on any topics (my favourite place/hobbies/school life etc.), Sentence Completion, Autobiographical writing (about one's leisure time activities, hometown etc.).

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Kumar, S., & Lata, P. (2011). *Communication skills*. Oxford University Press.
- Training, M. T. D. (2012). *Effective communication skills*. Bookboon.
- Hargie, O. (Ed.). (1986). *The handbook of communication skills* (p. 37). London: Croom Helm.

Semester – III

Course Title: Data Structure	L	T	P	Cr.
Course Code: BCA3200	3	0	0	3

Total Hours: 45**Learning Outcomes:** After the completion of the course the learner will be able to

- CO1. Apply appropriate constructs of Programming language, coding standards for application development
- CO2. Select appropriate data structures for problem solving and programming
- CO3. Identify appropriate searching and/or sorting techniques for a wide range of problems and data types.
- CO4. Differentiate between various types of data structures.

Course Content**UNIT I****10 hours**

Introduction to Data Structures: Algorithms and Flowcharts, Basics Analysis on Algorithm, Complexity of Algorithm, Introduction and Definition of Data Structure, Classification of Data, Arrays, Various types of Data Structure, Static and Dynamic Memory Allocation, Function, Recursion. Arrays, Pointers and Strings: Introduction to Arrays, Definition, One Dimensional Array and Multi-Dimensional Arrays, Pointer, Pointer to Structure, various Programs for Array and Pointer. Strings. Introduction to Strings, Definition, Library Functions of Strings.

UNIT II**10 hours**

Stacks and Queue: Introduction to Stack, Definition, Stack Implementation, Operations of Stack, Applications of Stack and Multiple Stacks. Implementation of Multiple Stack Queues, Introduction to Queue, Definition, Queue Implementation, Operations of Queue, Circular Queue, De-queue and Priority Queue.

UNIT III**15 hours**

Linked Lists and Trees: Introduction, Representation and Operations of Linked Lists, Singly Linked List, Doubly Linked List, Circular Linked List, and Circular Doubly Linked List. Trees: Introduction to Tree, Tree Terminology Binary Tree, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree, Tree Traversal, Threaded Binary Tree, AVL Tree B Tree, B+ Tree.

UNIT IV**10 hours**

Graphs, Searching, Sorting and Hashing Graphs: Introduction, Representation to Graphs, Graph Traversals Shortest Path Algorithms. Searching and Sorting: Searching, Types of Searching, Sorting, Types of sorting like quick sort, bubble sort, merge sort, selection sort. Hashing: Hash Function, Types of Hash Functions, Collision, Collision Resolution Technique (CRT), Perfect Hashing

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Hubbard, J. R. (2007). [Introduction to] Schaum's Outline of Data Structures with Java. McGraw-Hill.
- Horowitz, E., & Sahni, S. (1976). Fundamentals of data structures (Vol. 1982). Potomac, MD: Computer science press.
- Wirth, N. (1985). Algorithms & data structures. Prentice-Hall, Inc..
- Tarjan, R. E. (1983). Data structures and network algorithms. Society for Industrial and Applied Mathematics.

Web Search

- <https://www.geeksforgeeks.org/data-structures/>
- <https://www.javatpoint.com/data-structure-tutorial>
- <https://www.programiz.com/dsa/data-structure-types>
- [https://www.techtarget.com/searchdatamanagement/definition/data structure](https://www.techtarget.com/searchdatamanagement/definition/data-structure)

Course Title: Data Structure Lab	L	T	P	Cr.
Course Code: BCA3203	0	0	2	1

Total Hours: 30

Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Apply appropriate constructs of Programming language, coding standards for application development
- CO2. Select appropriate data structures for problem solving and programming
- CO3. Identify appropriate searching and/or sorting techniques for a wide range of problems and data types.
- CO4. Differentiate between various types of data structures.

Course Content

1. Write a program to insert an element into an array
2. Write a program to delete an element from an array.
3. Write a program to implement linear search algorithm
4. Write a program to implement binary search algorithm
5. Write a program to implement a bubble sort algorithm.
6. Write a program to implement a selection sort algorithm.
7. Write a program to implement PUSH operation in stacks.
8. Write a program to implement POP operation in stacks.
9. Write a program to implement Queues.
10. Write a program to insert an element in the beginning of the link list.
11. Write a program to insert an element in the middle of the link list.
12. Write a program to insert an element in the end of the link list.
13. Write a program to delete an element from the beginning of the link list.
14. Write a program to delete an element from the end of the link list.
15. Write a program for implementation of a graph.
16. Write a program for implementation of binary search trees.

Course Title: Introduction to Artificial Intelligence	L	T	P	Cr.
Course Code: BCA3210	4	0	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Identify problems that are amenable to solution by specific AI methods
- CO2. Represent knowledge in Prolog and write code for drawing inferences.
- CO3. Identify an appropriate AI technique for the problem at hand
- CO4. Compare the strengths and weaknesses of different artificial Intelligence techniques.

Course Content

UNIT I

15 hours

Introduction: Introduction to artificial intelligence, background and applications, Turing test, rational agents, intelligent agents, structure, behavior and environment of intelligent agents.

UNIT II

15 hours

Knowledge Representation: Propositional logic, first order predicate logic, resolution principle, unification, semantic nets, conceptual dependencies, frames, scripts, production rules, conceptual graphs.

UNIT III

15 hours

Problem Solving and Searching Techniques: Problem characteristics, production systems, control strategies, breadth first search, depth first search, hill climbing and its variations, heuristics search techniques: best first search, A* algorithm, constraint satisfaction problem, means-end analysis. Ethics in AI, Fairness in AI, Legal perspective

UNIT IV

15 hours

Game Playing: introduction to game playing, min-max and alpha-beta pruning algorithms. Prolog Programming: Introduction to Programming in Logic (PROLOG), Lists, Operators, basic Input and Output.

Transactional modes

Project based learning, Team Teaching, Flipped teaching, Open talk, Collaborative Teaching, Case Analysis, Panel Discussions, Group Discussions.

Suggested Readings

- Winston, P. H. (1992). Artificial intelligence. Addison-Wesley Longman Publishing Co., Inc..
- Winston, P. H. (1984). Artificial intelligence. Addison Wesley Longman Publishing Co., Inc..
- Boden, M. A. (Ed.). (1996). Artificial intelligence. Elsevier.
- Hunt, E. B. (2014). Artificial intelligence. Academic Press.

Web Sources

- https://www.vssut.ac.in/lecture_notes/lecture1428643004.pdf
- [https://mrcet.com/downloads/digital_notes/IT/\(R17A1204\)%20Ar](https://mrcet.com/downloads/digital_notes/IT/(R17A1204)%20Ar)

Course Title: Python Programming	L	T	P	Cr.
Course Code: BCA3211	3	0	0	3

Total Hours: 45

Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Understand the variables, expressions and statements.
- CO2. Apply conditional and looping constructs.
- CO3. Design and import functions in python programming.
- CO4. Learn the basics of Strings and Dictionaries.

Course Content

UNIT I

10 hours

Introduction to Python Getting Started: Introduction to Python- an interpreted high level language, interactive mode and script mode. Variables, Expressions and Statements: Values, Variables and keywords; Operators and Operands in Python: (Arithmetic, relational and logical operators), operator precedence, Expressions and Statements (Assignment statement); Taking input (using `raw_input()` and `input()`) and displaying output(`print` statement); Putting Comments.

UNIT II

10 hours

Strings: Creating, initializing and accessing the elements; String operators: `+`, `*`, `in`, `not in`, range slice `[n:m]`; Comparing strings using relational operators; String functions & methods: `len`, `capitalize`, `find`, `isalnum`, `isalpha`, `isdigit`, `lower`, `islower`, `isupper`, `upper`, `lstrip`, `rstrip`, `isspace`, `istitle`, `partition`, `replace`, `join`, `split`, `count`, `decode`, `encode`, `swapcase`, Pattern Matching.

Lists: Concept of mutable lists, creating, initializing and accessing the elements, traversing, appending, updating and deleting elements; List operations (joining, list slices); List functions & methods: `len`, `insert`, `append`, `extend`, `sort`, `remove`, `reverse`, `pop`

UNIT III

10 hours

Dictionaries: Concept of key-value pair, creating, initializing and accessing the elements in a dictionary, traversing, appending, updating and deleting elements. Dictionary functions & Methods: `cmp`, `len`, `clear()`, `get()`, `has_key()`, `items()`, `keys()`, `update()`, `values()`.

Tuples: Immutable concept, creating, initializing and accessing the elements in a tuple; Tuple functions: `cmp()`, `len()`, `max()`, `min()`, `tuple()`

UNIT IV

15 hours

Conditional constructs and looping: `if else` statement while, for (range function), `break`, `continue`, `else`, `pass`, Nested loops, use of compound expression in conditional constructs and looping Functions: Importing Modules (entire module or selected objects), invoking built in functions, functions from `math` module, using `random ()` and `randint()` functions of

random module to generate random numbers, composition. Defining functions, invoking functions, passing parameters, scope of variables, void functions and functions returning values, flow of execution.

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Guttag, J. V. (2013). Introduction to computation and programming using Python. Mit Press.
- Guttag, J. V. (2016). Introduction to computation and programming using Python: With application to understanding data. MIT Press.
- Langtangen, H. P., & Langtangen, H. P. (2011). A primer on scientific programming with Python (Vol. 1). Berlin/Heidelberg: Springer.

Web Search

- <https://www.toppr.com/guides/computer-science/programming-withpython/tuples/immutabletuples/#:~:text=These%20tuples%20are%20an%20ordered,can%20call%20them%20immutable%20tuples.>
- https://www.w3schools.com/python/gloss_python_join_lists.asp
- <https://www.w3schools.com/python/>
- <https://www.geeksforgeeks.org/python-programming-language/>

Course Title: Computer Graphics	L	T	P	Cr.
Course Code: BCA3212	2	0	0	2

Total Hours: 30

Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Describe Standard raster and vector scan devices as well as Graphical Input and output devices.
- CO2. Implement algorithms for drawing basic primitives such as line circle and ellipse.
- CO3. Implement algorithms for line clipping and polygon clipping and filling.
- CO4. Implement a 3D object representation scheme and carry out 2D and 3D Transformation, 3D projections.

Course Content

UNIT I

8 hours

Introduction: Introduction to Graphics systems, Basic elements of Computer graphics, Applications of computer graphics. Overview of Graphics Systems: Video Display Devices, Cathode Ray Tube, CRT monitors, Flat panel displays: Plasma Panel display, Thin-film electroluminescent displays, LED, Liquid Crystal Displays (LCD), Raster Scan Systems, Random Scan Systems.

UNIT II

7 hours

Drawing and clipping primitives: Raster scan line, circle and ellipse drawing algorithms, Polygon filling, line clipping and polygon clipping algorithms. Filled area primitives, character generation, Antialiasing.

UNIT III

8 hours

Transformation and Viewing: 2D and 3D Geometric Transformations, 2D and 3D Viewing Transformations (Projections- Parallel and Perspective), Vanishing points.

UNIT IV

7 hours

Geometric Modeling: Polygon Mesh Representation, Cubic Polynomial curves (Hermite and Bezier). Visible Surface determination and Surface Rendering: Z-buffer algorithm, List-priority algorithm and area subdivision algorithm for visible surface determination. Illumination and shading models, RGB color model and Basics of Computer Animation.

Transactional modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Hearn, D., Baker, M. P., & Baker, M. P. (2004). Computer graphics with OpenGL (Vol. 3). Upper Saddle River, NJ:: Pearson Prentice Hall.

- Foley, J. D., Van Dam, A., Feiner, S. K., Hughes, J. F., & Phillips, R. L. (1994). Introduction to computer graphics (Vol. 55). Reading: Addison Wesley.
- Shirley, P., Ashikhmin, M., & Marschner, S. (2009). Fundamentals of computer graphics. AK Peters/CRC Press.
- Foley, J. D., Van, F. D., Van Dam, A., Feiner, S. K., Hughes, J. F., & Hughes, J. (1996). Computer graphics: principles and practice (Vol. 12110). Addison-Wesley Professional.

Web Sources

- <https://www.javatpoint.com/computer-graphics-tutorial>
- <https://www.geeksforgeeks.org/introduction-to-computer-graphics/>
- <https://www.coursera.org/articles/computer-graphics>

Course Title: Computer Graphics Lab	L	T	P	Cr.
Course Code: BCA3213	0	0	4	2

Total Hours: 60**Learning Outcomes:** After the completion of the course the learner will be able to

- CO1. Apply mathematics and logic to develop Computer programs for elementary graphic operations
- CO2. Implement the Flood Fill Algorithm.
- CO3. Develop scientific and strategic approach to solve complex problems in the domain of Computer Graphics
- CO4. Develop the competency to understand the concepts related to Computer Vision and Virtual reality

Course Content

1. Write a program to plot a pixel.
2. Write a Program to Draw a Line.
3. Write a Program to Draw a Circle.
4. Write a program to draw an ellipse.
5. Write a program to draw arc.
6. Write a program to illustrate the functions setfillstyle(),setcolor(), setbkcolor(), floodfill() using inbuilt functions
7. Write a program to draw a HUT using various inbuilt functions.
8. Write a program to draw a line by using a direct method algorithm.
9. Program to Implement DDA Line Algorithm.
10. Draw a Line Using 'Bresenham's Line Algorithm'.
11. Draw a Circle Using 'Bresenham's Circle Drawing Algorithm'.
12. Write a program to draw a Circle by using the Polynomial Method.
13. Write a Program for Flood Fill Algorithms.
14. Write a program to implement 2D Translation.
15. Write a program to implement 2D Scaling.
16. Write a program to implement 2D Rotation about origin
17. Mini Project:-Moving Car

Course Title: Python Programming Lab	L	T	P	Cr.
Course Code: BCA3214	0	0	6	3

TotalHou**rs:90**

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Write, Test and Debug Python Programs.
- CO2. Implement Conditionals and Loops for Python Programs.
- CO3. Use functions and represent Compound data using Lists.
- CO4. Implement the basic conditional and looping constructs.

Course Content

Program 1: Print “Hello” world

Program 2: Add numbers and concatenate strings

Program 3: Input from user

Program 4: loops

Program 5: if-else - conditional checking

Program 6: Functions

Program 7: Math library

Program 8: Strings

Program 9: Exceptional handling

Program 10: Random numbers/string

Program 11: Demo of data structure – list

Program 12: Demo of data structure - dictionary

Program 13: Demo of data structure – tuple

Program 14: Command line argument

Course Title: E-Commerce (MOOC)	L	T	P	Cr.
Course Code: BCA3215	3	0	0	3

Total Hours: 45

Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Discuss about the basic concepts and technologies used in the field of E
- CO2. Commerce and Governance.
- CO3. Apply their knowledge of various Electronic Payment Systems in practical scenarios.
- CO4. Analyze and differentiate between various Governance Process Models.
- CO5. Evaluate Internet trading relationships, including Business-to Consumer
- CO6. (B2C), Business-to-Business (B2B), and Intra-organizational dynamics.

Course Content

UNIT I

10 hours

Introduction to e-commerce: History of e-commerce, e-business models B2B, B2C, C2C, C2B, legal; environment of e-commerce, ethical issues, electronic data interchange, value chain and supply chain, advantages and disadvantages of e-commerce. Electronic Payment Systems: Credit cards, debit cards, smart cards, e-credit accounts, e-money, Marketing on the web, marketing strategies, advertising on the web, customer service and support, introduction to m-commerce, case study: e-commerce in passenger air transport.

UNIT II

10 hours

E-Government, theoretical background of e-governance, issues in e governance applications, evolution of e-governance, its scope and content, benefits and reasons for the introduction of e-governance, e-governance models- broadcasting, critical flow, comparative analysis, mobilization and lobbying, interactive services / G2C2G.

UNIT III

15 hours

E-readiness, e-government readiness, E- Framework, step & issues, application of data warehousing and data mining in e-government, Case studies: NICNET-role of nationwide networking in e-governance, e-seva.

UNIT IV

10 hours

E-Government systems security: Challenges and approach to e-government security, security concern in e-commerce, security for server computers, communication channel security, security for client computers.

Transactional modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Winn, J. K., & Wright, B. (2000). The law of electronic commerce. Wolters Kluwer.
- United States. White House Office. (1997). A framework for global electronic commerce. White House.
- Andrea, G. (Ed.). (2002). Development Centre Studies Electronic Commerce for Development. OECD Publishing.

Course Title: Soft Skills Development	L	T	P	Cr.
Course Code: BCA3216	2	0	0	2

Total Hours: 30**Learning Outcomes:** After the completion of the course, the learner will be able to

- CO1. Exhibit improved communication and interpersonal abilities
- CO2. Demonstrate professionalism in behavior and appearance
- CO3. Effectively manage time, stress, and emotions
- CO4. Prepare for employment opportunities through mock interviews and resume writing
- CO5. Work efficiently in teams and practice leadership

Course Content**UNIT I****10 hours**

Introduction to soft skills: meaning, scope, and importance, Difference between soft skills and hard skills, Personality development: self-awareness, self-confidence, self-esteem, Positive thinking and attitude, Goal setting and motivation

UNIT II**10 hours**

Elements and types of communication, Verbal communication: oral skills, vocabulary, tone, fluency, Non-verbal communication: body language, eye contact, posture, Listening skills and barriers to effective communication, Written communication: email, letter, and report writing, Presentation skills: structure, delivery, and visual aids

UNIT III**10 hours**

Interpersonal relationships and empathy, Teamwork, collaboration, and conflict resolution, Time management and prioritization, Stress and anger management techniques, Emotional intelligence and adaptability, Professional grooming, body language, and workplace etiquette

UNIT IV**10 hours**

Resume and cover letter writing, Interview skills: preparation, practice, and FAQs, Group discussions and mock interviews, Leadership and decision-making, Problem-solving and creative thinking, Workplace communication and ethics

Transactional modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Personality Development and Soft Skills* – Barun K. Mitra
- *Soft Skills: Know Yourself and Know the World* – Alex K.
- *You Can Win* – Shiv Khera
- Online resources: NPTEL soft skills modules, Coursera, LinkedIn Learning

Elective-I

Course Title: Disaster Risk Reduction and Management: Skills for Safety and Resilience	L	T	P	Cr.
Course Code: BCA3217	2	0	2	3

Total Hours: 45

Course Outcomes: On the completion of the course the students will be able to

CO1. Identify hazards, vulnerabilities and risks at individual, institutional and community levels.

CO2. Outline the legal and institutional frameworks of DRR in India and globally.

CO3. Demonstrate life-saving skills, emergency communication, disaster response and risk mitigation techniques.

CO4. Utilize and implement basic tools and technologies for risk assessment, preparedness and resilience-building.

CO5. Prepare disaster management plans and design community awareness activities or prototypes in regional/local contexts.

Course Content

UNIT-I

5 Hours

Understanding Disaster Risk Reduction and Management

- Basic concepts and terminology: Hazard, Vulnerability, Capacity, Exposure, Disaster, Risk, Disaster Management & Disaster Risk Reduction.
- Hazard profile of India: Regional profile.
- Disaster Management Cycle: Mitigation, preparedness, response, relief, recovery, rehabilitation.
- Policy and legal frameworks: DM Act 2005, DM Amendment Act 2025, National Policy, State-specific Acts; PM 10 Points agenda.
- International frameworks: Sendai Framework, Paris Agreement, SDGs.
- Role of Institutions in DRR (overview only): NDMA, NIDM, IMD, CWC, GSI, BIS, ISRO, INCOIS, SDMA, DDMA, NDRF.
- Case studies of different disasters in India: Lessons learned (minimum 2).

UNIT-II

5 Hours

- Framework for Developing Disaster Management Plans.
- Hazard, Vulnerability, Capacity and Risk (HVCR) Assessment tools and techniques: Transect walk, Hazard mapping, Problem tree, Chapatti diagram etc.
- Mitigation and Preparedness: Evacuation planning, mock drills, tabletop exercises; disaster-specific mitigation, Crowd Management techniques.

- Basics of Incident Response System (IRS).
- Role of emergency forces: NDRF, SDRF, police, fire services, armed forces, NCC, NSS.
- Planning for more vulnerable groups.
- Emerging technologies: Drones, digital literacy, mobile apps (GIRI tool, SAFAR, Meghdoot, UMANG, Sachet, CWC Flood Alerts, IMD, BIS, IHIP), social media for DRR.
- Basics of safe construction and structural & nonstructural audit exercise (safety of home/ college buildings).
- Funding mechanisms for disasters in India.
- Emergency Communication Network.

UNIT-III**5 Hours****Life-Saving Skills**

- First Aid in disasters: Golden hour concept, CPR, wounds, choking, burns, fractures, animal bites (snake/dog/rabid), heat-related illnesses, triaging, stampede.
- Household and personal preparedness and protection: 72-hour emergency kit, safe food storage, water purification, ORS use, water sanitation and hygiene (WASH), and Infection Prevention Control (IPC) practices, Basic Sign Language.
- Search and Rescue methods.
- Fire safety and electrical/gas/LPG safety: Causes, prevention, fire extinguisher demonstration, indigenous methods (Natural first-aid remedies- aloe vera, turmeric, coconut oil, salt solution); traditional risk-reduction practices.
- Disaster-specific response: Floods, landslides, earthquakes, CBRN emergencies, pandemics, drowning, lightning, gas leakage, cyclone, heatwave, coldwave.
- Psychosocial support in DRR: Steps for implementing psychological first aid and its importance.
- Public health preparedness: Public health impacts of various disasters, Prevention of post-disaster water-borne and vector-borne diseases.

UNIT-IV**30 Hours****Field Exposure and Community Engagement**

- Field visits: District Emergency Operations Centre, State Disaster Response Force/ National Disaster Response Force units, fire stations, State Emergency Operations Center, hazard-prone communities, heat-prone areas (flood-prone village, fire-vulnerable urban slum).
- Practical exposure: Mock drills, demonstrations and simulations (multi-hazard, evacuation, earthquake, flood); interaction with responders and officials (Aapda Mitras, National Cadet Corps/National Service Scheme/Nehru Yuva Kendra Sangathan, Red Cross).
- Community Engagement projects: Street, plays (nukkad natak), awareness campaigns, DRR clubs (institute and community level clubs), Information, Education and Communication material (podcasts, videos, comics, photo essays, posters, Knowledge exchange webinars).
- Environmental hazards: Youth/community participation (tree plantation, soil

conservation).

- Project/assignment: Preparation of institutional/household DM plan in local language; budget-friendly multi-disaster survival kit prototype; reflective field report, youth-led community engagement projects and creation of IEC/digital communication materials. Multidisciplinary integration: Links with local governments, HEIs, youth/adolescent networks.
- Activities for mitigating disaster risks: Increasing green cover, plantation and knowledge of human anatomy.
- Interaction with: State, district, gram panchayat level officials, DRR helpline numbers, and knowledge of physical resources required and available locally; interview/session with disaster survivors.

Transactional Mode

Lecture Method, E-Team Teaching, Video-based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

1. Sphere Handbook for humanitarian response standards. Link: <https://spherestandards.org/handbook/>
2. Health emergency and disaster risk management framework (Health EDRM), WHO. Link: <https://www.who.int/publications/i/item/9789241516181>

Course Title: Basics of Cyber Security	L	T	P	Cr.
Course Code: BCA3218	3	0	0	3

Total Hours: 45**Course Outcomes:** On the completion of the course the students will be able to**Unit-I****8 Hours****Introduction to Cyber security**

Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.

Unit-II**12 Hours****Cyber-crime and Cyber law**

Classification of cyber-crimes, Common cyber crimes cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India, Case studies.

Unit-III**12 Hours****Social Media Overview and Security**

Introduction to Social Networks. Types of social media, social media platforms, social media monitoring, hashtags, Viral content, social media marketing, social media privacy, Challenges, opportunities, and pitfalls in online social networks, Security issues related to

social media, flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies

Unit-IV

13 Hours

E - Commerce, Digital Payments, Digital Devices Security, Tools and Technologies for Cyber Security

Definition of E- Commerce, Main components of E-Commerce, Elements of E- Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions. Relevant provisions of Payment Settlement Act, 2007, End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions

Suggested Readings

1. Cyber Crime Impact in the New Millennium, by R. C Mishra, Auther Press. Edition 2010.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson, 13th November, 2001)
4. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
5. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.

6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
7. Fundamentals of Network Security by E. Maiwald, McGraw Hill

Course Title: Programming using Java	L	T	P	Cr.
Course Code: BCA4251	3	0	0	3

Total Hours: 45

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Solve the computational problems using basic statements like if-else, control structures, array, and strings.
- CO2. Knowledge about the user requirements for software functionality in Java programming language.
- CO3. Apply basic principles of creating Java applications with Applet programming.
- CO4. Develop a given program using the basic elements like Control and Conditional statements.

Course Content

UNIT-I

10 hours

Introduction to Java: Introduction to java, Java History, Java Features; How Java Differs from C and C++; Comments in java, Java Program Structure, Implementing a Java Program, Java Virtual Machine, Command Line Arguments, Programming Style, Java and Internet, Java and World Wide Web, Web Browsers, Hardware and Software Requirements; Java Support Systems, Java Environment. Java Tokens; Java Statements.

UNIT II

15 hours

Constants, Variables and Data Types: Introduction; Constants, Variables, Data Types, Introduction to Operators, Expressions, Operator Precedence. Decision Making, Branching and Looping: Decision making and branching Statements, Looping Statements, labeled loops, Jumping Statements.

UNIT III

10 hours

Classes, Objects and Methods: Introduction, defining a Class, Data member, member function, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods, Arrays, Strings, Vectors: Arrays, Jagged Arrays, Strings, String functions: Vectors, Wrapper Classes, Inheritance: Extending a Class, Overriding Methods, Final Variables and Methods, Final Classes, Finalizer Methods, Abstract Methods and Classes, Visibility Control.

UNIT IV**10 hours**

Interfaces: Introduction, Defining Interfaces, Extending Interfaces, Implementing Interfaces, Accessing Interface Variables, Implementing Multiple Inheritance using Interfaces.

Packages: Introduction; System Packages, Using System Packages, Naming Conventions, Creating Packages, accessing a Package, Using a Package, Adding a Class to a Package, Hiding Classes.

Managing Errors and Exceptions: Introduction; Types of Errors; Exceptions, Exception Handling using Try, Catch and Finally block: Throwing Our Own Exceptions, Using Exceptions for Debugging.

Applet Programming: Introduction; How Applets Differ from Applications; Applet Life Cycle; Creating an Executable Applet.

Transactional Mode:

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Li, Y. (2022). *Computer Software Java Programming Optimization Design*. In *International Conference on Frontier Computing* (pp. 1086- 1092). Springer, Singapore.
- Liang, Y. D. (2003). *Introduction to Java programming*. Pearson Education India.
- Liang, Y. D. (2018). *Introduction to Java programming and data structures*. Pearson Education.
- Kavka, C. (2003, October). *Introduction to JAVA*. In *Second Workshop on Distributed Laboratory Instrumentation Systems, ICTP, Trieste, Italy*.

Course Title: Programming Using Java Lab	L	T	P	Cr.
Course Code: BCA4253	0	0	2	1

Total Hours:30

Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Discuss the concepts of object-oriented programming.
- CO2. Test the performance of Exception handling and multi-threading.
- CO3. Implementing and debugging the Java programs.
- CO4. Develop an Applet code using Java Programming.

Course Content

1. Introduction to JAVA, Class, Object, Package, Applet.
2. Write a Java program which does the creation of Class and object.
3. Usage of import statement and package declaration in java programs.
4. Declaring variables of various data types and their effect by changing the access modifiers like private, public, protected, default.
5. Write a program which makes use of Comparison Operators.
6. Write programs which make use of Arithmetic Operators.
7. Write a program which makes use of Logical Operators.
8. Write a program which makes use of control Statement like if, while, do while.
9. Write Java programs, which make use of Statements like Try, catch, finally.
10. Write a Java program, which makes use of control Statements like Try, catch, finally, throw, and throws.
11. Write code snippets which make usage of Method Overloading, Using super, this, super (), this () in Java Programs.
12. Write code snippets which make usage of method Overriding.
13. Write code snippets which make Applet.
14. Write code snippets which make usage of recursion.
15. Write code snippets which make usage of Thread.
16. Write code snippets which make usage of Thread Synchronization.
17. Write code snippets which make usage of String Methods.
18. Write code snippets which make usage of Swing Package.

Course Title: Machine Learning	L	T	P	Cr.
Course Code:BCA4260	3	0	0	3

Total Hours: 45

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Describe the basic concepts of Bayesian Decision Theory.
- CO2. Implement the working of perceptron learning algorithm, criterion and Windrow-Hoff learning algorithm.
- CO3. Depict the algorithms like Nearest Neighbor classification, K-nearest neighbor and their applications.
- CO4. Evaluate the models generated from data.

Course Content

UNIT I

10 Hours

Overview and Introduction to Bayes Decision Theory: Machine intelligence and applications, pattern recognition concepts classification, regression, feature selection, supervised learning class conditional probability distributions, Examples of classifiers bayes optimal classifier and error, learning classification approaches.

UNIT II

15 Hours

Linear machines: General and linear discriminates, decision regions, single layer neural network, linear separability, general gradient descent, perceptron learning algorithm, mean square criterion and widrow-Hoff learning algorithm; multi-Layer, Perceptron: two-layers universal approximates, back propagation learning, on-line, off-line error surface, important parameters.

UNIT III

10 Hours

Learning decision trees: Inference model, general domains, symbolic decision trees, consistency, learning trees from training examples entropy, mutual information, ID3 algorithm criterion, C4.5 algorithm continuous testnodes, confidence, pruning, learning with incomplete data case, VC-dimension, fundamental algorithm independent concepts,

UNITIV

10Hours

Machine learning concepts and limitations: Learning theory, formal model of the learnable,

sample complexity, learning in zero-bayes and realizable case, VC-dimension, fundamental algorithm independent concepts, hypothesis class, target class, inductive bias, Occam's razor, empirical risk, limitations of inference machines, approximation and estimation errors, Trade Offs.

Transactional Modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Alpaydin, E. (2020). Introduction to machine learning. MIT press.*
- *Jordan, M. I., & Mitchell, T. M. (2015). Machine learning: Trends, perspectives, and prospects. Science, 349(6245), 255-260.*
- *Mitchell, T. M., & Mitchell, T. M. (1997). Machine learning (Vol. 1, No. 9). New York: McGraw-hill.*
- *Bishop, C. M., & Nasrabadi, N. M. (2006). Pattern recognition and machine learning (Vol. 4, No. 4, p. 738). New York: Springer.*

CourseTitle: MACHINE LEARNING LAB	L	T	P	Cr.
Course Code: BCA4261	0	0	2	1

Total Hours:30

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Understand the Basic operations of Linear Algebra in Machine Learning.
- CO2. Use various Supervised Learning techniques like Linear Regression and Nonlinear Regression.
- CO3. Apply Statistical approaches for multiple Learning techniques.
- CO4. Construct models for Classification.
- CO5. Build neural network models.

Course Content

1. Write a Program to perform the following operations on matrices
 - a) Matrix addition
 - b) Matrix Subtraction
 - c) Matrix Multiplication
 - d) Matrix Inversion
 - e) Transpose of a Matrix
2. Write a Program to perform the following operations
 - a) Find the minimum and maximum element of the matrix
 - b) Find the minimum and maximum element of each row in the matrix
 - c) Find the minimum and maximum element of each column in the matrix
 - d) Find trace of the given matrix
 - e) Find rank of the given matrix
 - f) Find eigenvalues and eigenvectors of the given matrix
3. Write a Program to find the mean, median, standard deviation and mode using user defined functions.
4. Create a data frame with columns at least 5 observations
 - a) Retrieve a particular column from the DataFrame.
 - b) Summarize the data frame and observe the statistics of the DataFrame created
 - c) Observe the mean and standard deviation of the data frame and print the values.
5. Write a program to implement the Linear Regression for a sample training data set stored as a .CSV file. Compute Mean Square Error by considering few test data sets.
5. Write a program to implement the Non-linear Regression for a sample

training data set stored as a .CSV file. Compute Mean Square Error by considering few test data sets.

6. Write a program to implement the Logistic Regression for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier.

7. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

8. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

9. Write a program to implement Support Vector Machine algorithm to classify the iris data set. Print both correct and wrong predictions.

10. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

11. Write a program to demonstrate the working of the decision tree based CART algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

12. Write a program to construct a Regression tree for cost estimation by assuming any numerical dataset.

13. Write a program to calculate the accuracy, precision, and recall for your data set. Assume a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task.

14. Implement a single neural network and test for different logic gates.

15. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

16. Backpropagation algorithm and test the same using appropriate data sets.

Course Title: Relational Database Management System	L	T	P	Cr.
Course Code: BCA4262	3	0	0	3

Total Hours: 45**Course Learning Outcomes:** After the completion of the course the learner will be able to

- CO1. After the completion of the course the learner will be able to
- CO2. Identify the difference about database systems from the file systems by enumerating their features.
- CO3. Acknowledge the role of the database administrator.
- CO4. Retain the knowledge about physical and logical database designs.
- CO5. Converts an Entity-Relationship diagram to Relational Schema.

Course Content**UNIT-I****10 hours**

Introduction of DBMS: Data Modeling for a Database, three level Architecture of DBMS, Components of a DBMS.

Introduction to Data Models: Hierarchical, Network and Relational Model, Comparison of Network, Hierarchical and Relational Model, Entity Relationship Model.

UNIT-II**15 hours**

Relational Database: Relational Algebra and Calculus, SQL Fundamentals, DDL, DML, DCL, PL/SQL Concepts, Cursors, Stored Procedures, Stored Functions, Database Triggers.

UNIT III**10 hours**

Introduction to Normalization: First, Second, Third Normal Forms, Dependency Preservation, Boyce-Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form,

Joins: Inner join, left join, Right join, Full join, Join Dependencies and Fifth Normal Form, Domain-key normal form (DKNF).

UNIT IV**10 hours**

Database Recovery: Concurrency Management, Database Security, Integrity and Control. Structure of a Distributed Database, Design of Distributed Databases.

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning

Suggested Readings

- Ramakrishnan, R., Gehrke, J., & Gehrke, J. (2003). *Database management systems (Vol. 3)*. New York: McGraw-Hill.
- Korth, F. Henry. *Database System Concepts*, McGraw Hill
- Lu, G. (1999). *Multimedia database management systems*. Boston: Artech House.
- Date, C. J. (1975). *An introduction to database systems*. Pearson Education India.

Course Title: Relational Database Management Systems Lab	L	T	P	Cr.
Course Code: BCA4263	0	0	2	1

Total Hours: 30

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Solve the query of the database using SQL DML / DDL commands.
- CO2. Enforce integrity constraints on a database.
- CO3. Apply the basic concepts of Database Systems and Applications.
- CO4. Design a commercial relational database system (Oracle, My SQL) by writing SQL using the system

List of Experiments

1. Introduction to DBMS & SQL.
2. To implement Various DDL comments.
3. Implement the DML commands.
4. Study of Various types of data Constraints and implementation.
5. Study of all types of operators.
6. Implement the concept of Set Operators.
7. Explore select clauses -order by, having etc.
8. Implement the concept of Inbuilt Function.
9. Implement the concept of Joins,
10. Implement the concept of views.
11. Implement the concept of Indexes

Course Title: Fundamentals of Data Science	L	T	P	Cr.
Course Code: BCA4264	2	0	0	2

Total Hours:30

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Recognize the various discipline that contribute to a successful data science effort.
- CO2. Understand the processes of data science identifying the problem to be solved, data collection, preparation, modeling, evaluation and visualization.
- CO3. Be aware of the challenges that arise in Data Sciences.
- CO4. Be able to identify the application of the type of algorithm based on the type of the problem.
- CO5. Be comfortable using commercial and open source tools such as the R/Python language and its associated libraries for data analytics and Visualization.

Course Content

UNIT-I:

Hour:5

Defining Data Science and Big data, Benefits and Uses, facets of Data, Data Science Process. History and Overview of R, Getting Started with R, R Nuts and Bolts

UNIT-II:

Hours:10

The Data Science Process: Overview of the Data Science Process-Setting the research goal, Retrieving Data, Data Preparation, Exploration, Modeling, data Presentation and Automation. Getting Data in and out of R, Using reader package, Interfaces to the outside world.

UNIT-III:

Hours:5

Machine Learning: Understanding why data scientists use machine learning-What is machine learning and why we should care about, Applications of machine learning in data science, where it is used in data science, The modeling process, Types of Machine Learning- Supervised and Unsupervised.

UNIT-IV:

Hours:10

Handling large Data on a Single Computer: The problems we face when handling large data, General Techniques for handling large volumes of data, generating programming tips for dealing with large datasets.

Sub setting R objects, Vectorized Operations, Managing Data Frames with the dplyr, Control structures, functions, Scoping rules of R, Coding Standards in R, Loop Functions, Debugging, Simulation. Case studies on preliminary data analysis.

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning

Suggested Reading:

- *Davy Cielen, Arno D. B. Maysman, Mohamed Ali, "Introducing Data Science" Manning Publications, 2016.*
- *Roger D. Peng, "R Programming for Data Science" Lean Publishing, 2015.*
- *Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 2014.*
- *Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical Data Science Cookbook", Packt Publishing Ltd., 2014.*

Course Title: Fundamentals of Data Science Lab	L	T	P	Cr.
Course Code: BCA4265	0	0	4	2

Total Hours:60

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Perform basic R operations with variables and data types.
- CO2. Create and manipulate vectors, lists, matrices, and data frames.
- CO3. Implement and visualize Linear Regression.
- CO4. Perform Logistic Regression and evaluate with confusion matrix.

Course Content

1. Basic R operations: variables, data types, and arithmetic
2. Create and manipulate vectors, lists, matrices, and data frames
3. Read data from CSV and Excel using readr and readxl.
4. Export data from R to a CSV file
5. Data cleaning: handle missing values, convert data types
6. Data summarization and exploratory data analysis (EDA)
7. Data visualization using ggplot2: histogram, boxplot, bar plot
8. Apply dplyr for data wrangling: filter, select, mutate, summarize
9. Implement Linear Regression and visualize with plots
10. Perform Logistic Regression and evaluate using confusion matrix
11. Subsetting and vectorized operations on large datasets
12. Write user-defined functions and use control structures (if, for, while)
13. Simulate data using rnorm(), runif(), and basic random sampling.

Course Title: Indian Health Sciences	L	T	P	Cr.
Course Code: IKS0006	2	0	0	2

Total Hours:30**Learning Outcomes:**

The course is a walk for the students to gain a holistic knowledge on human health. The course provides elementary idea on various nutrients and their impacts on human physiology. In addition, students will be able to learn some of the common diseases and their management strategies. The last segment of this course deals with the stress and its management.

Course Content**Unit-I****8 Hours****Fundamentals of health**

Definition of health-WHO definition; Components of health- physical, social, mental, spiritual and its relevance. Concept of wellness. Health enhancing behaviors and their impacts on physiology: Exercise, Nutrition, Meditation, Yoga. Health compromising behaviors and their impacts on physiology: alcoholism, smoking.

Unit-II**8 Hours****Public Health and Nutrition**

Macronutrients and Micronutrients; Functions, dietary sources and clinical manifestations of deficiency/ excess of the following nutrients: Carbohydrates, lipids and proteins; Fat soluble vitamins-A, D, E and K; Water soluble vitamins – thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin Important clinical manifestations of deficiency of minerals on human health: calcium, iron and iodine, Concept of Recommended Dietary Allowance (RDA), Adequate Intake (AI), Tolerable Upper Intake Level (UL), and Estimated Average Requirement (EAR),Determination and importance of BMI. Idea on overweight and obesity. Outline idea on Indian food pyramid.

Unit-III**8 Hours****Human health and diseases**

Pathogens: Outline idea; introduction to parasites causing human diseases (dengue, amoebiasis, malaria, ascariasis) and their control; Symptoms and treatment of these diseases. Drug and alcohol abuse in adolescence, Elementary idea on lifestyle disorders –Cerebrovascular Disease, Hypertension, cancer, Type 2 Diabetes, Chronic Obstructive Pulmonary Disease (COPD), Osteoarthritis, Osteoporosis, Cataracts.

Unit-IV

8 Hours

Mental health and well-being

Importance of Mental Health Awareness, Introduction to Anxiety, Stress, and Resilience; causes, symptoms and management of distress, Effects of Stress on Physical and Mental Health, Neurological disorders: Elementary idea on Parkinson's Disease, Dementia (Including Alzheimer's Disease), amyotrophic lateral sclerosis

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Reading:

- *Textbook of Preventive and Social Medicine - Banarsidas Bhanot Publishers, by K. Park*
- *Nutrition Science - New Age International Publishers, by B. Srilakshmi*
- *Principles of Anatomy and Physiology - Wiley, by G. J. Tortora & B. Derrickson*
- *Abnormal Psychology and Modern Life - Pearson, by R. C. Carson, J. N. Butcher, & S. Mineka*

Course Title: Digital Electronics	L	T	P	Cr.
Course Code: BCA4266	4	0	0	4

Total Hours:60**Course Learning Outcomes:** After the completion of the course the learner will be able to

- CO1. Classify the fundamental concepts and techniques used in digital electronics.
- CO2. Apply the principles of number system, binary codes and Boolean algebra to minimize logic expressions.
- CO3. Identify the basic requirements for designing an application.
- CO4. Analyze the various hazards in a digital design.

Course Content**UNIT I****15 hours**

Fundamental Concepts: Introduction to Analog and Digital Systems, Digital Signals, Basic Digital Circuits: AND, OR, NOT, NAND, NOR, XOR and XNOR gates. Boolean algebra Theorems, Characteristics of Digital IC. Number Systems: Positional and Non-positional number systems, Binary, Decimal, Octal and Hexadecimal, Base conversions, Binary arithmetic: Addition and Subtraction, 1's complement, 2's complement, subtraction using 1's complement and 2's complement.

UNIT II**15 hours**

Combinational Logic Design: SOP and POS Representation of Logic functions, K-Map representation and simplification up to 4 variable expressions, don't care condition. Multiplexers: 4X1, 8X1 and 16X1. De-multiplexers: 1 to 4, 1 to 8 and 1 to 16. BCD to Decimal decoder, Decimal to BCD encoder. Parity generator and Parity checker. Design of Half adder and Full adder.

UNIT III**15 hours**

Flip-Flops: Introduction, Latch, Clocked S-R Flip Flop, Preset and Clear signals, D-Flip Flop, J-K Flip Flop, The race-around condition, Master Slave J-K Flip Flop, D-Flip-Flop, Excitation Tables of Flip Flops. Edge- Triggered Flip Flops

UNIT IV**15 hours**

A/D and D/A Converters: Introduction, Digital to Analog Converters: Weighted-Register D/A converter, R-2R Ladder D/A converter. Analog to Digital Converters: Quantization and encoding, Parallel- comparator A/D converter, Counting A/D converter.

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Jain, R. P. (2003). *Modern digital electronics*. Tata McGraw-Hill Education.
- Maini, A. K. (2007). *Digital electronics: principles, devices and applications*. John Wiley & Sons.
- Pedroni, V. A. (2008). *Digital electronics and design with VHDL*. Morgan Kaufmann.
- Balch, M. (2003). *Complete digital design: a comprehensive guide to digital electronics and computer system architecture*. McGraw-Hill Education.

Course Title: Computer System Architecture	L	T	P	Cr.
Course Code: BCA4267	4	0	0	4

Total Hours:60

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Knowledge about the architecture of the central processing unit.
- CO2. Attain the knowledge of memory hierarchy.
- CO3. Exemplify various data transfer modes.
- CO4. Know about the concepts of Memory mapping and Cache memory.

Course Content

UNIT I

15 hours

Computer System Organization: CPU Organization, Instruction Execution (instruction cycle, types of instructions), RISC v/s CISC, Design Principles for Modern Computers, Instruction level parallelism. Processor level parallelism. Primary memory: Memory addresses, Byte Ordering, Error-correcting codes, Cache memory. Secondary memory: Memory hierarchy, SCSI disk, RAID.

UNIT II

15 hours

Instruction Set Architecture: Instruction formats, expanding op-codes, types of addressing modes, data transfer and manipulation instructions, Program control (status-bit conditions, conditional branch instructions, program interrupt, types of interrupt).

UNIT III

15 hours

Register Transfer Language: Register Transfer, Bus and memory transfer, Arithmetic micro operations, Logic micro-operations, shift micro-operations, Arithmetic logic shift unit Micro-programmed control, control word, control memory (concepts only).

UNIT IV

15 hours

Input-output Organization- I/O interfaces (I/O bus and interface modules, I/O versus memory bus, isolated versus memory-mapped I/O). Asynchronous Data transfer (strobe control, handshaking), modes of transfer (programmed I/O, interrupt-initiated I/O, software considerations), direct memory access

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Balch, M. (2003). Complete digital design: a comprehensive guide to digital electronics and computer system architecture. McGraw-Hill Education.
- Parhami, B. (2005). Computer architecture. Oxford University Press, New York, NY, USA

Semester – V

Course Title: Natural Language Processing	L	T	P	Cr.
Course Code: BCA5308	3	0	0	3

Total Hours: 45**Course Learning Outcomes:**After completion of this course, the learner will be able to:

- CO1. Learn the importance of natural language modelling.
- CO2. Understand the use of CFG and PCFG in NLP.
- CO3. Understand the role of semantics of sentences and pragmatic.
- CO4. Introduce Speech Production and Related Parameters of Speech.
- CO5. Show The Computation and Use of Techniques Such as Short Time Fourier Transform, Linear Predictive Coefficients and Other Coefficients in The Analysis of Speech.

Course Content**Unit I****10 hours**

Introduction: Definition of NLP, Origins and challenges of NLP, Language modeling: Grammar-based modeling, statistical modeling, Regular expressions, Finite Automata, Morphological Analysis, Transducers for lexicon and rules, Tokenization, Detecting and Correcting spelling errors, Minimum edit distance, Word Level Analysis:Unsmoothed n-grams, evaluating n-grams, smoothing, interpolation and backoff – word classes, part-of-speech tagging, rule-based, stochastic and transformation-based tagging, maximum entropy models.

Unit II**15 hours**

Syntactic Analysis:Context free grammars, grammar rules for English, treebanks, normal forms for grammar, dependency grammar, Top-down and Bottom-up Parsing, syntactic parsing, Ambiguities in NLP, dynamic programming parsing, shallow parsing, Probabilistic Context Top-down and Bottom-up Parsing Free Grammer (PCFG), probabilistic CYK, Lexicalized Probabilistic Context-Free Grammars, Porter Stemmer Technique.

Unit III**10 hours**

Semantics And Pragmatics:Requirements for representation, first-order logic, description logics – syntax-driven semantic analysis, semantic attachments – word senses, relations between senses, thematic roles, selectional restrictions – word sense disambiguation,

WSD using supervised, dictionary & thesaurus, bootstrapping methods – word similarity using thesaurus and distributional methods.

Unit IV

10 hours

Speech-Analysis & Speech Modeling: Features, feature extraction and pattern comparison techniques: speech distortion measures– mathematical and perceptual– log–spectral distance, cepstral distances, weighted cepstral distances and filtering, likelihood distortions, spectral distortion using a warped frequency scale, LPC, PLP and MFCC coefficients, time alignment and normalization – dynamic time warping, multiple time – alignment paths. Hidden Markov Models: Markov Chains, HMM, Likelihood Computation: The Forward Algorithm, Decoding: The Viterbi Algorithm, HMM Training: The Forward-Backward Algorithm.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning. Interactive lectures.

Suggested Reading

- Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014
- Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, O'Reilly Media, 2009.
- Lawrence Rabiner And Biing-Hwang Juang, “Fundamentals Of Speech Recognition”, Pearson Education, 2003.

Web Sources

- <https://web.stanford.edu/~jurafsky/slp3/A.pdf>
- <https://blog.gopenai.com/understanding-speech-processing-a-beginners-guide-to-lpc-plp-and-mfcc-27363d73de75>
- <https://www.geeksforgeeks.org/machine-learning/word-sense-disambiguation-in-natural-language-processing/programs.aspx>
- <https://www.geeksforgeeks.org/nlp/morphological-analysis-in-nlp/>

Course Title: Natural Language Processing Lab	L	T	P	Cr.
Course Code: BCA5309	0	0	2	1

Total Hours: 30

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Understand the preprocessing steps for NLP
- CO2. Apply Python libraries like NLTK for NLP to work on stop words, tokenization, corpus etc.
- CO3. Understand the importance of lemmatization and stemming concepts for NLP.
- CO4. Understand the process of applying NLP for various applications.

Course Content

1. Write a Python NLTK program to remove stop words from a given text.
2. Write a Python NLTK program to split the text sentence/paragraph into a list of words.
3. Write a Python NLTK program to tokenize sentences in languages other than English.
4. Write a Python NLTK program to create a list of words from a given string.
5. Write a Python NLTK program to list down all the corpus names.
6. Write a Python NLTK program to get a list of common stop words in various languages in Python.
7. Write a Python NLTK program to find the definition and examples of a given word using WordNet.
8. Write a Python NLTK program to find the sets of synonyms and antonyms of a given word.
9. Write the python code to develop Spam Filter using NLP
10. Write a Python NLTK program to find the number of male and female names in the name's corpus. Print the first 10 male and female names.
11. Write a Python program to demonstrate Lemmatization with NLTK.
12. Write a Python program to demonstrate Stemming with NLTK.
13. Write a Python Program for NLP analysis of Restaurant review.
14. Write a program for Twitter Sentiment Analysis using Python.
15. Write a program for Sentiment Analysis using VADER.

Course Title: Software Engineering	L	T	P	Cr.
Course Code: BCA5310	4	0	0	4

TotalHours:60

Learning Outcomes: After completion of this course, the learner will be able to:

CO1. Figure out the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction and deployment.

CO2. Review the techniques of software lifecycle.

CO3. Perform the various testing techniques.

CO4. Prepare the Documentation of Software Requirement Analysis (SRS).

Course Content

UNIT I

14 hours

Introduction: Software, Program, Software Crisis and Solutions, Software Evolution, Characteristics of good software, Software life cycle models: Build and Fix, Waterfall, Prototype, Iterative Enhancement, Rapid Application Development, Evolutionary, Prototyping, and Spiral Model.

UNIT II

16 hours

S/W Project Planning: Objectives, Decomposition techniques: S/W Sizing, Problem based estimation, Process based estimation Cost Estimation Models: COCOMO Model, the S/WEquation.

UNIT III

14 hours

System Analysis: Principles of Structured Analysis, Requirement analysis, DFD, Entity Relationship diagram, Data dictionary.

S/W Design: Objectives, Principles, Concepts, Design methodologies: Data design, Architectural design, procedural design, Cohesion and Coupling, Types of cohesion and coupling.

UNIT IV

16 hours

Testing fundamentals: Objectives, principles, testability, Test cases: White box & Black box testing.

Testing strategies: verification & validation, unit test, integration testing, validation testing, system testing

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Pressman S Roger (1992). Software Engineering, A Practitioner's Approach, Third Edition, McGraw Hill.*
- *Fairley E.R. (1985). Software Engineering Concepts, Mc Graw Hill.*
- *Jalota Pankaj (1992). An Integrated Approach to Software Engineering, Narosa Publishing House.*

Web Sources

- <https://www.geeksforgeeks.org/software-engineering/software-engineering-software-crisis/>
 - <https://www.geeksforgeeks.org/software-testing-techniques/>
- <https://www.geeksforgeeks.org/software-engineering-coupling-and-cohesion/>

CourseTitle:Minor Project	L	T	P	Cr.
CourseCode:BCA5311	0	0	4	2

TotalHours:60

Course Description:

The Minor Project course in the BCA AI & ML program enables students to practically apply the concepts and skills learned throughout their studies. Under the supervision of faculty mentors, students undertake a small-scale project that offers hands-on experience in areas such as software development, artificial intelligence, machine learning, problem-solving, and project management.

Course Title: Data Visualization	L	T	P	Cr.
Course Code: BCA5312	2	0	0	2

TotalHours:30

Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Identify and recognize visual perception and representation of data.
- CO2. Illustrate about projections of different views of objects.
- CO3. Apply various Interaction and visualization techniques.
- CO4. Analyze various groups for visualization. CO
- CO5. Evaluate visualizations

Course Content

UNIT I

08 hours

Introduction: Overview of visual perception, visual representation of data, Keys factors of Data Visualization, Exploring the Visual Data Spectrum: charting Primitives (Data Points, Line Charts, Bar Charts, Pie Charts, Area Charts), Gestalt principles, Information overload, Exploring advanced Visualizations (Candlestick Charts, Bubble Charts, Surface Charts, Map Charts, Infographics), Applications of Data Visualization.

UNIT II

07 hours

Visual Representation- Tables: Creating visual representations, visualization reference model, making use of HTML5 CANVAS, Integrating SVG, visual mapping, visual analytics, Design of visualization applications, Reading Data from Standard text files (.txt, .csv, XML). Introduction to D3.js: Getting setup with D3, making selections, changing selection's attribute.

UNIT III

07 hours

Advanced Data Visualization: Making charts interactive and Animated: Data joins, updates and exits, interactive buttons, updating charts, adding transactions, using keys Adding a Play Button: wrapping the update phase in a function, adding a Play button to the page, Making the Play button go, Allow the user to interrupt the play, sequence.

UNIT IV

08 hours

Information Dashboard Design: Introduction, Dashboard design issues and assessment of needs, Considerations for designing dashboard-visual perception, achieving eloquence, Advantages of Graphics _Library of Graphs, Designing Bullet Graphs, Designing Sparklines, Dashboard Display Media, Critical Design Practices, putting it all together - Unveiling the dashboard.

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Tamara Munzner, *Visualization Analysis and Design (VAD)*, CRC press, 2014.
- Claus O. Wilke, *Fundamentals of Data Visualization A Primer on Making Informative and Compelling Figures*, 2019.
- Julie Steele, Noah Iliinsky, *Beautiful Visualization Looking at Data through the Eyes of Experts*, 2010
- Nathan Yau, *Data Points: Visualization that means something*, Wiley, 2013.
- Gert H. N. Laursen and Jesper Thorlund, *Business Analytics for Managers: Taking business intelligence beyond reporting*, Wiley, 2010.

Web Sources

- <https://www.geeksforgeeks.org/data-visualization-and-its-importance/>
- <https://www.tutorialspoint.com/How-to-draw-an-SVG-file-on-an-HTML5-canvas>
- <https://www.geeksforgeeks.org/software-engineering-coupling-and-cohesion/>

Course Title: Data Visualization Lab	L	T	P	Cr.
Course Code: BCA5313	0	0	4	2

Total Hours: 60

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Use Python, R and Tableau for data visualization
- CO2. Apply data visuals to convey trends in data over time using tableau
- CO3. Construct effective data visuals to solve workplace problems
- CO4. Explore and work with different plotting libraries
- CO5. Learn and create effective visualizations.

Course Content

1. Introduction to various Data Visualization tools.
2. Introduction to Tableau and Installation
3. Basic Visualization in Python.
4. Visualization of datasets in terms of Line Chart, Area Chart, Bar Chart, Pie Chart, histogram, scatterplot, violin plot etc.
5. Basic Visualization in R.
6. Connecting to Data and preparing data for visualization in Tableau
7. Presenting the working of dataset with Pivot Tables and Pivot Chart
8. Data Aggregation and Statistical functions in Tableau
9. Creating Visualizations in Tableau
10. Interactive Development of dashboard

Course Title: Internship	L	T	P	Cr.
Course Code: BCA5304	0	0	0	4

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Demonstrate the ability to work in an AI/ML-related industrial environment.
- CO2. Apply analytical and technical skills to real-world datasets and problems.
- CO3. Develop and document project deliverables aligned with industry standards.
- CO4. Exhibit professional behavior, including time management, communication, and collaboration.

Course Description

The Internship course is designed to provide students with practical exposure to real-world applications of Artificial Intelligence (AI) and Machine Learning (ML) in an organizational or industrial setting. Through this hands-on experience, students are expected to apply the theoretical knowledge gained during the program to solve real-life problems, develop AI/ML models, or contribute to software solutions in a professional environment. The internship fosters technical proficiency, professional skills, and industry readiness by bridging the gap between academic learning and industry practices.

Course Title: Social Media Analytics	L	T	P	Cr.
Course Code: BCA5314	4	0	0	4

TotalHours:60

Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Understand and identify the various components of a web that can be used for mining process.
- CO2. Discover interesting patterns from Social Media Networks.
- CO3. Understand the structure of the web and the processes of Web crawling to create web applications.
- CO4. Analyze the emerging problems of social media analytics with sentiment analysis and opinion mining.

Course Content

UNIT I

15 hours

Introduction: Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas Network fundamentals and models: The social networks perspective - nodes, ties and influencers, social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization.

UNIT II

15 hours

Making Connections: Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity. Web analytics tools: Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis.

UNIT III

15 hours

Text Mining in Social Networks: Introduction, Keyword search, Classification Algorithms, Clustering Algorithms-Greedy Clustering, Hierarchical clustering, k-means clustering, Transfer Learning in heterogeneous Networks, Sampling of online social networks, Comparison of different algorithms used for mining, tools for text mining.

UNIT IV

15 hours

Visualizing Data and Individual Behavior: Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification, Collecting and analyzing

social media data; visualization and exploration, Individual Behavior Analysis, Individual Behavior Modeling Case Study of Facebook Mining and Twitter Mining.

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Matthew Ganis, Avinash Kohirkar, Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media, Pearson 2016.*
- *Jim Sterne, Social Media Metrics: How to Measure and Optimize Your Marketing Investment, Wiley Latest edition.*
- *Oliver Blanchard, Social Media ROI: Managing and Measuring Social Media Efforts in Your Organization (Que Biz-Tech), Que Publishing Latest edition*
- *Marshall Sponder, Social Media Analytics, McGraw Hill, Latest edition*
- *Tracy L. Tuten, Michael R. Solomon, Social Media Marketing, Sage, Latest edition*

Web Sources

- <https://www.spiceworks.com/marketing/advertising/articles/what-is-social-media-analytics/>
- https://www.slideshare.net/ben_luttrull/making-connections-through-social-media
- <https://headframe.io/en/blog-en/comparing-different-mining-algorithms/>
- <https://www.geeksforgeeks.org/data-visualization-and-its-importance/>

Course Title: Probability and Statistics	L	T	P	Cr.
Course Code: BCA5315	4	0	0	4

TotalHours:60

Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.
- CO2. Define and explain the different statistical distributions (e.g., Normal, Binomial, Poisson) and the typical phenomena that each distribution often describes.
- CO3. Define and demonstrate the concepts of estimation and properties of estimators.
- CO4. Apply the concepts of interval estimation and confidence intervals.

Course Content

UNIT I

15 hours

Algebra of Sets: sets and classes, limit of a sequence of sets, rings, sigma rings, fields, sigma-fields, monotone classes, Probability: Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' Theorem and independence, problems,

UNIT II

15 hours

Random Variables: Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, probability and moment generating function, median and quantiles, Markov inequality, Chebyshev's inequality, problems, Function of a random variable, problems.

UNIT III

15 hours

Special Distributions: Discrete uniform, binomial, geometric, negative binomial, hypergeometric, Poisson, continuous uniform, exponential, gamma, Weibull, Pareto, beta, normal, lognormal, inverse Gaussian, Cauchy, double exponential distributions, reliability and hazard rate, reliability of series and parallel systems, problems, Joint Distributions: Joint, marginal and conditional distributions, product moments, correlation and regression, independence of random variables, bivariate normal distribution, problems.

UNIT IV

15 hours

Transformations: functions of random vectors, distributions of order statistics, distributions of sums of random variables, problems, Descriptive Statistics: Graphical representation, measures of locations and variability, Estimation: Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions, problems.

Transactional Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *An Introduction to Probability and Statistics by V.K. Rohatgi & A.K. Md.E.Saleh.*
- *Introduction to Probability and Statistics by J.S. Milton & J.C.Arnold.*
- *Introduction to Probability Theory and Statistical Inference by H.J. Larson.*
- *Introduction to Probability and Statistics for Engineers and Scientists by S.M. Ross*
- *Probability and Statistics in Engineering by W.W. Hines, D.C. Montgomery, D.M. Gpldsman & C.M.Borrer*

Web Sources

- <https://www.itl.nist.gov/div898/handbook/eda/section3/eda366c.htm>
- https://en.wikipedia.org/wiki/Algebra_of_sets
- https://www.probabilitycourse.com/chapter3/3_1_5_special_discrete_distr.php
- <https://www.cuemath.com/geometry/transformations/>

Semester – VI

Course Title: Artificial Intelligence	L	T	P	Cr.
Course Code: BCA6360	3	0	0	3

Total Hours: 45

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Explain advanced concepts in artificial intelligence including deep learning, reinforcement learning, and probabilistic models.
- CO2. Analyze the architecture and working of models such as CNNs, RNNs, Transformers, and GANs.
- CO3. Implement and evaluate AI techniques in computer vision, NLP, and decision-making systems.
- CO4. Analyze the convergence, complexity, and learning dynamics of machine learning algorithms.

Course Content**Unit I****10 hours**

Advanced Machine Learning : Ensemble Learning (Bagging, Boosting, Stacking), Feature Engineering Techniques, Hyperparameter Tuning (Grid Search, Random Search, Bayesian Optimization), Deep Learning Architectures : Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTMs), Transformers and Attention Mechanism.

Unit I**15 hours**

Natural Language Processing (NLP): Text Processing and Tokenization, Word Embeddings (Word2Vec, GloVe, BERT), Sentiment Analysis and Text Classification, Named Entity Recognition (NER) and Sequence Labeling. Computer Vision: Image Classification and Object Detection, Image Segmentation and GANs, Face Recognition and Transfer Learning, OpenCV for Image Processing.

Unit III**10 hours**

Reinforcement Learning : Markov Decision Process (MDP) , Q-Learning and Deep Q Networks (DQN) , Policy Gradient Methods , Applications in Game AI and Robotics AI for Big Data : Handling Large Datasets with AI , AI and Cloud Computing (Google Cloud AI, AWS AI) , Scalable AI with Apache Spark AI Ethics and Bias : Ethical AI Considerations , Bias in AI Models , Explainable AI (XAI) .

Unit IV**10 hours**

AI Model Deployment and Optimization: Deploying AI Models with Flask and FastAPI, Optimization for Real-Time AI Systems, AI in Edge Computing. Advanced AI Applications: AI in Healthcare, AI in Finance (Fraud Detection, Trading Algorithms), AI in Autonomous Systems (Self-driving Cars, Drones), AI for Cybersecurity.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning. Interactive lectures.

Suggested Reading:

- *“Artificial Intelligence: A Modern Approach” (3rd or 4th Edition) by Stuart Russell & Peter Norvig*
- *“Deep Learning” by Ian Goodfellow, Yoshua Bengio, and Aaron Courville*
- *Reinforcement Learning: An Introduction” by Richard S. Sutton & Andrew G. Barto*
- *Probabilistic Graphical Models: Principles and Techniques” by Daphne Koller & Nir Friedman*
- *Pattern Recognition and Machine Learning” by Christopher Bishop*

Web Sources

- <https://arxiv.org/list/cs.AI/recent>
- <https://paperswithcode.com>
- <https://deepai.org>
- <https://ai.googleblog.com>
- <https://ocw.mit.edu>

Course Title: Neural Networks	L	T	P	Cr.
Course Code: BCA6361	3	0	0	3

Total Hours: 45

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Obtain the fundamentals and types of neural networks. The student will have a broad knowledge in developing the different algorithms for neural networks.
- CO2. Analyze neural controllers
- CO3. Have a broad knowledge in Fuzzy logic principles and will be able to determine different methods of Defuzzification.

Course Content

UNIT I

10 Hours

Introduction to Artificial Intelligence System: Neural Network, Fuzzy logic, Genetic Algorithm. **Fundamentals of Neural Networks:** What is Neural Network, Model of Artificial Neuron, Learning rules and various activation functions. **Neural Network Architecture:** Single layer Feed-forward networks. Multilayer Feed-forward networks. Recurrent Networks.

UNIT II

10 hours

Back propagation Networks: Back Propagation networks, Architecture of Back-propagation(BP) Networks, Back-propagation Learning, Variation of Standard Back propagation algorithms. **Associative Memory:** Autocorrelators, Heterocorrelators, Wang et al's Multiple Training Encoding Strategy, Exponential BAM, Associative Memory for Real coded pattern pairs, Applications.

UNIT III

15 hours

Adaptive Resonance Theory: Cluster Structure, Vector Quantization, Classical ART Network, Simplified ART Architecture, ART1 and ART2 Architecture and algorithms, Applications, Sensitivities of ordering of data. **Introduction about Fuzzy set theory:** Fuzzy versus Crisp, Crisp and fuzzy sets, Crisp and Fuzzy relations.

UNIT IV

10 hours

Fuzzy Systems: Crisp Logic, Predicate Logic, Fuzzy logic, Fuzzy rule based system, Defuzzification Methods, Applications. Integration of Neural Network, Fuzzy logic and

Genetic Algorithm: Hybrid system. Neural Networks, Fuzzy logic, and Genetic Algorithm Hybrids.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning. Interactive lectures

Suggested Readings

- *Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995.*
- *Neural Networks, Fuzzy Logic and Genetic Algorithms, by S. Rajasekaran and G.A. Vijayalakshmi Pai.*
- *. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI.*
- *Build_Neural_Network_With_MS_Excel_sample by Joe choong.*

Course Title: Artificial Intelligence Lab	L	T	P	Cr.
Course Code: BCA6362	0	0	2	1

Total Hours: 30**Course Learning Outcomes:** After the completion of the course the learner will be able to

- CO1. Understand the fundamentals of knowledge representation, inference
- CO2. Understand the fundamentals of theorem proving using AI tools.
- CO3. Develop a given program using the basic elements like control statements.
- CO4. Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information

Course Content

1. Implementation of toy problems
2. Developing agent programs for real world problems
3. Implementation of constraint satisfaction problems
4. Implementation and Analysis of DFS and BFS for an application
5. Developing Best first search and A* Algorithm for real world problems
6. Implementation of minimax algorithm for an application
7. Implementation of unification and resolution for real world problems.
8. Implementation of knowledge representation schemes - use cases
9. Implementation of uncertain methods for an application
10. Implementation of block world problem
11. Implementation of learning algorithms for an application
12. Development of ensemble model for an application
13. Expert System case study
14. Implementation of NLP programs
15. Applying deep learning methods to solve an application.

Course Title: Neural Networks Lab	L	T	P	Cr.
Course Code: BCA6363	0	0	2	1

Total Hours:30

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Understand the working of artificial neurons and simulate them using computational models.
- CO2. Apply various learning rules such as the Perceptron and Backpropagation to train neural networks.
- CO3. Analyze the impact of activation functions (Sigmoid, Tanh, ReLU) on neural network performance and convergence.
- CO4. Perform fuzzy set operations and understand the differences between crisp and fuzzy logic systems.

Course Content

1. Implementation of an Artificial Neuron Model
 2. Perceptron Learning Rule for Linearly Separable Data
 3. Backpropagation Algorithm for XOR Problem
 4. Comparison of Activation Functions (Sigmoid, Tanh, ReLU)
 5. Design and Simulation of a Recurrent Neural Network
 6. Auto-associative Memory Network Implementation
 7. Hetero-associative Memory Network Implementation
 8. Variations of Backpropagation Algorithms (Momentum, RMSprop)
 9. Fuzzy Set Operations: Union, Intersection, Complement
 10. Fuzzy Relations and Their Composition
 11. Design of a Mamdani Fuzzy Inference System
 12. Implementation of Defuzzification Methods (Centroid, MOM, Bisector)
 13. Basic Genetic Algorithm for Function Optimization
 14. Genetic Algorithm for Solving the Travelling Salesman Problem
- Design of a Neuro-Fuzzy Inference System (ANFIS)

Course Title: Multimedia And Its Applications	L	T	P	Cr.
Course Code: BCA6364	2	0	0	2

Total Hours:30

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. To understand the technologies behind multimedia applications
- CO2. To learn representations, perceptions and applications of Multimedia
- CO3. To understand the basic concepts of Multimedia Systems

Course Content

Unit -I

Hours 7

Definition - Classification - Multimedia application -Multimedia Hardware - Multimedia software - CDROM - DVD. Multimedia Audio: Digital medium - Digital audio technology - sound cards - recording - editing - MP3 - MIDI fundamentals - Working with MIDI - audio file formats - adding sound to Multimedia project.

Unit – II

Hours 8

Multimedia Text: Text in Multimedia -Multimedia graphics: coloring - digital imaging fundamentals - development and editing - file formats - scanning and digital photography

Unit- III

Hours 8

Multimedia Animation: Computer animation fundamentals - Kinematics - morphing - animation s/w tools and techniques. Multimedia Video : How video works - broadcast video standards - digital video fundamentals – digital video production and editing techniques - file formats.

Unit- IV

Hours 7

Multimedia Project : stages of project - Multimedia skills - design concept - authoring - planning and costing –Multimedia Team. Multimedia-looking towards Future: Digital Communication and New Media, Interactive Television, Digital Broadcasting, Digital Radio, Multimedia Conferencing

TransactionalMode

Lecture Method, E-Team Teaching, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, and Collaborative Learning.

Suggested Readings:

- *Kiran Thakrar, Prabhat k.andleigh, “Multimedia System Design”, Prentice Hall India.*
- *Malay k Pakhira, “Computer graphics, Multimedia and Animation”, Prentice Hall India, 2 nd Edition.*
- *NPTEL & MOOC courses titled Multi media*
- *<https://nptel.ac.in/courses/106105163/>*
- *W3schools.com/html/html-media.asp*

Course Title: Multimedia & its Applications Lab	L	T	P	Cr.
Course Code: BCA6365	0	0	4	2

Total Hours:60

Course Learning Outcomes: After the completion of the course the learner will be able to

- CO1. Understand the core components of multimedia systems, including text, audio, video, images, and animation.
- CO2. Identify and use multimedia hardware devices, such as microphones, sound cards, scanners, and digital cameras.
- CO3. Install and operate multimedia software tools for creating, editing, and integrating various media types.
- CO4. Author multimedia presentations that combine different media types using suitable tools and design principles

Course Content

1. Study and classification of multimedia components (text, image, audio, video, animation)
2. Installation and use of multimedia software tools like Photoshop, Audacity, GIMP, Premiere, Flash
3. Study of multimedia hardware components such as sound cards, microphones, video capture devices, scanners
4. Comparative study of CD-ROM and DVD technology in terms of storage and access speed
5. Recording and editing audio using software like Audacity
6. Converting audio to MP3 format and analyzing compression effects
7. Creating and editing MIDI audio files using tools like LMMS or GarageBand
8. Adding background music and sound effects to multimedia presentations
9. Formatting and designing text for use in multimedia projects (fonts, colors, layout)
10. Image editing and file format conversion using tools like Photoshop or GIMP
11. Scanning photographs and enhancing them using digital editing techniques
12. Creating basic 2D animation using animation software like Adobe Animate or Pencil2D
13. Implementing morphing and kinematics-based animation techniques
14. Editing digital video clips, adding transitions and effects, and exporting in different formats
15. Developing a complete multimedia project combining text, images, audio, video, and

animation using authoring tools

Course Title: Major Project	L	T	P	Cr.
Course Code: BCA6354	0	0	8	4

Total Hours:120

Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Update oneself with all the latest changes in the technological world.
- CO2. Become master in one's specialized technology.
- CO3. Analyze and understand the environment of the organization.
- CO4. Develop to cognizance of the importance of management principles

Course Title: Indian Education	L	T	P	Cr.
Course Code: IKS0002	2	0	0	2

Total Hours:30

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Understand development of education and their historical importance in India.
- CO2. To know about the education system in ancient era, buddha era their relation and knowledge.
- CO3. To understand the commission for development of education, committee and their importance.
- CO4. To understand the problems about education.

Unit-1

7 Hours

Education in Vedic Period, Buddhist period and its characteristics and importance of present time. Education system in medieval period its importance, main education center and important factors.

Unit-II

8 Hours

Education in colonial period charter act 1813, Oriental accidental education controversy Macaulays Minutes, wood dispatch Hunter commission, Gokhle's bill, sadler commission, Vardha Scheme of Education and Sargent plan.

Unit-III

8 Hours

University education commission (1948-49), Secondary education commission (1952-53), education commission (1964-66), National policy of education (1986) Revised Policy of Education, University education commission (1948-49), Secondary education commission (1952-53), education commission (1964-66), National policy of education (1986) Revised Policy of Education (1992) and their importance.

Unit-IV

7 Hours

Universalization of Primary education Vocationalisation of Secondary Education, Student peace and balance in education occasion.

Transactional modes

Lecture Method, E-Team Teaching, Video-based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Aggarwal, J.C., *Landmarks in the History of Modern Indian Education*. Vikas Publishing House
- Mitra, S.K., *Education in Ancient India*, Asha Jyoti Book Sellers
- Mukherjee, S.N., *History of Education in India: Modern Period*, Acharya Book Depot
- Keay, F.E., *Indian Education in Ancient and Later Times*, Oxford University Press
- Sharma, R.A., *Development of Educational System in India*, R. Lall Book Depot

Course Title: Big Data	L	T	P	Cr.
Course Code: BCA6366	4	0	0	4

Total Hours:60**Course Learning Outcomes:** After completion of this course, the learner will be able to:

- CO1. Discuss the building blocks of Big Data.
- CO2. Articulate the programming aspects of cloud computing
- CO3. Represent the analytical aspects of Big Data
- CO4. Knowledge about the recent research trends related to Hadoop File System, Map Reduce and Google File System etc.

Course Content**UNIT-1****Hours 16**

Introduction to Big Data: Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis Vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - ReSampling - Statistical Inference - Prediction Error

UNIT-2**Hours 14**

Mining Data Streams: Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real Time Analytics Platform (RTAP) Applications -- Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

UNIT-3**Hours 14**

Hadoop Environment: History of Hadoop- The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with HadoopScaling Out- Hadoop Streaming- Design of HDFS-Hadoop file systemsJava interfaces to HDFS- Basics-Developing a Map Reduce ApplicationHow Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features - Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation – Hadoop ConfigurationSecurity in Hadoop

UNIT-4**Hours 16**

Data Analysis Systems and Visualization: Link Analysis – Page Rank - Efficient Computation of Page Rank- Topic-Sensitive Page Rank – Link Spam- Recommendation

Systems- A Model for Recommendation Systems Content-Based Recommendations - Collaborative Filtering Dimensionality Reduction- Visualizations - Visual data analysis techniques-interaction techniques- Systems and applications.

Transactional Mode

Lecture Method, E-Team Teaching, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, and Collaborative Learning.

Suggested Reading:

- Chris Eaton, (2012). *Dirk derooet al., Understanding Big data*, McGraw Hill.
- Tom White, (2012). *HADOOP: The definitive Guide*, O Reilly.
- Hurwitz, J., Nugent, A., Halper, F., & Kaufman, M. (2013). *Big data for dummies* (Vol. 336). Hoboken, NJ: John Wiley & Sons.

Web Sources

- <https://www.javatpoint.com/what-is-big-data>
- <https://www.guru99.com/what-is-big-data.html>
- <https://www.geeksforgeeks.org/what-is-big-data/>
- <https://cloud.google.com/learn/what-is-big-data>

Course Title: Software Project Management	L	T	P	Cr.
Course Code: BCA6367	4	0	0	4

Total Hours:60

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Identify the different project contexts and suggest an appropriate project management strategy
- CO2. Practice the role of project planning, risks associated in successful software development.
- CO3. Identify and describe the key phases of project monitoring and contracts in management.
- CO4. Learn to apply the concept of project management and planning on organizing a team and people's behavior.

Course Content

UNIT-I

Hours 16

Introduction to Software Project Management: Project Definition, Contract Management, Activities Covered by Software Project Management, Overview of Project Planning, plan methods, methodology. Project Evaluation: Strategic Assessment, Technical Assessment, Cost Benefit Analysis, Cash Flow Forecasting, Cost Benefit Evaluation Techniques, Risk Evaluation, selection of project approach: discussion on models, choice of process models.

UNIT-II

Hours 14

Activity Planning: Objectives, Project Schedule, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass, Backward Pass, Activity Float, Shortening Project Duration, Activity on Arrow Networks, Risk Management: Nature of Risk, Types of Risk, Managing Risk, Hazard Identification, Hazard Analysis, Risk Planning and Control.

UNIT-III

Hours 14

Monitoring and Control: Creating Framework, Collecting the Data, Visualizing Progress, Cost Monitoring, Earned Value analysis, Prioritizing Monitoring, Getting Project Back to Target, and Change Control. Managing Contracts: Introduction, Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance. Resource allocation: introduction and nature of resources, identification of resource requirements, scheduling, creating critical path, cost schedule, counting cost.

UNIT-IV

Hours 16

Effort estimation: basics of software estimation, techniques, COCOMO-II, cost, staffing pattern. Managing People and Organizing Teams: Introduction, Understanding Behavior, Organizational Behavior: Background, Selecting The Right Person For The Job, Instruction In The Best Methods, Motivation , The Oldman, Hackman Job Characteristics Model, Working In Groups, Becoming A Team, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety.

Transactional Mode

Lecture Method, E-Team Teaching, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, and Collaborative Learning.

Suggested Reading:

- *Bob Hughes, Mike Cotterell, Software Project Management, Tata McGraw Hill Publishing*
- *Ramesh, Gopalaswamy, Managing Global Projects, Tata McGraw Hill Publishing*
- *Royce, Software Project Management, Pearson Education Publishing Thomas, S Chand.*
- *Jalote, Software Project Management in Practice, Pearson Education Publishing*

Web Sources

- https://www.tutorialspoint.com/software_engineering/software_project_management.html
- <https://www.wrike.com/project-management-guide/faq/what-is-effortestimation/>