FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

FACULTY OF COMPUTER APPLICATIONS

Bachelor of Computer Applications

BCA - Artificial Intelligence and Data Science

Outcome Based Curriculum &Syllabus

REGULATION 2025

(For the Students admitted from 2025-26 onwards)

Dr. M.G.R

EDUCATIONAL AND RESEARCH INSTITUTE

(Deemed to be university)

University with Graded Autonomy Status

Maduravoyal, Chennai-600095, Tamil Nadu, India

(An ISO 9001:2015 Certified Institution)

DECLARATION

I, **Dr. Viji Vinod** Head of **Faculty of Computer Applications**, hereby declare that this copy of the syllabus for **Bachelor of Computer Applications** BCA - Artificial Intelligence and Data Science **(BCA-AI&DS)** Full time **2025 Regulation** from page no. 1 to 215 is the final version which is being taught in the class and uploaded in our University website. I assure that the Syllabus available in our University website is verified and found correct. The Curriculum and Syllabus has been approved by our Academic Council / Vice Chancellor.

Date:

Signature

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

Faculty of Computer Applications

VISION

To become a leading centre for computer applications, fostering an environment of constant learning and innovation.

MISSION

M1 : To create and maintain an environment for the pursuit of academic excellence with the use of computing technology.

M2 :. To develop intellectual strength of students and guiding them towards technical, professional and entrepreneurship excellence.

M3 : To nurture analytical skills, inter- personal skills and build higher level of attitude, ethics and confidence.

M4 : To identify areas of cooperation with Industries and Institutions and implement them well within time-frame to mutual advantage and satisfaction.

M5 : Collaborate with industry and other agencies for academic and research programs.

QUALITY POLICY:

Imparting quality education and achieve academic excellence through planning, leadership, brilliance, inspiration and effectiveness.

PROGRAM EDUCATION OBJECTIVE: PEO

PEO 1: To demonstrate a sound knowledge in key areas of Computer Sciences and Industrial Computing

PEO 2: To demonstrate a substantial understanding of concepts in key areas of Computer Sciences

PEO 3: To carry out the required analysis and synthesis involved in Computer Systems, Information systems and Computer Applications

PEO 4: To demonstrate professional competence in developing software and in its design and implementation.

PEO 5: To develop sound Practical Skills to enable them to addressing problems which arise from Computer systems and Applications.

PROGRAM OUTCOME: POs

PO1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.

PO2: Communication Skills: Ability to understand and express thoughts and ideas effectively in writing and orally; and present complex information in a clear and concise manner to different groups.

PO3: Critical and Reflective thinking: Capability to apply analytic thought to analyze and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach. Critical sensibility, with self awareness and reflexivity of both self and society.

PO4: Research-related skills : Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation.

PO5: Team work and Leadership qualities : Function effectively as an individual, and as a team member or leader in diverse teams, and in multidisciplinary environment.

PO6: Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data and further presentation.

PO7: Multicultural competence and knowledge of heritage: Possess knowledge of the values and beliefs of multiple cultures to effectively engage globally in a multicultural society and interact respectfully with diverse groups. Ability to understand and propagate heritage values.

PO8: Moral and ethical awareness: Ability to embrace moral/ethical values in conducting one‘s life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.

PO9: Life long learning: Ability to update knowledge and skills, participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

PROGRAM SPECIFIC OUTCOME: PSOs

PSO 1 : Logical and Problem Solving Skills :
Ability to analyse the software problem and design, formulate and obtain solution to the problem through learning of Mathematical fundamentals to problem solving.

PSO 2 : Project based learning : Ability to develop information and Computing skills through innovative techniques in modern IT environment to become an IT Professional or for higher studies.

PSO 3: Social Responsibility and Environment Awareness : An understanding of computational Professionalism through leadership and team building by means of environmental awareness and social responsibility.

PSO 4 : Business, Entrepreneurial and Industrial Knowledge : Ability to cultivate industrial business through learning of entrepreneurship.

Mapping PEOs with Mission

PEOs	M1	M2	M3	M4	M5
PEO1	3	3	2	3	3
PEO2	3	3	1	3	3
PEO3	2	3	2	3	3
PEO4	2	3	3	3	3
PEO5	3	3	2	3	3

Mapping PEOs with POs & PSOs

PEOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
PEO1	2	3	1	3	2	3	3	2	3	2	3	1	3
PEO2	3	3	3	3	3	3	3	3	3	3	3	3	3
PEO3	2	3	2	3	2	3	3	2	3	2	3	2	3
PEO4	3	3	3	3	3	3	3	3	3	3	3	3	3
PEO5	2	3	1	3	2	3	3	2	3	3	3	3	3

Strength of Correction: 3-High, 2-Medium, 1-Low

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

Table 1: Semester wise Credit Distribution Format: BCA - AI&DS 2025

Semester	Core Courses	Ability Enhancement Courses	Multi-Disciplinary Elective course	Value Added Courses	Skill Enhancement Courses	Discipline Specific Elective	Total
I	3	2	2	2	10	0	19
II	14	0	0	2	5	0	21
III	11	0	0	2	4	3	20
IV	10	0	0	0	7	3	20
V	0	0	0	0	6	15	21
VI	4	1	0	0	4	10	19

Category-wise distribution

Description	Core Courses	Ability Enhancement Courses	Multi-Disciplinary Elective course	Value added Courses	Skill Enhancement courses	Discipline Specific Elective	Total
BCA-AI&DS	42	3	2	6	36	31	120

***3 Years BCA – AI& DS Program Total credits: 120**

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

Table 2 LISTOF DISCIPLINE SPECIFIC ELECTIVES – Appendix I

S. No	Course Code	Course Title	L	T	P	Credit	Exam
1	CBCA25E01	Basics of Data Analytics using spreadsheet	2	0	2	3	ETL
2	CBCA25E02	Data visualization	2	0	2	3	ETL
3	CBCA25E03	Introduction to Data Science	3	0	0	3	TY
4	CBCA25E04	Data mining and warehousing	3	0	0	3	TY
5	CBCA25E05	Mobile Computing	3	0	0	3	TY
6	CBCA25E06	Information Security	3	0	0	3	TY
7	CBCA25E07	Software Project Management	3	0	0	3	TY
8	CBCA25E08	Internet of things	3	0	0	3	TY
9	CBCA25E09	Management Information System	3	0	0	3	TY
10	CBCA25E10	Open Source Programming	4	1	0	5	TY
11	CBCA25E11	Software Testing	4	1	0	5	TY
12	CBCA25E12	Business Intelligence & Analytics	4	1	0	5	TY
13	CBCA25E13	Cloud computing for data analytics	3	0	4	5	ETL
14	CBCA25E14	Big data Analytics	3	0	4	5	ETL
15	CBCA25E15	Introduction to ML	3	0	4	5	ETL
16	CBCA25E16	Data Security and Privacy	4	1	0	5	TY
17	CBCA25E17	Natural Language Processing	3	0	4	5	ETL
18	CBCA25E18	Digital Image Processing	4	1	0	5	TY
19	CBCA25E19	Augmented Reality & Virtual Reality	4	1	0	5	TY
20	CBCA25E20	Block Chain Technology	4	1	0	5	TY
21	CBCA25E21	Time Series Analysis	3	0	4	5	ETL

22	CBCA25E22	Deep Learning with Python	3	0	4	5	ETL
23	CBCA25E23	Thinking Restful Services	3	0	4	5	ETL
24	CBCA25E24	Deep Learning with Watson	3	0	4	5	ETL
25	CBCA25E25	Building Application using LLM-L1	3	0	4	5	ETL
26	CBCA25E26	Building Application using LLM-L2	3	0	4	5	ETL

Table 3: List of Indian Knowledge System - Appendix II

S. No	Course Code	Course Title	L	T	P	Credit	Exam
1.	CBCA25MD1	Indian Knowledge Systems and Traditions	2	0	0	2	IE
2.	CBCA25MD2	Indian Culture and Civilization	2	0	0	2	IE
3.	CBCA25MD3	Indian Vision for Human Society (Vishva Kalyan thru Vasudhaiva Kutumbkam)	2	0	0	2	IE
4.	CBCA25MD4	Indian Science, Engineering and Technology (Past, Present and Future)	2	0	0	2	IE
5.	CBCA25MD5	Indian Town Planning and Architecture	2	0	0	2	IE
6.	CBCA25MD6	Indian Mathematics and Astronomy	2	0	0	2	IE
7.	CBCA25MD7	Indian Aesthetics (including Music and Music Instruments)	2	0	0	2	IE
8.	CBCA25MD8	Indian Health, Wellness and Psychology (including Ayurved)	2	0	0	2	IE

Table 4: List of Indian or Foreign Language I & II Appendix III

S. No	Course Code	Course Title	L	T	P	Credit	Exam
1.	CBCA25A02	TAMIL - I	1	1	0	0*	IE
2.	CBCA25A03	HINDI -I	1	1	0	0*	IE
3.	CBCA25A04	SANSKRIT- I	1	1	0	0*	IE
4.	CBCA25A05	FRENCH -I	1	1	0	0*	IE
5.	CBCA25A06	GERMAN -I	1	1	0	0*	IE
6.	CBCA25A07	JAPANESE -I	1	1	0	0*	IE
7.	CBCA25A08	SPANISH -I	1	1	0	0*	IE
8.	CBCA25A10	TAMIL- II	1	1	0	0*	IE
9.	CBCA25A11	HINDI - II	1	1	0	0*	IE
10.	CBCA25A12	SANSKRIT- II	1	1	0	0*	IE
11.	CBCA25A13	FRENCH - II	1	1	0	0*	IE
12.	CBCA25A14	GERMAN - II	1	1	0	0*	IE
13.	CBCA25A15	JAPANESE - II	1	1	0	0*	IE
14.	CBCA25A16	SPANISH - II	1	1	0	0*	IE

Table 5: Yoga/Sports/NCC/NSS/Disaster Management - Appendix IV

S. No	Course Code	Course Title	L	T	P	Credit	Exam
1.	CBCA25VA3	Yoga	0	0	4	2	IE
2.	CBCA25VA4	Sports	0	0	4	2	IE
3.	CBCA25VA5	NCC	0	0	4	2	IE
4.	CBCA25VA6	NSS	0	0	4	2	IE
5.	CBCA25VA7	Disaster Management	0	0	4	2	IE

GENERAL COURSE STRUCTURE AND THEME

A. Definition of Credit

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hr. Practical (P) per week	2 Credit

B. Course Code and Definition

Course Code	Definition
L	Lecture
T	Tutorial
P	Practical
C	Core Courses
A	Ability Enhancement Courses
MD	Multi-Disciplinary Elective Courses
VA	Value Added Courses
S	Skill Enhancement Courses
E	Discipline Specific Elective
OE	Open Elective

FACULTY OF COMPUTER APPICATIONS

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Program Structure for BCA AI & DS (Full Time)

SEMESTER I

S. No	Course Code	Course Title	L	T	P	Credit	Exam
3 weeks compulsory induction program (UVH – I)							
1	CBCA25C01	Mathematics Foundations to Computer Science-I	3	0	0	3	TY
2	**CBAD25S01**	**Python for Data Science**	**3**	**0**	**4**	**5**	ETL
3	CBCA25S02	Introduction to Digital Office	3	0	4	5	ETL
4	CBCA25A01	General English – I	1	1	0	2	TY
5	CBCA25MDX	Indian Knowledge System^	2	0	0	2	IE
6	CBCA25VA1	Environmental Science and Sustainability	2	0	0	2	TY
7	CBCA25AXX	Indian or Foreign Language I	1	1	0	0*	IE
TOTAL						19	

Credits Sub Total: 19

SEMESTER II

S. No	Course Code	Course Title	L	T	P	Credit	Exam
1	CBCA25C02	Mathematics Foundations to Computer Science-II	3	0	0	3	TY
2	CBAD25C01	Business Intelligence with Cognos	3	0	4	5	ETL
3	CBCA25C04	Operating System	2	0	0	2	TY
4	CBCA25S03	Object Oriented Programming Using C++	3	0	4	5	ETL
5	CBCA25C05	Web Technologies	3	0	2	4	ETL
6	CBCA25VA2	Indian Constitution	2	0	0	2	IE
7	CBCA25AXX	Indian or Foreign Language II	1	1	0	0*	IE
TOTAL						**21**	

Credits Sub Total: 21

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

SEMESTER III

S. No	Course Code	Course Title	L	T	P	Credit	Exam
1	CBCA25C06	Object Oriented Modeling and Design	3	0	0	3	TY
2	CBCA25C07	Data Base Management System	3	0	4	5	ETL
3	CBAD25S02	Big Data using Hadoop	2	0	4	4	ETL
4	CBCA25C08	Software Engineering	3	0	0	3	TY
5	CBCA25EXX	Professional Elective – I	1	0	4	3	ETL/TY
6	CBCA25VAX	Yoga/Sports/NCC/NSS/Disaster Management	0	0	4	2	IE
TOTAL						**20**	

Credits Sub Total: 20

SEMESTER IV

S. No	Course Code	Course Title	L	T	P	Credit	Exam
1	CBCA25C09	Entrepreneurship and Startup Ecosystem	1	1	0	2	IE
2	CBCA25C10	Computer Networks	3	0	0	3	TY
3	CBCA25S05	Java Programming	3	0	4	5	ETL
4	CBAD25C02	Machine Learning Fundamentals with Python	3	0	4	5	ETL
5	CBCA25EXX	Professional Elective – II	1	0	4	3	ETL/TY
6	CBCA25S06	Design Thinking And Innovation	1	1	0	2	IE
TOTAL						**20**	

Credits Sub Total: 20

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

SEMESTER V

S. No	Course Code	Course Title	L	T	P	Credit	Exam
1	CBCA25EXX	Professional Elective — III	3	0	4	5	ETL/ TY
2	CBCA25EXX	Professional Elective IV	3	0	4	5	ETL/ TY
3	CBCA25EXX	Professional Elective V	3	0	4	5	ETL/ TY
4	CBCA25S07	Quantitative Techniques	0	2	0	2	IE
5	CBCA25S08	Internship / Technical Skill / Capstone Project	0	0	8	4	IE
6	CBCA25S09	Major Project [evaluation in 6th semester]	-	-	-	0	-
TOTAL						**21**	

Credits Sub Total: 21

SEMESTER VI

S. No	Course Code	Course Title	L	T	P	Credit	Exam
1	CBAD25C03	Generative AI using Watson X	2	0	4	4	ETL
2	CBCA25EXX	Professional Elective VI	3	0	4	5	ETL/ TY
3	CBCA25EXX	Professional Elective VII	3	0	4	5	ETL/ TY
4	CBCA25A09	Soft Skill	0	1	0	1	IE
5	CBCA25S09	Major Project	0	0	8	4	LB
TOTAL						**19**	

Credits Sub Total: 19

Credit Summary
Semester: I : 19
Semester: II : 21
Semester: III : 20
Semester: IV : 20
Semester: V : 21
Semester: VI : 19
Total: 120

SEMESTER – I

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25C01	MATHEMATICS FOUNDATION TO COMPUTER SCIENCE - I	L	T	P	C	TY/Lb/ IE
		3	0	0	3	TY
	Prerequisite –Higher secondary Mathematics					
	Course Designed by – Faculty of Mathematics					

OBJECTIVES

- To understand theconcepts in sets and relations
- To understand the Basic concepts in several Mathematical functions
- To understand the Basic concepts in Counting and Recurrence relation
- To understand the Basic concepts in Graph theory
- To understand the Basic concepts in Matrix algebra

COURSE OUTCOMES (COs)

CO1	Provide a basic understanding of fundamental mathematical concepts such as sets, functions, matrix algebra, and discrete mathematics.
CO2	This course enables the students to use mathematical models and techniques to analyze and understand problems in computer science.
CO3	This course demonstrates how the mathematical principles give succinct abstraction of computer science problems and help them to efficiently analyze.
CO4	Able to formulate problems and solve recurrence relations.
CO5	Able to model and solve real-world problems using graphs and trees.

Mapping of Course Outcomes with Program outcomes (Pos)

(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	Cos/ PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	2		3	3		1			2	3	2		
	CO2	2		3	3		1			2	3	2		
	CO3	2		2	3		1			2	3	2		
	CO4	2		3	3		1			2	3	2		
	CO5	2		2	3		1			2	3	2		

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
		√						
4	Approval		Meeting of Academic Council					

CBCA25C01 MATHEMATICS FOUNDATION TO COMPUTER SCIENCE – I

UNIT I: Set, Relation **9 Hours**

Set, Set Operatioons, Properties of Set operations, Subset, Venn Diagrams, Cartesian Products, Relations on a Set, Properties of Relations, Representing Relations using matrices and digraphs.

UNIT II: Function **9 Hours**

Exponential, Logarithmic and Polynomial Functions:

UNIT III: Counting and Recurrence Relation **9 Hours**

Basics of counting, Pigeonhole principle, permutation, combination, Binomial coefficients, Binomial theorem, Recurrence relations, modeling recurrence relations with examples like Fibonacci numbers, the tower of Hanoi problem.

UNIT IV: Elementary Graph Theory **9 Hours**

Basic terminologies of graphs, connected and disconnected graphs, subgraph, paths and cycles, complete graphs, digraphs, weighted graphs, Euler and Hamiltonian graphs.

Trees, properties of trees, concept of spanning tree. Planar graphs. Definitions and basic results on the topics mentioned.

UNIT V: Matrix Algebra **9 Hours**

Types of matrices, algebra of matrices-addition, subtraction and multiplication of matrices, determinant of a matrix, symmetric and skew-symmetric matrices, orthogonal matrix, rank of a matrix, inverse of a matrix, applications of matrices to solve system of linear equations, Eigen values and Eigen vectors, Caley-Hamilton theorem.

Total : 45 hours

Text Books

1. Garg, Reena, Engineering Mathematics, Khanna Book Publishing Company, 2024. (AICTE Recommended Textbook)
2. Garg, Reena, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2023.
3. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
4. DeoNarsingh, Graph Theory with Application to Engineering and Computer Science, Prentice Hall, India, 1979.
5. Vasishtha A. R. and Vasishtha A. K., Matrices, Krishna Prakashan, 2022.

Reference Books

1. Grimaldi Ralph P. and Ramana B. V., Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education, 2007.
2. Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
3. West Douglas B., Introduction to Graph Theory, Second Edition, Pearson Education, 2015.

Web Resources

1. https://nptel.ac.in/courses/106103205
2. https://nptel.ac.in/courses/111101115

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBAD25S01	PYTHON FOR DATA SCIENCE	L	T	P	C	TY/Lb/ IE
		3	0	4	5	ETL
	Prerequisite : Basic programming logic, familiarity with digital tools, and foundational math/statistics knowledge.					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES:

- To understand the core syntax and semantics of Python, including data types, structures, and functions.
- To apply Python libraries such as NumPy and Pandas for efficient data manipulation and analysis.
- To explore data visualization techniques using libraries like Matplotlib and Seaborn for meaningful insights.
- To implement basic statistical methods and machine learning models using libraries such as Scikit-learn.
- To develop practical problem-solving skills through real-world data science scenarios and projects.

COURSE OUTCOMES (COs)

CO1	To Understand and perform operations in Python datatype.
CO2	To Understand the python Data Structure (List, Tuples, Sets, and Dictionaries)
CO3	To work on NumPy to manipulate numerical data
CO4	To work on dataset to perform data analytics tasks
CO5	To understand and work on data visualization
	Mapping of Course Outcomes with Program outcomes (Pos)
	(1/2/3 indicates strength of correlation) 3-HIGH, 2-Medium, 1-Low

1	Cos/ PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	3	2	3	3	2	2	3	2	2	3	3	2	2
	CO2	2	2	3	2	3	3	2	3	3	2	2	1	3
	CO3	3	2	2	1	3	3	1	3	3	3	3	3	2
	CO4	3	3	3	2	1	3	2	1	3	3	3	2	3
	CO5	2	3	2	3	3	3	3	3	3	3	2	2	3

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
						√		
4	Approval		Meeting of Academic Council					

CBAD25S01 **PYTHON FOR DATA SCIENCE**

UNIT I – Basics of Python **9 Hours**

Introduction to Python- Variables and Data Types- Operators- python Operators (Membership and identity operators)- Conditional Statements and Loops- Functions in python - Error Handling and Exceptions

UNIT II – Python Data Structures **12 Hours**

Introduction to Data Structures – Lists - Indexing, slicing, - Accessing and modifying the elements- Adding, removing, and updating elements- Tuples - Accessing tuple elements- Operations on Tuples- Built-in Functions in Tuple- Sets- Set Operations – Dictionaries- Creating and Accessing Dictionaries- Modifying Dictionaries- String- regular expression in python

UNIT III – Data Science Libraries in Python **12 Hours**

Introduction to Data Science Libraries in Python- Introduction to NumPy- Array creation - Array Indexing and Slicing - Array Operations- Reshaping and Resizing Arrays- NumPy Statistical Functions- Advanced NumPy Operations - Introduction to Pandas- Pandas Data Structure (Series, DataFrame,)- Indexing and Selecting Data in Pandas- Data Manipulation with Pandas(DataFrame Operations ,Handling Missing Data, Data Aggregation and Grouping)

UNIT IV – Data Visualization in Python **12 Hours**

Introduction to Data Visualization- Visualization Principles- Introduction to Matplotlib- Creating Multiple Plots- Advanced Plotting Techniques- Introduction to Seaborn- Creating Common Visualizations with Seaborn- Data Visualization with Pandas- Plot Types in Pandas- Customization in Pandas Plotting

Total : 45 hours

TEXT BOOK:

Python for Data Analysis by Wes McKinney (2018)

Python Data Science Handbook by Jake VanderPlas (2016)

REFERENCE BOOK:

Python for Data Science For Dummies by John Paul Mueller and Luca Massaron (2016)

Hands-On Data Analysis with NumPy and Pandas by Stefanie Molin (2020)

CBAD25S01 **PYTHON FOR DATA SCIENCE**

List of Lab Programs:

1. Create a basic calculator that performs addition, subtraction, multiplication, and division based on user input. Handle division by zero using exception handling.
2. Write a Python program to create a list with integers, perform indexing and slicing, add new elements, remove elements, and update existing elements.
3. Write a Python program to create two sets and perform operations such as union, intersection, and difference.
4. Create a dictionary and perform operations like adding, modifying, and removing key-value pairs. Print the dictionary after each operation.
5. Write a Python program using regular expressions to extract all email addresses from a given text.
6. Create a NumPy array and calculate the mean, median, mode, and standard deviation of the dataset.
7. Create a 1D NumPy array and reshape it into a 2D array. Perform operations such as summing rows or columns in the reshaped array.
8. Create a NumPy array with 10 random integers between 1 and 100. Use indexing and slicing to extract and modify elements from the array.
9. Create a NumPy array with some missing (NaN) values. Use appropriate functions like np.nanmean(), np.nanstd(), and np.isnan() to handle these missing values.
10. Create a dataset following a normal distribution and visualize it using a histogram to analyze how the data behaves.
11. Create a Pandas DataFrame and perform operations such as selecting, modifying, and deleting data. Handle missing data using Pandas functions.
12. Write a program that reads a dataset (e.g., a CSV file) into a Pandas DataFrame, performs data aggregation (e.g., sum, mean), and groups data by specific columns.
13. Write a Python program to plot a simple line graph using Matplotlib. Plot data on the x-axis and y-axis and customize the title and labels.
14. Create a bar chart to represent categorical data using Matplotlib. Add titles and labels to the axes.
15. Use Seaborn to create a histogram to represent the distribution of a dataset. Customize the bins and labels.

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25S02	INTRODUCTION TO DIGITAL OFFICE	L	T	P	C	TY/Lb/IE
		3	0	4	5	ETL
	Prerequisite – Basic understanding of computer operations and familiarity with Windows operating system.					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES

- Develop proficiency in using Microsoft Office tools such as MS Word, Excel, PowerPoint, and Access.
- Apply office automation tools to enhance productivity and prepare professional documents.
- Understand and utilize advanced features in MS Office for efficient data handling and presentation.

COURSE OUTCOMES (COs)

CO1	Understand the basic concepts and purpose of office automation tools.
CO2	Operate word processing software effectively.
CO3	Use spreadsheet software to perform data analysis and calculations.
CO4	Develop and deliver presentations using presentation software.
CO5	Manage emails and scheduling using communication tools.

	Mapping of Course Outcomes with Program outcomes (Pos)												
	(1/2/3 indicates strength of correlation) 3-HIGH, 2-Medium, 1-Low												
1	COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	3	2	3	3	2	2	3	2	2	3	3	2	2
	CO2	2	2	3	2	3	3	2	3	3	2	2	1	3
	CO3	3	2	2	1	3	3	1	3	3	3	3	3	2
	CO4	3	3	3	2	1	3	2	1	3	3	3	2	3
	CO5	2	3	2	3	3	3	3	3	3	3	2	2	3
3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE						
						√								
4	Approval	Meeting of Academic Council												

CBCA25S02 INTRODUCTION TO DIGITAL OFFICE

UNIT I: MS Word - Basics and Advanced Features 9 Hours

Introduction to MS-WORD: Features of MS-Word, Window Components and Navigation. Basic Operations and Document Formatting: Creating and Formatting Documents, Selecting and Editing text, Shortcut Keys, Formatting Characters and Paragraphs with Indents, Drop Caps, Alignment Options, Using Format Painter. Page and Layout Formatting: Page setup, Headers and Footers, Bullets and Numbering, Using Tabs, Table of Contents, and Index. Working with Tables: Inserting Table, Adjusting Layouts, Mathematical calculations on Table Data, Formatting and Styling Tables, Find and Replace text, Use the Go To function. Proofing Tools: Spell Check, Thesaurus, Autocorrect, Comments. Advanced MS Word features: Difference between Wizards and Templates, Customizing the Quick Access Toolbar, Creating and Managing Macros. Inserting Multimedia and Objects: Inserting Images, Shapes, Text boxes, 3D models, Equations, Hyperlinks. Mail Merge and Document output: Executing Mail Merge Operations, Printing Documents.

UNIT II: MS Excel - Basics and Advanced Features 12 Hours

Introduction to MS Excel: Excel Features, Spreadsheets, Workbooks, Creating, Saving &Editing a Workbook, Renaming Worksheet. Data Entry and Basic Operation: Entering Data (numbers, labels, and formulas), Find and Replace, Adding and Deleting Rows and Columns, Filling Series, Fill with Drag, Data Sort. Formatting worksheet: Formatting Cells and Text, Applying Styles and Conditional Formatting, Adjusting Column Width and Row Height, Format Painter Tool. Functions and Formulas: Functions in Excel-Financial, Logical, Math (SUM, AVERAGE, COUNT, MAX,MIN, IF). Ms-Excel Advanced Features: Cell Referencing (Relative, Absolute, Mixed), What-if Analysis, Sort and Filter Data, Macros. Introduction to charts: Types of charts, Creating, Formatting and Editing a Chart, Printing a Chart, Printing Worksheet.

UNIT III: MS PowerPoint 12 Hours

Introduction of Ms-PowerPoint: Features of Power Point, Applications and Uses. Working with Slides:Slide Components, Templates and Wizards, Using Template, Choosing an Auto Layout, Using Outlines, Adding Headings and Sub Headings. Slide Content and Formatting: Adding and Editing Text, Formatting Text, Using Slide Master, Adding new Slides, Changing Color Scheme, Changing Slide Background, Applying Shading and Visual Enhancements. Enhancing slides with Multimedia: Adding Header and Footer, Adding Clipart and Auto Shapes, Adding Music or Sound. Slide Organisation and Presentation views: Working in Slide Sorter View - Deleting, Duplicating, Rearranging Slides, Adding Transition between Slides, Applying Animations to Text and Objects, Viewing and Running the Slide Show, Printing Slides.

UNIT IV: MS ACCESS 12 Hours

Introduction to MS Access: Introduction to Microsoft Access, Features and Benefits of MS Access, Creating and Saving a Database. Tables and Data Types: Creating Tables, Field Types (Text, Number, Date/Time, Currency, etc.)Primary Key, Data Validation, Input Masks, Relationships between Tables (One-to-One, One-to-Many, Many-to-Many) Working with Forms: Creating forms using Form Wizard and Design View, Modifying Form Layout and Design, Using Controls, Sub forms and Navigation Forms. Queries in MS Access: Types of Queries,

Update, Delete, Append, Make-table, Joins, Aggregate functions-SUM, AVG, COUNT, Reports: Creating Reports using Report Wizard, Designing Custom Reports.

Textbooks

1. Microsoft Office Step by Step – Joan Lambert
2. Mastering MS Office - *Bittu Kumar*
3. MS Office - *Laxmi Publications*

Reference Books

1. Microsoft Word 2019 In Depth – Faithe Wempen (Pearson, 2018)
2. Microsoft Excel 2019 Bible – Michael Alexander, Richard Kusleika (Wiley, 2018)
3. Access 2019 Bible – Michael Alexander, Dick Kusleika (Wiley, 2018)

Web Resources

1. Microsoft Official Training and Support
   https://support.microsoft.com/en-us/training

1. GCF Global – Free Office Tutorials
   https://edu.gcfglobal.org/en/subjects/office/

2. Tutorials Point – Microsoft Office Suite
   https://www.tutorialspoint.com/microsoft_office/index.html

CBCA25S02 INTRODUCTION TO DIGITAL OFFICE

List of Lab Programs:

MS Word

1. Create a resume using various formatting features.
2. Design a letter using mail merge with at least 3 recipients.
3. Format a document with headers, footers, page numbers, and drop caps.
4. Create and format a table with total calculations and borders.

MS Excel

5. Create a student mark sheet using formulas and functions.
6. Generate a monthly sales report and insert a chart.
7. Filter data based on criteria and sort in ascending order.

MS PowerPoint

8. Create a presentation with 5 slides on a given topic.
9. Apply slide transitions and object animations.
10. Insert images, videos, and audio into a slide.
11. Set up a slideshow with automatic timings.

MS Access

12. Create a database with student information and setprimary key.
13. Use forms for data entry and queries to retrieve students with marks above 60.
14. Create a report grouped by course showing average marks.
15. Import Excel data and generate summary report.

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25A01	GENERAL ENGLISH – I	L	T	P	C	TY/Lb/ IE
		1	1	0	2	Ty
	Prerequisite – +2 Level					
	Course designed by – Department of English					

Course Objectives

1. To provide learning environment to practice listening, speaking, reading and writing skills.
2. To assist the students to carry on the tasks and activities through guided instructions and materials.
3. To effectively integrate English language learning with employability skills and training.
4. To provide hands-on experience through case-studies, mini-projects, group and individual presentations.

Course Outcomes (COs)

1. Possess Language skills (LSRW) to communicate in English without any inhibition.
2. Express with appropriate lexis and syntax in English for social and academic communication
3. Demonstrate content knowledge through appropriate language use for academic success.
4. Analyze and interpret any genre of literature in English for research, projects, placement
5. Engage themselves in organized academic and business writing with professional ethics.

Mapping of course outcomes (COs) with Program Outcomes (POs)& Program Specific Outcomes

(3/2/1 indicates the strength of correlation) 3= High; 2= Medium; 1= Low

Cos/ PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO 4
CO1	3	3	3	3	3	3	3	1	3	3	3	3	3
CO2	3	3	3	3	3	3	3	1	3	3	3	3	3
CO3	3	3	3	3	3	3	3	1	3	3	3	3	3
CO4	3	3	3	3	3	3	3	1	3	3	3	3	3
CO5	3	3	3	3	3	3	3	1	3	3	3	3	3

Category	CC	AEC	MDE	VAC	SEC	DSE	OE
		✓					

4. Approval		Meeting of Academic Council

CBCA25A01 **GENERAL ENGLISH – I**

Unit I: Vocabulary Building **6 Hours**

The concept of Word formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.

Unit II: Basic Writing Skills **6 Hours**

Sentence structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely, Formal and Informal letters.

Unit III: Identifying Common Errors in Writing **6 Hours**

Subject-Verb agreement, Noun-Pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies.

Unit-IV: Nature and Style of sensible Writing **6 Hours**

Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion, Module V: Writing Practices, Comprehension, Précis Writing, Essay Writing

Unit-V: Oral Communication **6 Hours**

(This Module involves interactive practice sessions in Language Lab)

Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations

Total : 30 hours

Text/Reference Books:

1. AICTE's Prescribed Textbook: Communication Skills in English (with Lab Manual), Anjana Tiwari, Khanna Book Publishing Co., 2023.

2. Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.

3. Practical English Usage. Michael Swan. OUP. 1995.

4. Remedial English Grammar. F.T. Wood. Macmillan 2007

5. On Writing Well. William Zinsser. Harper Resource Book. 2001

6. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

7. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011. 8. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Indian Knowledge System^

CBCA25MDX	**Indian Knowledge System^**	**L**	**T**	**P**	**C**	**TY/Lb/IE**
		2	0	0	2	IE
	Course Designed by – Faculty of Computer Applications					

***For Detailed Course Refer Appendix – II**

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25VA1	**ENVIRONMENTAL SCIENCE AND SUSTAINABILITY**	**L**	**T**	**P**	**C**	**TY/Lb/ IE**
		2	0	0	2	Ty
	Prerequisite –Nil					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES :

1. To acquire knowledge of the Environment and Ecosystem & Biodiversity
2. To acquire knowledge of the different types of Environmental pollution
3. To know more about Natural Resources and social issues and the Environment
4. To attain familiarity of human population and Environment.

COURSE OUTCOMES (Cos) :

Students completing the course were able to

CO1	know about Environment and Ecosystem & Biodiversity
CO2	Clearly comprehend air, water, Soil, Marine, Noise, Thermal and Nuclear Pollutions and Solid Waste management and identify the importance of natural resources.
CO3	Understand about the natural resources and environmental problems associated with climate change, global warming, acid rain, ozone layer depletion etc., and explain possible solution.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1	2	1	2	2	2	3	1	2	2
CO2	2	1	1	1	2	1	2	2	2	3	2	2	2
CO3	2	1	1	1	2	1	2	2	2	**1**	**2**	**1**	**2**

Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program 2 Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills

Category	CC	AEC	MDE	VAC	SEC	DSE	OE
				√			

Approval						Meeting of Academic Council

CBCA25VA1 ENVIRONMENTAL SCIENCE AND SUSTAINABILITY

UNIT-I Understanding Environment, Natural Resources, and Sustainability 6 Hours

Fundamental environmental concepts and their relevance to business operations; Components and segments of the environment, the man-environment relationship, and historical environmental movements.

UNIT-II Natural Resources, and Sustainability 6 Hours

Concept of sustainability; Classification of natural resources, issues related to their overutilization, and strategies for their conservation. Sustain able practices in managing resources, including deforestation, water conservation, energy security, and food security issues. The conservation and equitable use of resources, considering both inter-generational and inter-generational equity, and the importance of public awareness and education.

UNIT-III: Ecosystems, Biodiversity, and Sustainable Practices 6 Hours

Various natural co-systems, learning about their structure, functions, and ecological characteristics. The importance of biodiversity, the threats it faces, and the methods used for its conservation. Ecosystem resilience, homeostasis, and carrying capacity, emphasizing the need for sustainable ecosystem management. Strategies for in-situ and ex-situ conservation, nature serves, and the significance of India a mega diverse nation.

UNIT- IV Environmental Pollution, Waste Management, and Sustainable Development 6 Hours

Various types of environmental pollution, including air, water, noise, soil, and marine pollution, and their impacts on businesses and communities. Causes of pollution, such as global climate change, ozone layer depletion, the green house effect, and acid rain with a particular focus on pollution episode sin India. Importance of adopting cleaner technologies; Solid waste management; Natural and man-made disasters, their management, and the role of businesses in mitigating disaster impacts.

UNIT-V Social Issues, Legislation, and Practical Applications 6 Hours

Dynamic interactions between society and the environment, with focus on sustainable development and environmental ethics. Role of businesses in achieving sustainable development goals and promoting responsible consumption. Overview of key environmental legislation and the judiciary's role in environmental protection, including the Water (Prevention and Control of Pollution) Actof1974, the Environment (Protection) Actof1986, and the Air (Prevention and Control of Pollution) Actof1981. Environmental justice, environmental refugees, and there settlement and rehabilitation of affected populations; Ecological economics, human population growth, and demographic changes in India.

Total : 30 hours

Text Books (Latest Editions)

1. Poonia,M.P. *Environmental Studies,* Khanna Book Publishing Co.
2. Bharucha, E.Text book of Environmental Studies, Orient Blackswan Private Ltd.
3. Dave,D.,&Katewa,S.S.*TextBookofEnvironmentalStudies.*CengageLearningIndiaPvt. Ltd.
4. Rajagopalan,R. *Environmental studies: fromcrisistocure*, Oxford University Press.
5. Miller, G.T.& Spoolman S.*Living in the Environment*. Cengage.

References:-

1. https://www.ourplanet.com
2. https://www.undp.org/content/undp/en/home/sustainable-development-goals.html
3. www.myfootprint.org
4. https://www.globalchange.umich.edu/globalchange1/current/lectures/kling/ecosystem/ecosystem.html

CBCA25AXX	**Indian or Foreign Language I**	**L**	**T**	**P**	**C**	**TY/Lb/IE**
		1	1	0	0	IE
	Course Designed by – Faculty of Computer Applications					

***For Detailed Course Refer Appendix – III**

SEMESTER – II

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25C02	MATHEMATICS FOUNDATION TO COMPUTER SCIENCE - II	L	T	P	C	TY/Lb/ IE
		3	0	0	3	Ty
	Prerequisite –Basic Level					
	Course Designed by – Faculty of Mathematics					

OBJECTIVES

- To understand the concepts in Logic
- To understand the Basic concepts in Algebraic structures
- To understand the Basic concepts in Numerical Methods
- To understand the Basic concepts in Linear Programming
- To understand the Basic concepts in Transportation problem

COURSE OUTCOMES (COs)

CO1	This course helps the students to understand correct lines of arguments and proofs.
CO2	This course introduces mathematical techniques that are foundations for understanding advanced computational methods, including numerical methods and optimization.
CO3	is course helps the students to understand various problem-solving strategies and methods to tackle both theoretical and practical challenges in computer science.
CO4	Use statistical methodology and tools in the problem-solving process.
CO5	To understand various graphs in different geometries related to edges.

Mapping of Course Outcomes with Program outcomes (Pos)

(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	Cos/ PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	2		3	3		1			2	3	2		
	CO2	2		3	3		1			2	3	2		
	CO3	2		2	3		1			2	3	2		
	CO4	2		3	3		1			2	3	2		
	CO5	2		2	3		1			2	3	2		

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
		√						
4	Approval		Meeting of Academic Council					

CBCA25C02 MATHEMATICS FOUNDATION TO COMPUTER SCIENCE – II

UNIT I: **9 hours**

Logic and Methods of Proofs:

Propositions, logical operations (basic connectives), compound statements, construction of truth table, quantifiers, conditional statements, tautology, contradiction, contingency, logical equivalence. Conjunctive Normal Forms (CNF) and Disjunctive Normal Forms (DNF), Mathematical Induction.

UNIT II: **9 hours**

Algebraic Structures:

Semi-group, Monoid, Group, Subgroup. (Definition and Simple problems only)

Unit III: **9 hours**

Numerical Methods:

Concept and importance of errors in numerical methods**.** Solution of algebraic and trancendetal equations. Bisection method and Newton-Raphson methods. Numerical Interpolation : Newton's Forward and Newton's Backward interpolation formula and Lagrange's formula.

UNIT IV: **9 hours**

Optimization Techniques:

Linear programming: Introduction, LP formulation, Graphical method for solving LPs with two variables, Simplex Method.

UNIT V: **9 hours**

Transportation problem: Definition, Linear form, North-west corner method, Least cost method, Vogel's approximation method for finding feasible solution, MODI method for finding optimum solution.

Total : 45 hours

Text Books

1. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
2. Sastry S. S., Introductory Methods of Numerical Analysis, Fifth Edition, PHL, 2022.
3. TahaHamdy A., Operations Research: An Introduction, Eighth Edition, Pearson Prentice Hall, 2003.
4. S.B. Singh, Discrete Structures, Khanna Book Publishing, 2023 (AICTE Recommended Textbook)

Reference Books

1. Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
2. Chakravorty J. G. and Ghosh P. R., Linear Programming and Game Theory, Moulik Library, 2017.
3. Sharma J. K., Operations Research: Theory and Applications, Fourth Edition, Macmillan Publishers, 2007.

Web Resources

1. https://nptel.ac.in/courses/111107127
2. https://www.math.iitb.ac.in/~siva/si50716/SI507lecturenotes.pdf

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBAD25C01	**Business Intelligence with Cognos**	**L**	**T**	**P**	**C**	**TY/Lb/ IE**
	Prerequisite :Basic knowledge of data warehousing and familiarity with IBM Cognos tools for reporting and analysis.	3	0	4	5	ETL
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES:

- Understand core concepts of Business Intelligence (BI) and IBM Cognos.
- Learn to create and manage reports and dashboards.
- Develop data models using Cognos Framework Manager.
- Analyze and visualize data for informed decision-making.
- Apply security and access controls within Cognos

COURSE OUTCOMES (COs)

CO1	To Understand the Basics Business Intelligences using IBM Cognos BI
CO2	To Design and Develop Various Reports
CO3	To Enhance Reports with Filters and Prompts
CO4	To Visualize Data Using Charts and Dashboards
CO5	To Optimize Report Performance and Usability
	Mapping of Course Outcomes with Program outcomes (Pos)
	(1/2/3 indicates strength of correlation) 3-HIGH, 2-Medium, 1-Low

1	Cos/ PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	3	2	3	3	2	2	3	2	2	3	3	2	2
	CO2	2	2	3	2	3	3	2	3	3	2	2	1	3
	CO3	3	2	2	1	3	3	1	3	3	3	3	3	2
	CO4	3	3	3	2	1	3	2	1	3	3	3	2	3
	CO5	2	3	2	3	3	3	3	3	3	3	2	2	3

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
						√		

4	Approval		Meeting of Academic Council

CBAD25C01 **BUSINESS INTELLIGENCE WITH COGNOS**

UNIT I – Introduction to IBM Cognos BI and Report Studio **9 hours**

Introduction to Data- Types of Data – Data Storage- (Data centres, Data Warehouse, data Mart) – Introduction to Business Intelligence - Overview of IBM Cognos BI -Introduction to the Reporting Application - Examine Report Studio and its interface - Explore different report types

UNIT 2 Creating and Formatting Reports **12 HOURS**

Cognos BI components – project creating – Data model convention - Create List Reports- List Operation - (Format, group, and sort list reports) - Describe options for aggregating data - Create a multi-fact query - Create Crosstab Reports - Convert a list to a crosstab- Create complex crosstabs using drag-and-drop functionality

UNIT 3 - Filtering and Focusing Reports **12 HOURS**

Introduction to data Filters - Focus Reports using Filters - Create filters to narrow the focus of reports - Examine detail filters and summary filters - Determine when to apply filters on aggregate data - Focus Reports using Prompts (Optional) - Identify various prompt types- Search for prompt items - Navigate between pages

UNIT 4 - Advanced Reporting and Customization **12 HOURS**

Data visualization using Cognos BI - Present Data Graphically - Create charts containing peer and nested items -Present data using different chart type options - Extend Reports using Calculations - Create calculations based on data in the data source -Create expressions using functions - Customize Reports with Conditional Formatting

Total : 45 hours

TEXT BOOK:

IBM Cognos Analytics: Reporting and Dashboards, IBM Press, 2019.
IBM Cognos 10 Report Studio: Practical Examples, MC Press, 2013.

REFERENCE BOOK:

Business Intelligence: Insight and Innovation Beyond Analytics and Big Data, Technics Publications, 2013. IBM Cognos Business Intelligence: The Official Guide, McGraw Hill, 2011.

CBAD25C01 **BUSINESS INTELLIGENCE WITH COGNOS**

List of Lab Programs:

1: Exploring IBM Cognos BI and Report Studio

You are a business analyst at an e-commerce company. Your manager has asked you to explore IBM Cognos BI and understand its reporting capabilities.

1. Log in to IBM Cognos BI and open Report Studio.
2. Explore different report templates and available tools.
3. Create a basic report with sample sales data.

2: Creating a Basic List Report

Scenario: Your company wants to track product sales by category. You need to create a List Report showing product names, sales amounts, and total revenue.

1. Create a List Report with product details.
2. Apply sorting, grouping, and aggregation.
3. Export the report as PDF and Excel.

3: Working with Filters in Reports

The sales team wants a report that only displays products with sales above $5000.

1. Create a List Report with sales data.
2. Apply detail filters to exclude low-sales products.
3. Apply summary filters to filter out aggregated data.

4: Creating Crosstab Reports

Scenario: A retail store wants to analyze sales trends across different regions. You need to create a Crosstab Report showing sales by product category and region.

1. Convert a List Report into a Crosstab Report.
2. Arrange data into rows (categories) and columns (regions).
3. Apply sorting and formatting for better readability.

5: Implementing Multi-Fact Queries

Your company tracks both sales and customer feedback. You need to create a report that joins sales and customer reviews to analyze their impact.

1. Use multiple fact tables to join sales and feedback data.
2. Create a multi-fact query for analysis.
3. Display aggregated values for each product.

6: Using Prompts for Dynamic Filtering

The finance team needs a sales report by country, but they want to choose the country dynamically.

1. Create a drop-down prompt for selecting a country.
2. Implement mandatory and optional prompts.
3. Test the report by selecting different values.

7: Formatting Reports and Applying Conditional Formatting

Scenario: Your HR department wants a report highlighting employees with low performance scores in red.

1. Highlight employees with performance below 60%.
2. Apply color coding based on performance levels.
3. Use conditional formatting for improved readability.

8: Creating Charts and Visualizations

Your marketing team wants to visualize quarterly sales trends using charts.

1. Create a bar chart showing sales per quarter.
2. Design a pie chart representing sales per region.
3. Use a line chart to track annual growth.

9: Implementing Calculations and Expressions

Your finance team needs a profit margin calculation in reports.

1. Add a calculated field for profit margin.
2. Use Cognos expressions to create custom formulas.
3. Apply runtime calculations to adjust data dynamically.

10: Developing a Dashboard Report

Your CEO wants an executive dashboard to view key business metrics in one place.

1. Create a dashboard displaying KPIs, charts, and tables.
2. Apply interactivity and navigation between reports.
3. Optimize layout for clear visualization.

11: Customizing Reports with Multi-Language Support

Your company operates in multiple countries and needs reports in different languages.

1. Create a multi-lingual report using Cognos translations.
2. Apply language-specific formats and labels.
3. Test the report by switching between languages.

12: Implementing Drill-Through Reports

Your sales team wants a summary report that allows them to click on a region to see detailed sales data.

1. Create a summary report with sales data by region.
2. Link it to a detailed report with product-level sales.
3. Test drill-through functionality for interactive reporting.

13: Exporting and Scheduling Reports

Your company wants an automated monthly sales report to be emailed to managers.

1. Schedule a weekly/monthly report in Cognos.
2. Export reports to CSV, Excel, and PDF formats.
3. Automate report generation and email delivery.

14: Using IBM Cognos Query Studio

Your team needs quick ad-hoc reports without complex configurations.

1. Create a quick report using Query Studio.
2. Apply sorting, filtering, and simple aggregations.
3. Convert the report into a chart visualization.

15: Performance Optimization and Best Practices

Your company has large datasets, and reports are running slowly. You need to optimize performance.

1. Analyze slow-running reports.
2. Apply efficient filtering and indexing.
3. Reduce query execution time using best practices.

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25C04	OPERATING SYSTEM	L	T	P	C	TY/Lb/ IE
		2	0	0	2	TY
	Prerequisite – Familiar with Basic Hardware and software aspects of computer system organization.					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES:

- Understand the role of Operating Systems
- Explore OS Components and Architecture
- Learn Process Management

COURSE OUTCOMES (COs)

CO1	Explain the fundamentals of the operating system.
CO2	Comprehend multithreaded programming, CPU scheduling, process management, process synchronization,
CO3	Compare the performance of CPU scheduling algorithms
CO4	Identify the features of I/O and File handling methods.
CO5	Evaluate and apply different CPU scheduling and deadlock handling algorithms.

Mapping of Course Outcomes with Program outcomes (Pos)

(1/2/3 indicates strength of correlation) 3-HIGH, 2-Medium, 1-Low

1	COs/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	3	2	3	3	3	2	3	3	2	3	3	2	2
	CO2	2	3	3	1	2	3	1	2	3	2	2	3	3
	CO3	3	2	2	3	3	1	3	3	1	3	3	1	2
	CO4	2	3	3	2	1	3	2	1	3	3	1	2	3
	CO5	3	3	2	3	2	3	3	2	3	2	3	3	3

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
		✓						

4	Appro		Meeting of Academic Council

CBCA25C04 OPERATING SYSTEM

UNIT I **6 Hours**

Operating Systems Overview: Introduction, Evaluation of OS, Components & services of OS, Structure, Architecture, Types of OS, Batch systems, Concepts of Multiprogramming and Time Sharing, Parallel, Distributed and real time systems.

Operating Systems Structures: Operating system services and systems calls, system programs, operating system structure, operating systems generations.

UNIT II **6 Hours**

Process Management: Process concepts, Process states, Process State Transitions, Process Scheduling, Process Control Block, Threads, Concepts of Multithreads, Benefits of Threads, Types of Threads

Process Scheduling: Definition, Scheduling objectives, Scheduling algorithms, CPU Scheduling, Preemptive and Non- Preemptive Scheduling algorithms (FCFS, SJF and RR), Performance evaluation of the Scheduling algorithms

UNIT III **6 Hours**

Process Synchronization: Introduction, Inter-Process Communication, Race Conditions, Critical Section Problem, Mutual Exclusion, Semaphores, Monitors

Deadlocks: System Model, Deadlock Characterization, Deadlock Prevention, Detection And Avoidance, Banker's Algorithm, Recovery From Deadlocks.

UNIT IV **6 Hours**

Memory Management: Logical and Physical address map, Swapping, memory allocation, MFT, MVT, Internal and External fragmentation and Compaction, Paging, Segmentation.
Virtual Memory: Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing
I/O Management: Principles of I/O hardware: Disk structure, Disk Scheduling Algorithms

UNIT V **6 Hours**

File System: Concept of A File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection. File System Implementation: File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance, Comparison of UNIX and Windows.

Total : 30 hours

TEXT BOOKS:

1. Ekta Walia, OperatingSystems Concepts, Khanna Publishing House,2022 (AICTE Recommended Textbook).
2. AbrahamSilberschatz,PeterBaerGalvin,GregGagne(2006),OperatingSystemPrinciples,7th edition or later edition, Wiley India Private Limited, New Delhi.
3. Stallings(2006),OperatingSystems,InternalsandDesignPrinciples,5th edition,Pearson Education, India.

REFERENCE BOOKS:

1. Andrew S. Tanenbaum (2007), Modern Operating Systems, 2nd edition, Prentice Hall of India, India.
2. Deitel & Deitel(2008),Operatingsystems,3rd edition, Pearson Education, India.

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25S03	**OBJECT ORIENTED PROGRAMMING USING C++**	**L**	**T**	**P**	**C**	**TY/Lb/ IE**
		3	0	4	5	ETL
	Prerequisite – Knowledge of Problem Solving Techniques using C programming language					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES

1. To enable the students to understand about the basic computing concepts.
2. To understand the binary system and system languages
3. To developing skills and enable them to excel in the MS- Office packages

COURSE OUTCOMES (COs)

CO1	To introduce the object oriented programming system concepts
CO2	To introduce syntax and semantics of C++ programming language
CO3	To develop modular programs using C++
CO4	To setup C++ environment to create, debug and run programs
CO5	Develop applications using inheritance, polymorphism, and dynamic binding to promote code reuse and flexibility.
	Mapping of Course Outcomes with Program outcomes (Pos)
	(1/2/3 indicates strength of correlation) 3-HIGH, 2-Medium, 1-Low

1	COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	3	2	3	3	2	2	3	2	2	3	3	2	2
	CO2	3	3	3	1	2	3	1	2	3	2	2	1	3
	CO3	3	2	2	1	3	3	1	3	3	3	3	1	3
	CO4	3	3	3	2	1	3	2	1	3	3	3	2	3
	CO5	3	3	2	3	2	3	3	2	3	2	3	2	3

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
						✓		
4	Appro				Meeting of Academic Council			

CBCA25S03 OBJECT ORIENTED PROGRAMMING USING C++

Unit 1: Introduction to Object-Oriented Programming 9 Hours

Introduction to Programming Paradigms: Procedural vs Object-Oriented, Principles of Object-Oriented Programming: Encapsulation, Abstraction, Inheritance, Polymorphism-Overview of C++ and its features-Structure of a C++ program-Data types, Operators, and Control Structures
Functions in C++: Call by value, reference-Input/Output in C++.

Unit 2: Classes and Objects 12 Hours

Defining and declaring classes-Creating objects and accessing class members-Member functions: Inside and outside the class-Constructors and Destructors: Default, Parameterized, Copy Static members (data and methods)-Friend functions and Friend classes-Scope resolution operator.

Unit 3: Inheritance and Polymorphism 12 Hours

Types of Inheritance: Single, Multiple, Multilevel, Hierarchical, Hybrid, Constructors in inheritance, Function Overloading and Overriding-Virtual Functions and Runtime Polymorphism
Abstract classes and pure virtual functions, Object slicing and upcasting/ downcasting.

Unit 4: Operator Overloading and Templates 12 Hours

Concept of Operator Overloading-Overloading unary and binary operators,-Overloading using friend functions,Type conversion: Basic to class, class to basic, class to class Introduction to Templates,Function templates and Class templates, Exception Handling: Try, catch, throw blocks, multiple catch, Advanced Topics and File Handling: File Streams: ifstream, ofstream, fstream
Reading from and writing to text and binary files-File pointers and their manipulations (seekg, seekp, tellg, tellp),Command line arguments, Dynamic memory allocation (new, delete)
Standard Template Library (brief overview of vectors, lists, maps).

Total : 45 hours

Text Books

1. Object Oriented Programming with C++ by E. Balagurusamy, McGraw-Hill Education (India).
2. ANSI and Turbo C++ by Ashoke N. Kamthane, Pearson Education.

Reference Books

1.Big C++ - Wiley India.

2. C++: The Complete Reference- Schildt, McGraw-Hill Education (India) 3. C++ and Object Oriented Programming – Jana, PHI Learning.

4. Object Oriented Programming with C++ - Rajiv Sahay, Oxford.

5. Mastering C++ - Venugopal, McGraw-Hill Education (India).

CBCA25S03 **OBJECT ORIENTED PROGRAMMING USING C++**

List of Lab Programs:

1. Create a class with data members and member functions, then create and use objects of that class.
2. Write a program to demonstrate default, parameterized, and copy constructors and destructors.
3. Write aprogramtoimplement a friend function that can access private data of two different classes.
4. Writeac++programtodemonstrate inline functions and use the scope resolution operator.
5. Write ac++program to implement the concept of unary operator overloading.
6. Write aprogramt o u se multiple functions with the same name but different parameters.
7. Write aprogramt o Implement a simple inheritance hierarchy with base and derived classes.
8. Write a program to demonstrate multilevel and multiple inheritance.
9. Write a program to demonstrate virtual functions and base class pointers for achieving polymorphism.
10. Write a C++ program to implement the concept of Binary operator overloading.
11. Write a C++ program to implement the concept of Virtual functions.
12. Write a program to read and write data to a file using fstream.
13. Implement try-catch blocks to handle different types of exceptions.
14. Write a program to Exception Handling by implement try-catch blocks to handle different types of exceptions.
15. Write a program **to** Static Members and Functions toUse static data members and member functions across objects.

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25C05	**WEB TECHNOLOGIES**	**L**	**T**	**P**	**C**	**TY/Lb/ IE**
		3	0	2	4	ETL
	Prerequisite – Proficiency in at least one programming language, such as Python, Java, or C++. Understanding of programming concepts such as loops, conditionals, functions, and data structures like arrays, lists.					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES

- Understand the Fundamentals of the Web
- Develop Skills in Front-End Web Development
- Master Back-End Web Technologies
- Explore Web Development Tools and Standards
- Understand Security and Performance

COURSE OUTCOMES (COs)

CO1	To understand the concepts and architecture of the World Wide Web, Markup languages along with Cascading Style Sheets.
CO2	To understand the concepts of event handling and data validation mechanisms.
CO3	To understand the concepts of embedded dynamic scripting on client and server side Internet Programming
CO4	To develop modern interactive web applications
CO5	Design and implement server-side applications using technologies such as Node.js, PHP, or Python with backend frameworks.
	Mapping of Course Outcomes with Program outcomes (Pos)
	(1/2/3 indicates strength of correlation) 3-HIGH, 2-Medium, 1-Low

1	COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	3	3	3	3	2	2	2	3	2	3	3	3	2
	CO2	2	3	3	3	2	3	3	3	2	3	2	2	1
	CO3	3	2	2	1	3	3	2	3	3	3	3	1	3
	CO4	3	2	2	3	2	3	2	1	3	2	3	2	3
	CO5	3	3	3	3	2	3	2	3	2	2	3	3	3

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
		√						

4	Approv		Meeting of Academic Council

CBCA25C05 WEB TECHNOLOGIES

UNIT: 1 INTRODUCTION TO HTML 9 Hours

History of HTML- Objective- Basic Structure of HTML- Header Tags- Body Tags- Paragraph Tags- Tags for creating FORM – TABLE-TEXTAREA-ANCHOR- IMAGE-PIC-LISTS-DIV-NAVBAR- Intro to CSS- - Types-selectors and Responsiveness of a web page

UNIT :2 INTRODUCTION TO BOOTSTRAP 12 Hours

Introduction to Bootstrap- Downloads- Linking – Using Classes of Bootstrap- Understanding the Grid System in Bootstrap- Intro to WWW, Protocols- Applications and development tools- Web browsers- DNS- Web hosting Provider- Webservers-types- Web hosting in Cloud- Types of web hosting

UNIT: 3 INTRODUCTIONS TO JAVA SCRIPT 12 Hours

Functions and Events-Document Object model traversing using JavaScript- Output system: Alert-Throughput-Input box- Console Variables-Arrays-Date and String handling- Manipulating CSS through JS- Form Validation: -Required Validator- Length Validator- Pattern Validator.

UNIT: 4 ADVANCED JAVA SCRIPT / INTRODUCTION TO XML 12 Hours

Combining HTML, CSS and JAVA SCRIPT- Intro to AJAX- Purpose – advantages- disadvantages. Introduction to XML: uses – key concepts-DTD 8 schemas- XSL-XSLT. Intro to XHTML-JSON

Text Books:

1. Laura Lemay, Mastering HTML, CSS & Java Script Web Publishing, BPB Publications, 2016
2. Thomas A. Powell, The Complete Reference HTML &CSS, 5th Edition, 2017
3. HTML and CSS: Design and Build Websites" by Jon Duckett
4. Learning Bootstrap 5" by Matt Lambert.

References:

1. Silvio Moreto, Bootstrap 4 By Example, eBook, 2016
2. Tanweer Alam, Web Technologies, Khanna Book Publishing, 2011
3. Beginning Web Programming with HTML, XHTML, and CSS" by Jon Duckett
4. Web Technologies: A Computer Science Perspective" by Jeffrey C. Jackson
5. Internet and World Wide Web: How to Program" by Paul Deitel, Harvey Deitel, Abbey Deitel

Web References:

1. www.javatpoint.com
2. www.W3schools.com
3. https://www.geeksforgeeks.org/web-technology/
4. https://www.freecodecamp.org/
5. https://www.tutorialspoint.com/web_development_tutorials.htm

CBCA25C05 **WEB TECHNOLOGIES**

List of Lab Programs:

1. Create your Class timetable using Table Tag and format with External CSS
2. Create your Resume using all HTML- text, size, color and format with Inline CSS
3. Write a HTML/ JAVASCRIPT page to create a login page with regular expressions for validations.
4. Develop a Simple Calculator for addition, Subtraction, Multiplication and Division using Java Script.
5. Create a webpage using Frame with rows and columns where will have HEADER FRAME, LEFT FRAME, RIGHT FRAME and STATUS BAR FRAME.
6. Design a webpage for your college containing description of courses, department, faculties, library - using list, href and anchor tags.
7. Write a JavaScript program using Switch Case.
8. Create XML file to store Student Information – Reg No, Name, Mobile No, DOB, and Email-ID
9. Write a Java Script program using built in Java Script Objects
10. Write a program to retrieve date from a text file and displaying it using AJAX
11. Create your college website using inline, internal and external CSS
12. Create XSL file to convert XML file to XHTML file
13. Write a program for populating values from JSON text.
14. Create XML Scheme for (0).
15. Write a program to transform JSON text to Java Script Object.

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25VA2	**INDIAN CONSTITUTION**	**L**	**T**	**P**	**C**	**TY/Lb/ IE**
		2	0	0	2	IE
	Prerequisite –Nil					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES

1. To enable students to know the key aspects of Indian constitution
2. To enable them to operationalize Indian constitution

COURSE OUTCOMES (COs)

CO1	Knowing how the constitution of India was framed
CO2	Awareness about fundamental rights and duties
CO3	Understanding government formation both union and state
CO4	Idea about judiciary functions and powers
CO5	Knowledge about election commission and the functions
	Mapping of Course Outcomes with Program outcomes (Pos)
	(1/2/3 indicates strength of correlation) 3-HIGH, 2-Medium, 1-Low

1	COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	3	2	2	3	3	2	2	2	1	3	3	2	3
	CO2	3	2	2	3	2	3	2	3	1	3	3	3	3
	CO3	3	3	2	2	3	2	1	2	1	2	3	3	2
	CO4	3	3	3	2	3	2	3	2	1	3	1	1	2
	CO5		3					2	2	1	3	2		

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
					✓			
4	Appro				Meeting of Academic Council			

CBCA25VA2 **INDIAN CONSTITUTION**

UNIT-I An Economic History of the Constitution of India 6 Hours

Historical understanding of the constitution as an economic document. Understanding the Preamble, Starting from the land reform cases in the 1950s to the validity of the bitcoin ban imposed by the RBI, this module signpost all of the important economic moments in the constitutional history of post-colonial India; Constitutional design, Legal Regulation and economic justice.

UNIT-II Fundamental Rights and Business in India 6 Hours

Article 19 (1) (g), grants every citizen the right, to practice any profession, or to carry on any profession, occupation, trade, or business. Like other fundament alrights, this right is subject to reasonable restrictions impose by the state. This particular provision of the Constitution has been one of the most severely litigated freedoms. Fundamental Duties.

UNIT-III Fiscal Federalism 6 Hours

Article articles 301 to 307 of the Constitution pertains to Trade, Commerce and Inter course within the Territory of India; Challenges associated with fiscal federalism in India including the vertical fiscal imbalance; Article 280 of the Constitution.

UNIT-IV Constitutional battles 6 Hours

This module will be taught through key case studies that demonstrate the complex and fascinating overlap between the constitution and business and shall use Saurabh Kirpal's book Fifteen Judgments.

UNIT-V Constitutional and economy 6 Hours

Cases that Shaped India's Financial Landscape as our guide through this landscape. The case studies include the banning of diesel engine cars, Telecom regulation and ownership of broadcast media, Demonetization, Aadhaar, the lifting of restrictions on dealing in Crypto currencies.

TOTAL: 30 HOURS

References:-

- The Oxford H and book of the Indian Constitution, Oxford university press.

Cases

1. Rustom Cavasjee Cooper V. Union of India,(1970)1SCC248
2. State of Rajasthan v. Mohan Lal Vyas, AIR 1971 SC 2068 (confirmation of a private monopoly, non-violation of fundament alright)
3. Mithilesh Garg v. Union of India, (1992) 1 SCC 168 : AIR 1992 SC 221 (Right to carry on business, not breached when it is liberalized)
4. Chintaman Rao V. The State of Madhya Pradesh, AIR 1951SC118 (scope of reasonable restrictionsinrelation to trade and occupation)
5. Cooverjee B.BharuchaV.Excise Commissioner, Ajmer, AIR1954 SC220(there as on ableness of the restriction imposed may depend upon the nature of the business and prevailing conditions including public health and morality).

CBCA25AXX	**Indian or Foreign Language II**	**L**	**T**	**P**	**C**	**TY/Lb/IE**
		1	1	0	0	IE
	Course Designed by – Faculty of Computer Applications					

***For Detailed Course Refer Appendix – III**

SEMESTER – III

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25C06	**OBJECT ORIENTED MODELING AND DESIGN**	**L**	**T**	**P**	**C**	**TY/Lb/IE**
		3	0	0	3	TY
	Prerequisite - Basic knowledge of object basis and Unified modeling language diagrams.					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES

- Develop a working understanding of formal object-oriented analysis and design processes.
- Develop an appreciation for and understanding of the risks inherent to large-scale software development-
- Develop the skills to determine which processes and OOAD techniques should be applied to a given project.

COURSEOUTCOMES(Cos)

Students completing this course were able to

CO1	To understand the Basic concepts of object oriented system development.
CO2	To understand the methodology and UML.
CO3	To understand the concept of object oriented analysis identifying use case.
CO4	To understand the concept of object oriented design.
CO5	To understand the concept of software quality assurance.

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**	**PO8**	**P09**
CO1	3	2	3	3	2	2	3	2	2
CO2	2	2	3	2	3	3	2	3	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	2	3	2	3	3	3	3	3	3

Cos/PSOs	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	2	2
CO2	2	2	1	3
CO3	3	3	3	2
CO4	3	3	2	3
CO5	3	2	2	3

3/2/1Indicates Strength Of Correlation, 3 –High, 2-Medium, 1-Low

Category	CC	AEC	MDE	VAC	SEC	DSE	OE
	√						
Approval			Meeting of Academic Council				

CBCA25C06 **OBJECT ORIENTED MODELING AND DESIGN**

UNIT I **9 Hours**

Introduction OOSD Methodology - Unified approach - Object basics - Object state and properties - Behavior Methods -Messages - Information hiding - Class hierarchy - Relationships – Associations - Aggregations- Identity - Dynamic binding - Persistence - Meta classes - Object oriented system development life cycle - S/W device process- High quality Software Object Oriented System Development- Reusability.

UNIT II **9 Hours**

Methodology and UML Introduction – Survey – Rumbugh- Booch- Jacobson methods – Patterns – Frameworks - Unified approach – Unified modeling language - Static and Dynamic models - UML diagrams - Class diagram - Use case diagrams -Dynamic modeling diagrams - Interaction Diagrams- sequence diagrams.

UNIT III **9 Hours**

Object Oriented Analysis Identifying Usecase - Business object analysis - Usecase driven object oriented analysis- Usecase model – Documentation - Introduction- classification theory- Approaches for Identifying classes - Identifying object- relationships- attributes- methods - Super-sub class-Aggregation Class Responsibility - Object responsibility.

UNIT IV **9 Hours**

Object Oriented Design -Design process – Axioms - Corollaries - Designing classes - Class visibility - Refining attributes - Methods and protocols - Object storage and object interoperability – DBMS - Object relational systems - Designing interface objects - Macro and Micro level processes - The purpose of a view layer interface

UNIT V **9 Hours**

Software Quality assurance - Testing strategies - Object orientation testing - Test cases - Test Plan - Debugging principles -Usability - Satisfaction-Usability testing-Satisfaction testing - Software Reviews and Inspections - Test Metrics and Measurements.

Total : 45 hours

REFERENCES:

1. Ali Bahrami (2003), Object Oriented System Development, McGraw Hill International Edition.

2. Craig Larman(2002) Applying UMI. and Patterns (2nd ed.) Pearson.

3. James Rumbaugh (2004) Object Oriented Modeling Language (2nd ed.), PHI.

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25C07	DATA BASE MANAGEMENT SYSTEM	L	T	P	C	TY/Lb/IE
		3	0	4	5	ETL
	Prerequisite - Basic knowledge of Set Theory.					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES

- Understand basic concepts of database systems, including data models, schemas, and instances.
- Introduce relational databases, relational algebra, and SQL for managing data.
- Explore database design using Entity-Relationship (ER) models and normalization techniques.
- Understand storage structures, indexing, and query optimization strategies.
- Explain transaction processing, concurrency control, and recovery techniques.

COURSE OUTCOMES (COs)

CO1	Understanding Core Concepts of DBMS
CO2	Proficiency in Database Design and SQL
CO3	Application of Advanced Database Techniques
CO4	Explain and implement normalization techniques to optimize database designs.
CO5	Demonstrate knowledge of storage and indexing mechanisms to improve data retrieval.

Mapping of Course Outcome with Program Outcome(POs)

1	COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	3	2	3	3	2	2	3	2	2	3	3	2	2
	CO2	3	3	3	1	2	3	1	2	3	3	2	3	3
	CO3	3	2	1	2	3	3	2	3	3	3	3	1	3
	CO4	3	3	3	2	1	3	2	1	3	3	3	2	1
	CO5	3	3	2	3	2	3	3	2	3	2	3	3	2

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
		✓						
4	Approval	Meeting of Academic Council						

CBCA25C07 DATA BASE MANAGEMENT SYSTEM

UNIT I **9 Hours**

Introduction to Databases: Definition of Data, Database, and DBMS, Overview of Database Applications, Advantages and Disadvantages of DBMS, Roles of Database Users and Administrators. **Data Models:** Introduction to Data Models, Types of Data Models (Hierarchical, Network, Relational, Object-oriented), Importance of Data Models in DBMS. **Database Design:** Keys: Primary Key, Candidate Key, Super Key, Foreign Key, Composite Key, Alternate Key, Unique Key, Surrogate Key, Constraints in a table: Primary Key, Foreign Key. **Unique Key, NOT NULL, CHECK**, Entity-Relationship (ER) Model, Entities and Entity Sets, Attributes and Relationships, ER Diagrams, Key Constraints and Weak Entity Sets, Extended ER Features, Introduction to the Relational Model and Relational Schema

UNIT II **12 Hours**

Relational Algebra and Calculus: Introduction to Relational Algebra, Operations: election, Projection, Set Operations, Join Operations, Division, Tuple and Domain Relational Calculus. **Structured Query Language (SQL):**SQL Basics: DDL and DML, Aggregate Functions (Min(), Max(), Sum(), Avg(), Count()), Logical operators (AND, OR, NOT), Predicates (Like, Between, Alias, Distinct), Clauses (Group By, Having, Order by, top/limit), Inner Join, Natural Join, Full Outer Join, Left Outer Join, Right Outer Join, Equi Join. **Advanced SQL:** Analytical queries, Hierarchical queries, Recursive queries, Views, Cursors, Stored Procedures and Functions, Packages, Triggers, Dynamic SQL. **Normalization and Database Design:** Functional Dependencies: Armstrong's Axioms, Definition, Properties (Reflexivity, Augmentation, Transitivity), Types (Trivial, Non-Trivial, Partial and Full Functional Dependency), Closure of Functional Dependencies, Normal Forms (1NF, 2NF, 3NF, BCNF), Denormalization

UNIT III **12 Hours**

Transaction Management: ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control, Performance of Locking, Transaction Support in SQL, Introduction to Crash Recovery, 2PL, Serializability, and Recoverability, Introduction to Lock Management, Dealing with Deadlocks. **Database Storage and Indexing:** Data on External Storage, File Organizations and Indexing, Index Data Structures, Comparison of File Organizations, Indexes and Performance Tuning, Guidelines for Index Selection, Basic Examples of Index Selection

UNIT IV **12 Hours**

NoSQL Databases and Big Data: Introduction to NoSQL, Data Models: Document, Key value, Column family, Graph. Uses and Features of NO/SQL document databases. CAP theorem, BASE vs ACID, CRUD operations, MongoDB operators, Overview of Big Data Technologies: Hadoop, MongoDB, Cassandra. **Database Security and Advanced Topics:**

Introduction to Database Security, Access Control, Discretionary Access Control, Introduction to Data Warehousing, OLAP, Data Mining

Total : 45 hours

Text Books

1. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, third edition, McGraw-Hill, 2018
2. Benjamin Rosenzweig, Elena Rakhimov, “Oracle PL/SQL by Example”, fifth edition, Prentice Hall, 2015
3. Brad Dayley, “NoSQL with MongoDB in 24 Hours”, 1st edition, Sams Publishing, 2024

Reference Books

1. Korth, Silbertz, Sudarshan, ”Database System Concepts”, Seventh Edition, McGraw-Hill (2019)
2. R.P. Mahapatra, GovindVerma, “Database Management Systems”, Khanna Publishing House, 2025.

Web Resources

1. https://oracle-base.com/articles
2. https://forums.oracle.com/ords/apexds/domain/dev-community/category/sql_and_pl_sql
3. https://asktom.oracle.com/ords/f?p=100:1:0

CBCA25C07 **DATA BASE MANAGEMENT SYSTEM**

List of Lab Programs:

1) DDL commands with constraints (Create, Alter, Drop)

2) DML Commands with constraints (Select, Insert, Update, Delete)

3) DCL Commands (Grant, Revoke) and TCL Commands (Commit, Rollback, Savepoint)

4) SQL Queries: simple, Nested and sub queries.

5) SQL commands using Aggregate function (Group by and Having Clause)

6) SQL Commands using Set operations

7) Indexes

8) Views

9) PL/SQL : Exceptional Handling

10) PL/SQL : Cursor

11) PL/SQL : Trigger

12) PL/SQL : Packages

13) Design and Develop Application for Library Management

14) Design and Develop Application for Student Mark Sheet Processing

15) Design and Develop Application for Pay Roll Processing

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBAD25S02	BIG DATA USING HADOOP	L	T	P	C	TY/Lb/IE
		2	0	4	4	ETL
	Prerequisite : Basic knowledge of programming (preferably Java or Python), understanding of databases and SQL, and familiarity with data storage concepts and operating systems					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES:

- To understand the fundamentals of big data,its characteristics, and challenges in traditional data processing.
- To explore the Hadoop ecosystem, including HDFS, MapReduce, and YARN for distributed data storage and processing.
- To implement data processing workflows using Hadoop tools like Pig and Hive for analysis and querying.
- To gain hands-on experience with Hadoop cluster setup, data ingestion, and file management.
- To analyze large-scale datasets using Hadoop and integrate with modern data platforms for real-world applications.

COURSE OUTCOMES (COs)

CO1	To Understand the Fundamentals of Big Data and Hadoop Ecosystem
CO2	To Analyze Hadoop Architecture and Cluster Management
CO3	To Implement Data Processing using MapReduce and Apache Spark
CO4	To Explore Advanced Big Data Technologies and NoSQL Databases
CO5	To Apply Big Data Solutions for Real-World Problems Using Hadoop Ecosystem Tools and Technologies
	Mapping of Course Outcomes with Program outcomes (Pos)
	(1/2/3 indicates strength of correlation) 3-HIGH, 2-Medium, 1-Low

1	Cos/ PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	3	2	3	3	2	2	3	2	2	3	3	2	2
	CO2	2	2	3	2	3	3	2	3	3	2	2	1	3
	CO3	3	2	2	1	3	3	1	3	3	3	3	3	2
	CO4	3	3	3	2	1	3	2	1	3	3	3	2	3
	CO5	2	3	2	3	3	3	3	3	3	3	2	2	3

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
						√		

4	Approval		Meeting of Academic Council

CBAD25S02 **BIG DATA USING HADOOP**

UNIT I – Introduction to Big Data and Hadoop Ecosystem **7 hours**

Introduction to Big Data – Hadoop Architecture- Types of Digital Data and Big Data - Evolution of Data Processing - Role of Apache Hadoop - Overview of Hadoop Infrastructure - Hortonworks Data Platform (HDP) - IBM-Added Value Components in Big Data

UNIT II – Apache Ambari and Hadoop Architecture **7 hours**

Introduction to Apache Ambari- Purpose – Architecture- Components - Importance of Big Data Strategy- Data Cluster Performance Factors - Understanding Hadoop Distributed File System (HDFS)- Role of NameNode (NN) - DataNode in a Hadoop Cluster

UNIT III – MapReduce and Apache Spark **7 hours**

Introduction to MapReduce - Limitations of Hadoop v1 and Evolution of YARN in Hadoop v2 - Introduction to Apache Spark - Role in Hadoop Infrastructure - Resilient Distributed Dataset (RDD) - Principles of Spark Programming - Overview of Apache Spark Libraries: Spark Streaming, Spark SQL, MLlib, and GraphX

UNIT IV – Advanced Big Data Technologies and NoSQL Databases **9 hours**

Data File Formats: CSV, XML, JSON, YAML- NoSQL Data Stores: HBase and Key-Value Stores - Apache Pig - Apache Hive for Data Processing- Security in Hadoop - DataPlane Service (DPS)

Total : 30 hours

TEXT BOOK:

Hadoop: The Definitive Guide, 4th Edition, O'Reilly Media, 2015.

Hadoop in Action, 2nd Edition, Manning Publications, 2017.

REFERENCE BOOK:

Designing Event-Driven Systems: Concepts and Patterns for Streaming Services with Apache Kafka, 1st Edition, O'Reilly Media, 2018.

Hadoop Real-World Solutions Cookbook, 2nd Edition, Packt Publishing, 2016.

CBAD25S02 **BIG DATA USING HADOOP**

List of Lab Programs

Exploring Big Data:

Write a Python program to analyze a large dataset (CSV file) and extract insights such as total records, missing values, and data types.

1. Hadoop Installation & Configuration:

   Install Hadoop on your system and configure a single-node cluster. Demonstrate how to start and stop Hadoop services.

2. HDFS File Operations:

   Perform basic Hadoop Distributed File System (HDFS) operations:

   i. Upload a file to HDFS.
   ii. Read a file from HDFS.
   iii. Delete a file from HDFS.
   iv. Check the replication factor of a file.

3. Apache Ambari Installation & Usage:

   Install and configure Apache Ambari on a Hadoop cluster. Monitor the cluster health and perform basic administrative tasks.

4. HDFS Architecture:

   Demonstrate the role of NameNode and DataNode by adding a new node to the cluster and verifying the storage allocation.

5. Cluster Performance Analysis:

   Use Apache Ambari to monitor resource usage (CPU, memory, disk) and analyze cluster performance.

6. MapReduce Word Count Program:

   Implement a simple word count program using MapReduce in Java.

7. Sorting with MapReduce:

   Write a MapReduce program to sort a dataset containing numerical values.

8. Apache Spark RDD Operations:

   Write a PySpark program to perform basic RDD operations like map(), filter(), and reduce().

   Apache Spark DataFrame Operations:

9. Load a CSV file into a Spark DataFrame and perform operations such as filtering, grouping, and aggregation using Spark SQL.Apache Spark Streaming:

10. Implement a real-time data streaming application using Apache Spark Streaming to process live Twitter data.

    Data Processing using Apache Pig:

11. Write a Pig script to process a large dataset, filter data, and perform aggregation.

    Data Querying with Apache Hive:

12. Create a Hive table, load data, and execute queries to retrieve meaningful insights from a structured dataset.

    NoSQL Database – HBase Operations:

13. Perform CRUD (Create, Read, Update, Delete) operations in HBase using the HBase shell.

    Hadoop Security & User Authentication:

14. Implement user authentication and access control in Hadoop to restrict unauthorized access to HDFS files.

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25C08	SOFTWARE ENGINEERING	L	T	P	C	TY/Lb/ IE
		3	0	0	3	TY
	Prerequisite –Basic understand of Software, Applications, Programming fundamentals.					
	Course Designed by –Faculty of Computer Applications					

OBJECTIVES

- Understand Software Development Processes
- Develop Systematic Engineering Practices
- Enhance Problem Solving and Design Skills
- Improve Software Quality

COURSE OUTCOMES (COs)

CO1	To Acquire a comprehensive understanding of the software development lifecycle and its application in contemporary software engineering practices.
CO2	To Develop proficiency in project management methodologies and strategic decision- making for successful software project execution.
CO3	To Master the art of software design, development, and testing to produce robust and efficient software solutions.
CO4	Implement software testing techniques for quality assurance and debugging.
CO5	Use project management tools and techniques to manage time, cost, and resources effectively.

Mapping of Course Outcomes with Program outcomes (POs)

(1/2/3 indicates strength of correlation) 3-HIGH, 2-Medium, 1-Low

1	COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO 3	PSO 4
2	**CO1**	3	2	3	3	3	2	3	3	2	3	3	2	2
	CO2	2	3	3	1	2	3	1	2	3	2	2	3	3
	CO3	3	2	2	3	3	1	3	3	1	3	3	1	2
	CO4	2	3	3	2	1	3	2	1	3	3	1	2	3
	CO5	3	3	2	3	2	3	3	2	3	3	2	3	3

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
		√						
4	Approval		Meeting of Academic Council					

CBCA25C08 **SOFTWARE ENGINEERING**

UNIT I **9 Hours**

Introduction: The evolving role of software, changing nature of software, layered technology, a process framework, Process models' The waterfall model, incremental process models, evolutionary process models, the unified process.

Agile software development: Agility Principles, Agile methods, Plan-driven and agile development, Extreme programming, Scrum, A Tool Set for the Agile Process.

UNIT II **9 Hours**

Software Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management .

Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan.

UNIT III **9 Hours**

Project Planning: Software pricing, Plan-driven development, Project scheduling. Agile planning, estimation techniques.

Design: Design process and design quality, design concepts, the design model, software architecture, data design, architectural design, Basic structural modeling, class diagrams, sequence diagrams, Collaboration diagrams, use case diagrams, component diagrams.

UNIT IV **9 Hours**

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.

Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

UNIT V **9 Hours**

Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability.

Release Management: Release planning, development and build plans, release strategies, risk management, and post-deployment monitoring.

Product sustenance: Maintenance, updates, End of life, migration strategies.

Total : 45 hours

Text Books

1. **Software Engineering, N S Gill, Khanna Publlshing House, 2023 (AICTE Recommended Textbook).**
2. **Software Engineering, Ian Somerville, 9th edltion, Pearson education.**
3. **Software Engineering A practitioner's Approach, 8th edition, Roger S Pressman, Bruce R Maxim McGraw Hill Education, 2015.**

Reference Books

1. **Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007.**
2. **Software Engineering' Principles and Practice Hans van Vliet.**

CBCA25EXX	**Professional Elective-I**	**L**	**T**	**P**	**C**	**TY/Lb/IE**
		1	0	4	3	ETL/TY
	Course Designed by – Faculty of Computer Applications					

Refer to Appendix-I for Professional Electives and choose either one specialization from the basket

CBCA25VAX	**YOGA/SPORTS/NCC/NSS/DISASTER MANAGEMENT AND PHYSICAL FITNESS**	**L**	**T**	**P**	**C**	**TY/Lb/IE**
		0	0	4	2	IE
	Prerequisite – +2					
	Course Designed by – Faculty of Computer Applications					

***For Detailed Course Refer Appendix – IV**

SEMESTER – IV

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25C09	ENTREPRENEURSHIP AND STARTUP ECOSYSTEM	L	T	P	C	TY/Lb/IE
		1	1	0	2	IE
	Prerequisite : +2					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES

1. To enrich the students towards the knowledge of entrepreneurial skills and to make the students understand the approaches to attain the goals of the business.
2. To recognize the value of problem solving, effective business management and entrepreneurial thinking to business development.
3. To identify the key factors and be able to apply the key entrepreneurial process – command and control, calculated risk-taking and opportunity recognition to business development

COURSE OUTCOMES (Cos) Students completing this course Will be able to

CO1	Provide information related to entrepreneurship
CO2	Make students state the importance of entrepreneurial development
CO3	State the importance of business idea generations
CO4	Gain knowledge on various EDP organized by Government Sectors
CO5	Provide them the nature of economic development and entrepreneurial growth.

Mapping of Course Outcome with Program Outcome (POs)

1	COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	2	3	2	3	3	3	3	2	3	3	3	2	2
	CO2	3	3	3	3	3	3	3	3	3	2	2	3	2
	CO3	3	2	3	3	2	3	3	3	2	3	3	2	3
	CO4	2	3	2	3	3	3	3	2	3	3	3	3	3
	CO5	3	3	3	3	2	3	2	3	3	3	2	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	CC	AEC	MDE	VAC	SEC	DSE	OE
	✓						

Approval	Meeting of Academic Council

CBCA25C09 ENTREPRENEURSHIP AND STARTUP ECOSYSTEM

Unit 1: Introduction to Entrepreneurship & Family Business **6 Hours**

- Definition and Concept of entrepreneurship
- Entrepreneur Characteristics
- Classification of Entrepreneurs
- Role of Entrepreneurship in Economic Development –Start-ups

Unit 2: Family Business **6 Hours**

Knowing the characteristics of Family business with discussion on few Indian cases of Family Business like Murugappa, Dabur, Wadia, Godrej, Kirloskar etc.

Unit 3: Evaluating Business opportunity **6 Hours**

- Sources of business ideas and opportunity recognition
- Guesstimating the market potential of a business idea
- Feasibility analysis of the idea
- Industry, competition and environment analysis

Unit 4: Building Blocks of starting ventures **6 Hours**

- Low cost Marketing using digital technologies
- Team building from scratch
- Venture Funding
- Establishing the value-chain and managing operations
- Legal aspects like IPR and compliances

Unit 5: Start-up Ecosystem **6 Hours**

- Know the components of the start-up ecosystem including Incubators, Accelerators, Venture Capital Funds, Angel Investors etc.
- Know various govt. schemes like Start-up India, Digital India, MSME etc.
- Sources of Venture Funding available in India
- Source of Technology, Intellectual Property management

Total : 30 hours

Text Books (Latest Edition):

1. Startup India Leaning Program by Start Up India available atwww.startupindia.gov.in

2. Entrepreneurship, Rajeev Roy, Oxford University Press-family Business Management by Rajiv Agarwal, Sage Publishing

3. Anish Tiwari , “Mapping the Startup Ecosystem in India”, Economic & Political Weekly.

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25C10	COMPUTER NETWORKS	L	T	P	C	TY/L
		3	0	0	3	TY
	Prerequisite - Basic Networking Knowledge: Familiarity with basic networking concepts such as IP addressing and network topologies.					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES

- Understand the basic concepts and principles of computer networking.
- Familiarize students with the layered architecture (OSI and TCP/IP models).
- Explain protocols, standards, and technologies used in each layer.
- Provide knowledge of addressing, routing, and switching.
- Develop skills in designing and analyzing small to medium-sized networks.
- Introduce network security, wireless networks, and emerging trends.

COURSE OUTCOMES (COs)

CO1	Understand the fundamental concepts of Computer Networks and their applications.
CO2	Develop problem-solving skills related to network design, implementation, and troubleshooting
CO3	Implement network protocols and configure network devices.
CO4	Configure basic networking components and troubleshoot network issues.
CO5	Understand basic concepts of network security, firewalls, and encryption.
	Mapping of Course Outcomes with Program outcomes (POs)
	(1/2/3 indicates strength of correlation) 3-HIGH, 2-Medium, 1-Low

1	COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO 2	PSO 3	PSO 4
2	**CO1**	3	2	3	2	2	2	2	2	2	3	3	2	3
	CO2	3	3	2	3	1	3	3	1	3	2	3	1	3
	CO3	3	3	3	1	3	2	1	3	2	3	2	3	2
	CO4	3	3	3	2	3	3	2	3	3	3	2	1	3
	CO5	3	3	3	3	2	3	3	2	3	3	3	1	3

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
		✓						
4	Approval				Meeting of Academic Council			

CBCA25C10 **COMPUTER NETWORKS**

UNIT I: Introduction to Computer Networks **9 Hours**

Overview of Computer Networks: Definition and Objectives, Applications and Examples. **Network Components and Architecture**, **Network Models:** OSI Model: Layers and Functions, TCP/IP Model: Layers and Functions. **Network Topologies:** Physical vs. Logical Topologies, Common Topologies: Star, Ring, Bus, Mesh, Hybrid, Advantages and Disadvantages of Each Topology. **Data Transmission:** Analog vs. Digital Signals, Transmission Modes: Simplex, Half-Duplex, Full-Duplex, Bandwidth and Latency
Networking Devices: Routers, Switches, Hubs, Bridges, Gateways, Functions and Configurations of Each Device.

UNIT II: Data Link Layer **9 Hours**

Data Link Layer Fundamentals: Functions of the Data Link Layer, Framing, Error Detection, and Error Correction, Flow Control Mechanisms. **Ethernet:** Ethernet Standards and Frame Structure, MAC Addressing and ARP, Ethernet Switching: Basic Concepts and Methods.

UNIT III: Networking Protocols & Network Layer **9 Hours**

Network Protocols: Introduction to TCP/IP Protocol Suite, IP Addressing: IPv4 and IPv6 Subnetting and CIDR Notation. **Address Resolution Protocol (ARP):** ARP Operation and Table, ARP Spoofing and Security Considerations .**Virtual LANs (VLANs):** Concept of VLANs, VLAN Tagging and Configuration, Benefits and Use Cases. **Network Layer:** IP Routing: Static vs. Dynamic Routing, Routing Protocols: RIP, OSPF, BGP, Network Address Translation (NAT),

UNIT IV: Transport Layer **9 Hours**

Transport Layer: TCP vs. UDP: Characteristics and Use Cases, TCP Handshake and Connection Management, Flow Control and Congestion Control in TCP, **Congestion Control Algorithms:** Techniques: Slow Start, Congestion Avoidance, Fast Retransmit, Fast Recovery, TCP Variants: TCP Reno, TCP Vegas.
Quality of Service (QoS): QoS Principles and Mechanisms, Differentiated Services (DiffServ) and Integrated Services (IntServ). **Network Security Fundamentals:** Threats and Vulnerabilities, Basic Security Mechanisms: Firewalls, VPNs, Encryption

UNIT V: Application Layer and Emerging Technologies **9 Hours**

Application Layer Protocols: HTTP/HTTPS: Structure and Operation, FTP, SMTP, POP3, IMAP: Protocols and Uses, DNS: Domain Name System and Resolution
Network Applications: Web Browsing, Email Communication, File Transfer, Voice over IP (VoIP) and Streaming. **Emerging Technologies:** Software-Defined Networking (SDN), Network Function Virtualization (NFV), Internet of Things (IoT) and Its Impact on Networking **Network Management:** SNMP: Simple Network Management Protocol, Network Monitoring Tools and Techniques. **Future Trends in Networking:** 5G and Beyond, Network Automation and Artificial Intelligence in Networking.

Total : 45 hours

Text Books:

- Andrew S. Tanenbaum, *"Computer Networks"*, 5th Edition, Pearson Education, 2011.
- James F. Kurose and Keith W. Ross, *"Computer Networking: A Top-Down Approach"*, 8th Edition, Pearson, 2021.

Reference Books:

1. Behrouz A. Forouzan, *"Data Communications and Networking"*, 5th Edition, McGraw-Hill Education, 2012.
2. Larry L. Peterson and Bruce S. Davie, *"Computer Networks: A Systems Approach"*, 6th Edition, Morgan Kaufmann, 2019.
3. Bhavneet Sidhu, *An Integrated Approach to Computer Networks*, Khanna Publishing House, 2023.
4. *Mastering PC Hardware & Networking*, Khanna Publishing House, 2024.

Web Resources:

1. Cisco Networking Academy – Online Courses and Resources
2. NetworkLessons.com – Tutorials on Various Networking Topics

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25S05	JAVA PROGRAMMING	L	T	P	C	TY/Lb/ IE
		3	0	4	5	ETL
	Prerequisite – Basic knowledge in Object Oriented Programming					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES

- Understand the Basics of Java
- Set Up Java Development Environment
- Learn Java Syntax and Structure
- Use Data Types and Variables
- Apply Operators and Expressions

COURSE OUTCOMES (COs)

CO1	To understand the basic concepts of OOP's programming.
CO2	To provide knowledge about Constructor, Inheritance and usage of Operator Overloading
CO3	To introduce the Java Programming concepts Package, Interface and Exception Handling
CO4	To develop the knowledge in the advance concepts Applets and AWT.
CO5	To familiarize the concepts Socket Programming, Proxy servers, TCP/IP

Mapping of Course Outcomes with Program outcomes (POs)

(1/2/3 indicates strength of correlation) 3-HIGH, 2-Medium, 1-Low

1	COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	CO1	3	2	3	3	3	2	2	3	2	3	3	1	21
	CO2	2	3	3	1	2	3	1	3	3	2	3	2	3
	CO3	3	2	2	2	3	3	2	2	3	3	2	1	3
	CO4	3	3	3	1	1	3	1	1	3	3	3	2	3
	CO5	2	3	3	3	2	3	3	2	3	2	3	3	3

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
						√		
4	Approval				Meeting of Academic Council			

CBCA25S05 JAVA PROGRAMMING

UNIT I **9 Hours**

Fundamentals of Object Oriented Programming: Basic Concepts of Object Oriented Programming (OOP), Benefits and Applications of OOP.

Java Evolution: Java Features, Difference between Java, C and C++, Java and Internet, Java Environment.

Overview of Java Language: Introduction to Simple Java Program, Use of Comments and Math function, Application of two classes, Java Program Structure, Java Tokens and statements, Implementing Java program And JVM, Command Line Arguments.

UNIT II **12 Hours**

Constants, Variables and Data Types: Constants, Variables, Data Types, Declaration of Variables, Giving values to Variables, Symbolic Constants, Typecasting.

Operators & Expressions: Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment & Decrement operators, conditional operators, Bitwise operators, Arithmetic Expressions, Evaluation of Expressions, Type Conversions in Expressions, Operator Precedence & Associativity.

Decision Making, Branching & Looping: Decision Making with Control Statements, Looping statements, Jump 1n loops, Labelled loops.

UNIT III **12 Hours**

Classes, Objects and Methods: Defining Class, Methods Declaration, Constructors, Methods Overloading, Overriding Methods, Inheritance

Arrays, Strings and Vectors: 1D arrays, Creating an Array, 2D arrays, Strings, Vectors, Wrapper Classes, Enumerated Types

Inheritance: Defining, extending classes, and Implementing Interfaces. Multiple inheritance and polymorphism.

UNIT IV **12 Hours**

Packages: Basics of packages, System packages, Creating and accessing packages, Creating user defined packages, Adding class to a package.

Exception Handling: Using the main keywords of exception handling: try, catch, throw, throws and finally; Nested try, Multiple catch statements, Creating user defined exceptions

Total : 45 hours

Text Books

1. Balaguruswamy E. (2023). Programming with JAVA: A Primer. 7th edition. India: McGraw Hill Education
2. Schildt, H. (2022). Java: The Complete Reference. 12th edition. McGraw-Hill Education.

Reference Books

1. AruneshGoyal, The Essentials of JAVA, Khanna Book Publishing Company Private Limited, 2012.
2. TanweerAlam, Core JAVA, Khanna Book Publishing Company Private Limited, 2015.
3. Y. Daniel Liang, Introduction to Java Programming, 7th Edition, Pearson, 2008.
4. S Malhotra and S. Choudhary, Programming in Java, 2nd Edition, OxfordUniversity Press, 2014.

Web Resources

- https://www w3schools com/java/.
- http://www java2s.com/.
- https://onlinecourses nptel ac.in/noc22 csd47/preview

CBCA25S05 **JAVA PROGRAMMING**

List of Lab Programs:

1. Write a program to read two numbers from user and print their product.
2. Write a program to print the square of a number passed through command line arguments.
3. Write a program to send the name and surname of a student through command line arguments and print a welcome message for the student.
4. Write a java program to find the largest number out of n natural numbers.
5. Write a java program to find the Fibonacci series & Factorial of a number using recursive and non-recursive functions.
6. Write a java program to multiply two given matrices.
7. Write a Java program for sorting a given list of names 1n ascending order.
8. Write a Java program that checks whether a given string 1s a palindrome or not . Ex: MADAM 1s a palindrome.
9. Write a java program to read n number of values 1n an array and display it in reverse order.
10. Write a Java program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from Add Subclass to use the member data of the superclass. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations.
11. Create a JAVA class called Student with the following details as variables within it.
    a. USN, NAME, BRANCH, PHONE, PERCENTAGE
    b. Write a JAVA program to create n Student objects and print the USN, Name, Branch, Phone, and percentage of these objects with suitable headings.
12. Write a Java program that displays the number of characters, lines and words in a text.
13. Write a Java program to create a class called Shape with methods called getPerimeter() and getArea(). Create a subclass called Circle that overrides the getPerimeter() and getArea() methods to calculate the area and perimeter of a circle.
14. Write a Java program to create a class Employee with a method called calculateSalary(). Create two subclasses Manager and Programmer. In each subclass, override the calculateSalary() method to calculate and return the salary based on their specific roles.
15. Write a Java program using an interface called ‘Bank’ having function 'rate_ofinterest()'. Implement this interface to create two separate bank classes “SBI” and ‘PNB’ to print different rates of interest. Include additional member variables, constructors also in classes ‘SBI’ and ‘PNB’.
16. Write a Java package program for the class book and then import the data from the package and display the result.
17. Write a Java program for finding the cube of a number using a package for various data types and then import it in another class and display the results.
18. Write a Java program for demonstrating the divide by zero exception handling.
19. Write a Java program that reads a list of integers from the user and throws an exception if any numbers are duplicates.
20. Create an exception subclass UnderAge, which prints “Under Age™ along with the age value when an object of UnderAge class 1s printed in the catch statement. Write a class exception Demo 1n which the method test() throws UnderAge exception if the variable age passed to it as argument 1s less than 18 Write main() method also to show working of the program.

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBAD25C02	MACHINE LEARNING FUNDAMENTALS WITH PYTHON	L	T	P	C	TY/Lb/ IE
		3	0	4	5	ETL
	Prerequisite : Basic Python programming skills, foundational knowledge of statistics and linear algebra, and familiarity with data handling using libraries like NumPy and Pandas.					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES:

- To understand the core concepts and types of machine learning including supervised, unsupervised, and reinforcement learning.
- To implement basic ML algorithms such as linear regression, decision trees, and k-means clustering using Scikit-learn.
- To explore model evaluation techniques including confusion matrix, accuracy, precision, recall, and cross-validation.
- To gain hands-on experience in preparing, preprocessing, and visualizing datasets for machine learning tasks
- To build and optimize end-to-end machine learning models for real-world applications using Python.

COURSE OUTCOMES (COs)

CO1	To Understand the Fundamentals of Machine Learning
CO2	To Apply Supervised Learning Techniques
CO3	To Explore Unsupervised and Reinforcement Learning
CO4	To Utilize IBM Watson Machine Learning Service
CO5	Develop and Deploy End-to-End Machine Learning Models Using Python and Real-World Datasets
	Mapping of Course Outcomes with Program outcomes (Pos)
	(1/2/3 indicates strength of correlation) 3-HIGH, 2-Medium, 1-Low

1	Cos/ PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	3	2	3	3	2	2	3	2	2	3	3	2	2
	CO2	2	2	3	2	3	3	2	3	3	2	2	1	3
	CO3	3	2	2	1	3	3	1	3	3	3	3	3	2
	CO4	3	3	3	2	1	3	2	1	3	3	3	2	3
	CO5	2	3	2	3	3	3	3	3	3	3	2	2	3

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
						√		

4	Approval		Meeting of Academic Council

CBAD25C02 MACHINE LEARNING FUNDAMENTALS WITH PYTHON

UNIT I – Machine Learning Introduction 9 HOURS

Introduction to Machine Learning - Types of Machine Learning - Machine Learning Workflow - Introduction to Python for Machine Learning – Introduction to Scikit-learn.

UNIT II – Supervised Learning 12 HOURS

Introduction to Supervised Learning- Regression Models (Linear Regression - Polynomial Regression - Decision Tree Regression - Random Forest Regression) - Classification Models- (Logistic Regression , K-Nearest Neighbors (KNN), Decision Trees and Random Forests, SVM, Naïve Bayes) - Performance Evaluation

UNIT III – Unsupervised Learning and Reinforcement Learning 12 HOURS

Introduction to Unsupervised Learning - Clustering Algorithms (K-Means Clustering- Hierarchical Clustering - DBSCA) - Introduction to Reinforcement Learning (RL) - Markov Decision Process (MDP) – Model Free Learning- Deep Q Learning – Introduction to Neural Networks for RL.

UNIT IV – IBM Watson Machine Learning Service 12 HOURS

Overview of IBM Watson Machine Learning - IBM Cloud and Watson AI Services – Watson Studio services - Key Features of Watson Machine Learning – project creation and Implementation - Data Preparation & Preprocessing- Building and Training Machine Learning Models. Introduction to Auto AI.

Total : 45 hours

TEXT BOOK:

Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (2nd Edition)
by Aurélien Geron (2019)

Hands-On Machine Learning with IBM Watson by James D. Miller (2019)

REFERENCE BOOK:

Turning Data into Insight with Machine Learning for IBM by Makenzie Manna (2023)

IBM Watson Solutions for Machine Learning: Achieving Successful Real-Time AI-Based Applications by Arindam Ganguly (2021).

CBAD25C02 MACHINE LEARNING FUNDAMENTALS WITH PYTHON

List of Lab Programs

1. Basic Data Preprocessing: Load a dataset, handle missing values, normalize/standardize data, and visualize key statistics using Python (Pandas, NumPy, Matplotlib).
2. Machine Learning Workflow Implementation: Implement a basic ML workflow with data loading, preprocessing, model training, and evaluation using Scikit-learn.
3. Exploring Scikit-learn Functions: Write a program that demonstrates the use of Scikit-learn functions like train_test_split, StandardScaler, and Pipeline using sample data.
4. Linear Regression Model: Train and evaluate a Linear Regression model on a dataset (e.g., House Price Prediction).
5. Polynomial Regression Implementation: Implement Polynomial Regression to model a non-linear relationship and visualize the fitted curve.
6. Decision Tree and Random Forest Regression: Train both models on a dataset and compare their performance using RMSE and R^2 scores.
7. Logistic Regression for Classification: Implement Logistic Regression on a dataset (e.g., predicting whether a customer will purchase a product based on age and salary).
8. K-Nearest Neighbors Classifier: Implement KNN for classification on a dataset and analyze how different values of k impact accuracy.
9. Support Vector Machine (SVM) for Classification: Train an SVM classifier with different kernel functions (linear, RBF, polynomial) and compare performance.
10. K-Means Clustering Implementation: Apply K-Means clustering on a dataset (e.g., Customer Segmentation) and visualize clusters.
11. Hierarchical Clustering for Grouping Data: Implement hierarchical clustering and generate a dendrogram for visualization.
12. Deep Q Learning for Reinforcement Learning: Implement a simple Deep Q-Learning model for an OpenAI Gym environment.
13. Data Preparation and Preprocessing in Watson Studio: Load data into Watson Studio, perform data cleaning and transformation, and visualize it.
14. Building and Deploying a Model using AutoAI: Use Watson AutoAI to train and deploy a model on IBM Cloud.
15. Deploying a Model as a REST API on Watson ML: Train a simple classification model, deploy it as an API, and make predictions using API calls.

CBCA25EXX	**Professional Elective-II**	**L**	**T**	**P**	**C**	**TY/Lb/IE**
		1	0	4	3	ETL/TY
	Course Designed by – Faculty of Computer Applications					

Refer to Appendix-I for Professional Electives and choose either one specialization from the basket

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25S06	DESIGN THINKING AND INNOVATION	L	T	P	C	Ty/Lb /IE
		1	1	0	2	IE
	Prerequisite - +2					
	Course Designed by – Faculty of Management Studies					

OBJECTIVES

1. To understand the principles of Design Thinking, a creative solution-based approach to problem solving.
2. To understand the practice of design thinking for Strategic Innovation

COURSE OUTCOMES (COs)

CO1	Apply design thinking concepts to give solution
CO2	Understanding the process of design thinking
CO3	Knowledge on innovation
CO4	Practicing innovation using design thinking
CO5	Use of design thinking in business
	(H/M/L indicates strength of correlation) H-HIGH, M -Medium, L-Low

1	COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	3	2	3	3	2	2	3	2	2	3	3	2	2
	CO2	3	3	3	1	2	3	1	2	3	2	2	1	3
	CO3	3	2	2	1	3	3	1	3	3	3	3	1	3
	CO4	3	3	3	2	1	3	2	1	3	3	3	2	3
	CO5	3	3	2	3	2	3	3	2	3	3	3	2	2

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
						✓		
4	Approval		Meeting of Academic Council					

CBCA25S06 **DESIGN THINKING AND INNOVATION**

Unit 1: Basics of Design Thinking **6 Hours**

1. Understand the concept of innovation and its significance in business
2. Understanding creative thinking process and problem solving approaches
3. Know Design Thinking approach and its objective
4. Design Thinking and customer centricity – real world examples of customer challenges, use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product.

Unit 2: Design Thinking Process and Success Stories **6 Hours**

1. Discussion of a few global success stories like AirBnB, Apple, IDEO, Netflix etc.
2. Explain the four stages of Design Thinking Process – Empathize, Define, Ideate, Prototype, Implement

Unit 3: Learning to Empathize and Define the Problem **6 Hours**

1. Know the importance of empathy in innovation process – how can students develop empathy using design tools
2. Observing and assimilating information
3. Individual differences & Uniqueness Group Discussion and Activities to encourage the understanding, acceptance and appreciation of individual differences.
4. What are wicked problems
5. Identifying wicked problems around us and the potential impact of their solutions

Unit 4: Ideate, Prototype and Implement **6 Hours**

1. Know the various templates of ideation like brainstorming, systems thinking
2. Concept of brainstorming – how to reach consensus on wicked problems
3. Mapping customer experience for ideation
4. Know the methods of prototyping, purpose of rapid prototyping.
5. Implementation

Unit 5: Feedback, Re-Design & Re-Create **6 Hours**

1. Feedback loop, focus on User Experience, address ergonomic challenges, user focused design
2. Final concept testing,
3. Final Presentation – Solving Problems through innovative design concepts & creative solution

TOTAL: 30 Hours

Text Books (Latest Edition):

1. E Balaguruswamy , Developing Thinking Skills (The way to Success), Khanna Book Publishing Company
2. Tim Brown,"Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", *Harvard Business Review*
3. 8 steps to Innovation by R T Krishnan & V Dabholkar, Collins Publishing

Reference Book

1. Design Thinking by Nigel Cross, Bloomsbury

SEMESTER – V

CBCA25EXX	**Professional Elective-III**	**L**	**T**	**P**	**C**	**TY/Lb/IE**
		3	0	4	5	ETL/TY
	Course Designed by – Faculty of Computer Applications					

Refer to Appendix-I for Professional Electives and choose either one specialization from the basket

CBCA25EXX	**Professional Elective-IV**	**L**	**T**	**P**	**C**	**TY/Lb/IE**
		3	0	4	5	ETL/TY
	Course Designed by – Faculty of Computer Applications					

Refer to Appendix-I for Professional Electives and choose either one specialization from the basket

CBCA25EXX	**Professional Elective-V**	**L**	**T**	**P**	**C**	**TY/Lb/IE**
		3	0	4	5	ETL/TY
	Course Designed by – Faculty of Computer Applications					

Refer to Appendix-I for Professional Electives and choose either one specialization from the basket

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25S07	QUANTITATIVE TECHNIQUES	L	T	P	C	Ty/Lb /IE
		0	2	0	2	IE
	Prerequisite - +2					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES

- To understand the basic concepts in Logical reasoning.
- To understand the basic concepts in Arithmetic Reasoning.
- To understand the basic concepts in Data Interpretation.

COURSEOUTCOMES(Cos)
students completing the course were able to

CO1	To understand the basic concepts in Logical statements and arguments
CO2	Understand the concepts in Arithmetic Reasoning.
CO3	Understand the basic concepts in Number system
CO4	Understand the basic concepts in Permutations and Combinations.
CO5	Learn how to analyze the data using pictorial representation.

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	2	3	1	3	2	3	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	3	2
CO2	2	1	2	3
CO3	3	3	1	1
CO4	3	3	2	3
CO5	2	1	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
						✓		
4	Approval			Meeting of Academic Council				

CBCA25S07 **QUANTITATIVE TECHNIQUES**

Unit I: Logical Reasoning I: **6 Hours**

Logical statements- Arguments – Assumption – Courses of Action

Unit II: Logical Reasoning II: **6 Hours**

Logical Conclusions - Deriving conclusion from passages – Theme detection

Unit III: Arithmetic Reasoning I: **6 Hours**

Number system, H,C,F. & L.C.M – Problem on ages – Percentage – Profit & Loss – Ratio & Proportion.

Unit IV: Arithmetic Reasoning II: **6 Hours**

Time & Work – Time & Distance – Clocks - Permutations and Combinations – Heights & Distances – Odd man out and series.

Unit V: Data Interpretation: **6 Hours**

Tabulation – Bar graphs – Pie graphs – Line graphs.

Total : 30 hours

Reference Book:

1. R.S. Agarwal, A modern approach to Logical Reasoning, S.Chand & Co., (2017).
2. R.S. Agarwal, A modern approach to Verbal and Non Verbal Reasoning, S.Chand & Co., (2017).
3. R.S. Agarwal, Quantitative Aptitude for Competitive Examinations, S.Chand & Co., (2017).
4. A.K. Gupta, Logical and Analytical Reasoning, Ramesh Publishing House, (2014).
5. B.S. Sijwali, Indusijwali, A new approach to Reasoning (Verbal and Non Verbal), Arihant Publishers,(2014).

CBCA25S08	**Internship/Technical Skill/Capstone Project**	**L**	**T**	**P**	**C**	**TY/Lb/IE**
		0	0	8	4	IE
	Course Designed by – Faculty of Computer Applications					

INTERNSHIP / Technical Skill

CO1: Apply theoretical knowledge to real world problems by participating in professional settings, gaining practical experience in a relevant industry.

CO2: Knowing the depth of the activities in the area of specialization

CO3: Take part in activities and learn by practice

1	COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	3	2					2			3		3	3
3	**CO2**	3	3				1	2		2	3		3	3
4	**CO3**	3	3	2			1			2	3	3	3	3

Students will have an opportunity to expose their knowledge and talent to make an innovative project. Students are supposed to do innovative projects useful to industries/society in the area of relevant field, inter and multi-disciplinary areas, under the guidance of a staff member. They have to prepare a project report and submit to the department.

At the end of the semester Viva-Voce examination will be conducted by the internal Examiner duly appointed by the Head of the department and the students will be evaluated.

CBCA25S09	**Major Project [evaluation in 6th sem]**	**L**	**T**	**P**	**C**	**TY/Lb/IE**
		0	0	0	0	-
	Course Designed by – Faculty of Computer Applications					

Major Project [evaluation in 6th sem]

CO1: Application of theoretical concepts

CO2: Problem solving and innovation

CO3: Foundation for final project/major project

CO4: Technical and project planning skills

CO5: Teamwork and communication

- Student will be formed into groups
- Guide will be allocated
- Need to finalize area and topic
- Need to prepare review report
- Finalize objectives and hypotheses
- Frame questionnaire or survey tool if required
- Meeting and getting the guides at every stage
- Certificate from the company has to be submitted to the department.

SEMESTER – VI

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBAD25C03	GENERATIVE AI USING WATSON X	L	T	P	C	TY/Lb/ IE
		2	0	4	4	ETL
	Prerequisite: Basic AI/ML concepts, Python programming, Familiarity with cloud platforms and IBM Watson services.					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES:

- To understand the foundational concepts of Generative AI and how they are implemented using IBM Watsonx.
- To explore model training, fine-tuning, and prompt engineering techniques using Watsonx.ai.
- To gain practical knowledge of deploying and managing generative AI models on the Watsonx platform.
- To integrate generative AI capabilities into applications using Watsonx APIs and SDKs.
- To introduce governance, security, and ethical considerations in generative AI model usage and deployment.

COURSE OUTCOMES (COs)

CO1	To Understand the Core Concepts of Generative AI
CO2	To Develop and Deploy AI Models using IBM Watsonx.ai
CO3	To Enhance AI Output with Effective Prompt Engineering
CO4	To Build Intelligent Chatbots and AI Solutions with IBM Watson
CO5	To Evaluate and Optimize Generative AI Solutions
	Mapping of Course Outcomes with Program outcomes (Pos)
	(1/2/3 indicates strength of correlation) 3-HIGH, 2-Medium, 1-Low

1	Cos/ PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	**CO1**	3	2	3	3	2	2	3	2	2	3	3	2	2
	CO2	2	2	3	2	3	3	2	3	3	2	2	1	3
	CO3	3	2	2	1	3	3	1	3	3	3	3	3	2
	CO4	3	3	3	2	1	3	2	1	3	3	3	2	3
	CO5	2	3	2	3	3	3	3	3	3	3	2	2	3

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
						√		
4	Approval		Meeting of Academic Council					

CBAD25C03 GENERATIVE AI USING WATSON X

UNIT I – Introduction to Generative AI 7 HOURS

Introduction to Generative AI - Brief History of Generative AI - Modern Generative AI Architectures - Generative AI Applications - Challenges, Limitations, and Risks - Data Privacy and Security

UNIT II – IBM watsonx.ai and Foundation Models 7 HOURS

Introduction to IBM watsonx.ai - Developing Generative AI Solutions with IBM watsonx.ai - Foundation Models in Generative AI - Choosing a Foundation Model in IBM watsonx.ai - Model Selection - Customizing Pre-trained Foundation Models

UNIT III – Developing Generative AI Solutions 7 HOURS

Prompt Engineering Techniques - Techniques for Avoiding Undesirable Outputs - Generating Accurate and Reliable Outputs - Fine-tuning- Ensuring AI-generated Responses

UNIT IV – Advanced AI Applications & Chatbots with IBM Watson 9 HOURS

Retrieval-Augmented Generation (RAG) - Building AI-Powered Chatbots using IBM Watsonx - Evaluation and Optimization of AI Solutions - Performance Metrics for Generative AI Models- Future Trends in Generative AI.

Total : 30 hours

TEXT BOOK:

Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play by David Foster (2019)

GEN AI Using IBM Watsonx course by IBM (2023)

REFERENCE BOOK:

Hands-On Generative AI with Transformers and Diffusion Models by Yuxi (Hayden) Liu (2023)

IBM Watson: Cognitive Computing in Practice by Rob High, Tanmay Bakshi (2020)

CBAD25C03 **GENERATIVE AI USING WATSON X**

List of Lab Programs :

1. Use Hugging Face to explore and test a pre-trained Generative AI model.
2. Train a basic VAE model using TensorFlow or PyTorch to generate synthetic data.
3. Implement word-level, subword-level, and character-level tokenization using Python's nltk and spaCy libraries.
4. Develop a custom tokenizer that removes stopwords and punctuation while preserving sentence structure.
5. Modify a prompt structure to improve the accuracy and relevance of AI-generated responses.
6. Generate and visualize word embeddings using Word2Vec, GloVe, and FastText on a sample dataset.
7. Implement stemming and lemmatization techniques and analyze their impact on tokenized text.
8. Apply IBM Watsonx.ai's tokenization tools to preprocess text data and visualize token distributions.
9. Train a custom Word2Vec model on a domain-specific corpus and evaluate word associations.
10. Use IBM Watsonx.ai to deploy a text-generation model and generate responses based on custom prompts.
11. Experiment with tokenization and embeddings using Watsonx.ai's NLP tools.
12. Customizing a Foundation Model for Sentiment Analysis Fine-tune a foundation model for sentiment classification using Watsonx.ai.
13. Use a text-to-image generative model (like DALL·E, Stable Diffusion, or IBM Watsonx.ai) to create an image based on a given text prompt.
14. Create a chatbot in Watson Assistant and integrate it with a foundation model for better responses.
15. Automating Code Generation using IBM Watsonx.ai. Generate Python scripts using Watsonx.ai's code-generation capabilities.

CBCA25EXX	**Professional Elective-VI**	**L**	**T**	**P**	**C**	**TY/Lb/IE**
		3	0	4	5	ETL/TY
	Course Designed by – Faculty of Computer Applications					

Refer to Appendix-I for Professional Electives and choose either one specialization from the basket

CBCA25EXX	**Professional Elective-VII**	**L**	**T**	**P**	**C**	**TY/Lb/IE**
		3	0	4	5	ETL/TY
	Course Designed by – Faculty of Computer Applications					

Refer to Appendix-I for Professional Electives and choose either one specialization from the basket

FACULTY OF COMPUTER APPICATIONS

BCA-Full Time Program- Curriculum &Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25A09	SOFT SKILL	L	T	P	C	TY/Lb/IE
		0	1	0	1	IE
	Prerequisite - English Language					
	Course Designed by – Faculty of Computer Applications					

OBJECTIVES
1.Become good listeners to get engaged in interactive communication for effective team building. 2. Develop assertive and adaptive behaviour to be leaders 3. Develop peer interaction for a successful lifelong learning. 4. Learn skills necessary for a cooperative living in academic and professional environments 5. Use soft skills for the purposes of research and follow ethics in society and profession.

COURSEOUTCOMES(Cos) students will be able to do data analytics using MS Excel	
CO1	Become good listeners to get engaged in interactive communication for effective team building.
CO2	Develop assertive and adaptive behaviour to be leaders
CO3	Develop peer interaction for a successful lifelong learning.
CO4	Learn skills necessary for a cooperative living in academic and professional environments
CO5	Use soft skills for the purposes of research and follow ethics in society and profession

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	3	3	1	2	3	2	2	3
CO2	3	3	3	1	2	3	2	2	3
CO3	3	3	3	1	2	3	2	3	3
CO4	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	2	3	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	**3**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**2**	**2**
CO4	**3**	**2**	**2**	**2**
CO5	**3**	**2**	**2**	**2**

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Program core	Program Elective	Open elective	Skill enhancing elective	Inter disciplinary/Allied	Skill component	Practical Project/ Internship	others
							√		

CBCA25A09 **SOFT SKILL**

Unit -I **3 Hours**

Listening, Speaking, Reading and Writing skills (LSRW)

Unit -II **3 Hours**

Team work skills: adaptability, emotional intelligence, learning skills

Unit -III **3 Hours**

Leadership Qualities: assertiveness, reasoning, compassion and compatibility

Unit -IV **3 Hours**

Problem solving: willingness to learn, creative thinking, developing observation skills

Unit -V **3 Hours**

Interview skills: employability skills, resume writing

Total : 15 hours

Suggested reading

S.P. Dhanavel, English and Soft Skills, Vol. 1, Orient Blackswan Pvt. Ltd. 2010

CBCA25S09	Major Project	L	T	P	C	TY/Lb/IE
		0	0	8	4	LB
	Course Designed by – Faculty of Computer Applications					

CO1: Understand the concept, use them in ideas and transform its applications.

CO2: Implement the technology to bring a new product.

CO3: Apply different algorithms and derive coding modules for execution

CO4: Complete knowledge of database concept pertaining to product developed.

CO5: Illustrate the completed project as document that stand as the source of reference

- Groups will be retained or re-formed, focusing on project continuity and progress.

1	COs /POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
2	CO1	3	2					2			3	3	2	
	CO2	3	3				1	2		2	3	3	2	
	CO3	3	3	2			1			2	3	3	2	
	CO4	3	3	3	3	2	2	2	3	2	3	3	2	3

- Continued mentorship by the allocated guide, with emphasis on independent problem-solving.
- Finalize detailed system design and architecture based on prior review and feedback.
- Develop and validate detailed project plan including timelines and milestones.
- Implement core modules, integrating algorithms and technologies as per objectives.
- Conduct extensive testing, debugging, and optimization of the developed product.
- Perform data collection through surveys, questionnaires, or experiments if required.
- Document the entire development lifecycle and prepare interim and final reports.
- Conduct regular review meetings with guide and possibly industry experts.
- Obtain and submit a certificate or proof of project collaboration/industry involvement (if applicable) to the department.
    - Prepare for project demonstration and viva voce presentation at the semester end.

APPENDIX I

Discipline Specific Electives

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E01	BASICS OF DATA ANALYTICS USING SPREADSHEET	L	T	P	C	Ty/Lb/ IE
		2	0	2	3	ETL
	Prerequisite : Knowledge on basics of mathematical & Statistical concepts such as arithmetic, percentages, averages					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To understand the general purpose of MS Excel and its built in functions for data analysis.
- To understand the importance of ROC curve and its use in finding the fitness of classification model.
- To know the basics of macros in MS Excel.
- To understand the working knowledge in MS Excel for linear regression analysis.

COURSEOUTCOMES(Cos)

students will be able to do data analytics using MS Excel

CO1	In this course, you will learn how to perform data analysis using Excel's most popular features
CO2	You will learn how to create pivot tables from a range with rows and columns in Excel.
CO3	Pivots are used in many different industries by millions of users who share the goal of reporting the performance of companies and organizations.
CO4	In addition, Excel formulas can be used to aggregate data to create meaningful reports.
CO5	To complement, pivot charts and slicers can be used together to visualize• data and create easy to use dashboards.

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	3	3	2	2	3	2	2
CO2	2	3	3	1	2	3	1	2	3
CO3	3	2	2	3	3	1	3	3	1
CO4	3	3	3	2	1	3	2	1	3
CO5	3	3	2	3	2	3	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	2	2
CO2	2	2	3	1
CO3	3	3	1	3
CO4	3	3	2	3
CO5	2	3	3	2

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Program core	Program Elective	Open elective	Skill enhancing elective	Inter disciplin ary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E01 BASICS OF DATA ANALYTICS USING SPREADSHEET

UNIT I: Introduction to Data Analytics **7 hours**

Understanding data and its types (structured, unstructured, semi-structured) - What is Data Analytics - Types of Data Analytics - Importance of Data Analytics - Applications of Data Analytics.

UNIT II: Spreadsheet Navigation and Formatting **7 hours**

Selecting Columns & Rows, Changing Column Width & Row Height, Auto fitting Columns & Rows, Hiding/Unhiding Columns & Rows, Inserting & Deleting Columns & Rows, Cell, Address of a cell, Components of a cell – Format, value, formula, Use of paste and paste special

UNIT III : Formulas, Functions, and Basic Charts **7 hours**

Creating Formulas, Formula Functions : Sum, Average, if, Count, max, min, Upper, Lower, Using AutoSum, Advance Formulas: Concatenate, Vlookup, Hlookup, Match, Countif, Text, Trim - Creating Charts, Different types of chart, Formatting Chart Objects, Changing the Chart Type, Showing and Hiding the Legend, Showing and Hiding the Data Table

UNIT IV : Advanced Charts, Data Analysis, and PivotTables **9 hours**

Creating Charts, Different types of chart, Formatting Chart Objects, Changing the Chart Type, Showing and Hiding the Legend, Showing and Hiding the Data Table- Data Analysis : Sorting, Filter, Text to Column, Data Validation- PivotTables : Creating PivotTables, Manipulating a PivotTable, Using the PivotTable Toolbar, Changing Data Field, Properties, Displaying a PivotChart, Setting PivotTable Options, . Adding Subtotals to PivotTables

Total:30 hours

Text Book:

1. "Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics" by Cliff T Ragsdale, Cegage learning asia pet. 2015

REFERENCE BOOKS

2. "Excel 2019 Bible" by Michael Alexander, Richard Kusleika, and John Walkenbach, John Wiley & Sons, 25 Sept 2018
3. “Mastering Excel” by WebTech Solutions, Khanna Publishing House, 2024.

CBCA25E01 **BASICS OF DATA ANALYTICS USING SPREADSHEET**

List of lab programs:

1. Basic Arithmetic and Logical Functions (SUM, AVERAGE, MIN, MAX, ROUND, IF, AND, OR, IFERROR)
2. Importing Data from Various Sources (CSV, text files)
3. Data Transformation Techniques (Text-to-columns, data validation)
4. Text Functions for Data Manipulation (TRIM, CLEAN, TEXT, RIGHT, LEFT, MID)
5. Lookup and Reference Functions (VLOOKUP, HLOOKUP, INDEX, MATCH)
6. Data Aggregation Techniques (SUMIFS, COUNTIFS, AVERAGEIFS)
7. Creating Various Chart Types (Bar, line, pie, scatter)
8. Data Visualization Best Practices (Choosing the right chart, formatting, styling)
9. Creating and Customizing PivotTables
10. Create and Customizing Pivot Charts

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E02	**DATA VISUALIZATION**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		2	**0**	**2**	**3**	**ETL**
	Prerequisite: Basic knowledge of data structures, such as tables and databases. Basic understanding of data analysis concepts and familiarity with data types.					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To give overview of descriptive and inferential statistics.
- To provide basics of R and Python.
- To manipulate and visualize data using R, python and Watson Studio.
- To focus on plots using Matplotlib and seaborn.
- To analyze data using various visualization tools.
- To create maps in python using folium.

COURSEOUTCOMES(Cos)

Students completing this course were able to

CO1	Differentiate descriptive and inferential statistics.
CO2	Use R to do statistics and to visualize data.
CO3	V isualize analyzed data using IBM Watson Studio.
CO4	Familiar with python scripts used for visualization.
CO5	U se advance visualization tool and sea born functionalities.

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**	**PO8**	**P09**
CO1	3	2	3	2	3	2	2	3	2
CO2	3	3	3	1	3	3	1	3	3
CO3	3	2	2	2	2	3	2	2	3
CO4	3	3	3	1	1	3	1	1	3
CO5	2	3	3	3	2	3	3	2	3

Cos/PSOs	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	1	2
CO2	2	3	2	3
CO3	3	2	1	3
CO4	3	3	2	3
CO5	2	3	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Program core	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E02 DATA VISUALIZATION

UNIT I : INTRODUCTION TO STATISTICS **7 hours**

Data , Data collection methods–Descriptive Statistics – Measures of Central Tendency & Dispersion –Inferential Statistics– Population , Sampling methods –Random Variables, Probability Distribution , Normal Distribution .

UNIT II : VISUALIZATION USING R **7 hours**

Basics of R programming , Data manipulation with R(Packages : dplyr, tidyr , data.table , lubridate) Data visualization with R (ggplot2 package)

UNIT III : DATA ANALYSIS USING PYTHON **7 hours**

Basics of Python ,Numpy Library – Arrays creation , Indexing , Slicing , Aggregation , Reshaping , Pandas Library – Series , Data Frame , using csv & excel files , Data cleaning & manipulation , Merging & Joining.

UNIT IV:VISUALIZATION USING PYTHON **9 hours**

Matplotlib Library – Line plot , Scatter plot , Histogram , Histogram , Box plot , Pie chart . Seaborn Library – Basic plots , Pair plots , Heatmaps .

Total: 30 hours

TEXT BOOKS:

1. "Storytelling with Data: A Data Visualization Guide for Business Professionals" by Cole Nussbaumer Knaflic, Wiley; 1st edition, 2015.
2. "The Visual Display of Quantitative Information" by Edward Tufte, Graphics Press USA; 2nd edition, 2001.

REFERENCE BOOKS:

1. Fundamentals of Data Visualization by Claus O Wilke 2019.

2. "Data Visualization: A Practical Introduction" by Kieran Healy, Princeton University Press, 2018.

CBCA25E02 **DATA VISUALIZATION**

List of lab programs:

1. Do the data manipulation operations for iris and mtcars dataset using dplyr package and obtain the results forfollowing functions:
   i. filter
   ii. select
   iii. arrange
   iv. summarise
   v. mutate

2. Create a data frame and do the following operations using tidyr package
   i. gather
   ii. spread
   iii. separate
   iv. unite

3. Do the following operations for any external dataset using data. table package
   i. Select a subset row
   ii. Select a column with particular values
   iii. Select columns with multiple values
   iv. Select a column to return a vector
   v. Select multiple columns
   vi. Returns the sum and standard deviation
   vii. Sum of selected columns

4. Do the following visualizations for any external csv file
   i. Line graph
   ii. Bar graph
   iii. Histogram
   iv. Scatter plot
   v. Pie chart

5. Do the following Data analysis for your own Data set using pandas package.
   i. Make the first column as index
   ii. Select single column and print the data
   iii. Select multiple columns and print the data
   iv. Select single column and print the last five elements of the data.
   v. Select multiple rows and print the first five elements of the data
   vi. Select multiple rows and columns from the data set and print it.
   vii. Select all the rows and some columns (more than two) from the data set and print it.
   viii. Print the same data set again and delete the first column from the data set and print it.
   ix. Change the 1st, 2nd and 3rd columns name and print it

6. a. Reading and Writing CSV/Excel Files using Pandas
   b. Pandas Series and Data Frame Operations

7. Data cleaing and Manipulation using Panda
   a. Data Cleaning: Handling Missing Values and Outliers.

b. Data Manipulation: Sorting, Filtering, and Grouping

8. Consider any csv file and do the following visualization using matplotlib package
   i. Line graph /with style
   ii. Bar Graph
   iii. Histogram
   iv. Scatter plot
   v. Pie chart

9. Merge the two data sets (any two csv files) and perform the following join operations
   i. Natural join
   ii. Full outer join
   iii. Left outer join
   iv. Right outer join

10. Do the following operations for your own data using pandas
   i. Descriptive data analytics using pandas
   ii. Print the data based on particular year, particular month and particular data
   iii. Filter the data based on conditions (any conditions)
   iv. Select any two columns and do the pandas sort operations (ascending and descending)

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E03	INTRODUCTION TO DATA SCIENCE	L	T	P	C	Ty/Lb/IE
		3	0	0	3	TY
	Prerequisite: Basic understanding of statistics (mean, variance), familiarity with spreadsheets/databases					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To understand the overview and definition of Data Science with its crucial role in current business world.
- To understand the importance of mathematics & Statistics in Data Science.
- To understand the role of machine learning techniques in Data Science and its different types.
- To know the integrated role of computers and its components in Data Science
- To understand the flow and process model of data science project management.

COURSEOUTCOMES(Cos)

Students completing this course were able to

CO1	Describe what Data Science is and the skill sets needed to be a data scientist
CO2	Explain the significance of exploratory data analysis (EDA) in data science
CO3	Ability to learn the supervised learning, SVM
CO4	Apply basic machine learning algorithms (Linear Regression)
CO5	Explore the Networks, Page Rank

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	2	2	3	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	3	2	3	1	3	1	3	3
CO4	3	3	3	2	3	3	2	1	3
CO5	3	2	3	1	3	2	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	2	3
CO2	2	1	2	2
CO3	2	3	2	2
CO4	3	3	2	3
CO5	3	3	2	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E03 INTRODUCTION TO DATA SCIENCE

Unit – I: Introduction to Data Science **9 hours**

Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

Unit – II: Data Collection and Data Pre-Processing **9 hours**

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

UNIT– III: Exploratory Data Analytics **9 hours**

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

UNIT– IV: Model Development **9 hours**

Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

UNIT– V: Model Evaluation **9 hours**

Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

Total: 45 hours

TEXT BOOKS:

1. Data Smart: Using Data Science to Transform Information into Insight 1st Edition by John W. Foreman. (2015) Wiley Publication.
2. Data Science from Scratch: First Principles with Python 1st Edition by Joel Grus .

REFERENCE BOOKS:

1.Jojo Moolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016.

2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E04	DATA MINING AND WAREHOUSING	L	T	P	C	Ty/Lb/IE
		3	0	0	3	TY
	Prerequisite: : Familiarity with data analysis tools, especially SQL, NoSQL ,SAS, and Hadoop.					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- Be familiar with mathematical foundations of data mining tools.
- To Understand and implement classical models and algorithms in data warehouses and data mining.
- To Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
- To Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

COURSEOUTCOMES(Cos)

Students completing this course were able to

CO1	Understandthefunctionalityofthevariousdatamining an datawarehousingcomponent
CO2	Appreciatethestrengthsandlimitationsof various dataminingand datawarehousingmodels.
CO3	Explain the analyzing techniques of various data
CO4	Describe different methodologies used in data mining and data warehousing.
CO5	Compare different approaches of data ware housing and data mining with various technologies.

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	2	2	3	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	3	2	3	1	3	1	3	3
CO4	3	3	3	2	3	3	2	1	3
CO5	3	2	3	1	3	2	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	2	3
CO2	2	1	2	2
CO3	2	3	2	2
CO4	3	3	3	3
CO5	3	3	2	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E04 DATA MINING AND WAREHOUSING

UNIT I : INTRODUCTION TO DATA WAREHOUSING 9 hours

Introduction to Data Warehousing – Defining features , architecture of a Data Warehousing – Data Warehousing Schema – Dimensional modeling – ETL Process – Testing, Growth and maintenance - OLAP in Data Warehousing.

UNIT II : DATA MINING FUNDAMENTALS AND PREPROCESSING 9 hours

Data Mining - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction –Mining Frequent patterns , Associations & correlations - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association rules

UNIT III : CLASSIFICATION AND PREDICTION TECHNIQUES 9 hours

Classification and Prediction - Issues Regarding Classification and Prediction – Classification by Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines - Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor.

UNIT IV: CLUSTERING AND UNSUPERVISED LEARNING 9 hours

Cluster Analysis - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods

UNIT V : MINING COMPLEX DATA AND APPLICATIONS 9 hours

Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web

Total: 45 hours

TEXT BOOKS:

1. Jiawei Han & Micheline Kamber(2008), Data Mining Concepts and Techniques (2nd ed) , Elsevier, Reprit.
2. Alex Berson& Stephen J. Smith(2007) , Data Warehousing, Data Mining & OLAP, Tata McGraw – Hill Edition.
3. Soman,K,P, ShyamDiwakar&Ajay,V(2006),Insight into Data mining Theory and Practice, Easter Economy Edition, Prentice Hall of India.

REFERENCES:

1. Gupta,G,K(2006),Introduction to Data Mining with Case Studies‖, Easter Economy Edition, Prentice Hall of India.
2. Pang-Ning Tan, Michael Steinbach &Vipin Kumar(2007), Introduction to Data Mining, Pearson Education.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E05	MOBILE COMPUTING	L	T	P	C	Ty/Lb/IE
		3	0	0	3	TY
	Prerequisite: Mobile Communication and Network Security					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To introduce the concepts of Mobile Computing and its Principle.
- To impart the basic concepts of Radio Frequency and the Transmission of Radio Signals.
- To familiarize the concepts of Telecommunication and its Networks.
- To provide the knowledge of Wireless LAN and its architecture.
- To understand the Mobile Network and Transport Layer and its technology.

COURSEOUTCOMES(Cos)

Students completing this course were able to

CO1	Understand the basic concepts of Mobile Computing.
CO2	Applying the radio frequency in mobile computing are used in communication devices such as transmitters,receiver,etc.wavesareaformofelectromagneticradiationwithidentified radio frequencies.
CO3	Implement the basic concept of Medium access or multiplexing methods are FDMA, CDMA, TDMA and SDMA the mechanism.
CO4	Evaluate the Wireless LAN-Design goals-Wireless transmission technology, Settings for wireless LAN-IEEE802.11-Architecture.Simultaneously use of equipment and reduce the wiring expense.
CO5	Create Physical design, Technology, Alter the Transmission and physical security. A conceptual division of methods in the layered architecture of protocols in the network stack in the Internet protocol.

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	2	3	1	3	2	3	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	3	2
CO2	2	1	2	3
CO3	3	3	1	1
CO4	3	3	2	3
CO5	2	1	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E05 MOBILE COMPUTING

UNIT I: Fundamentals of Wireless Transmission 9 hours

Wireless-Wireless networks in comparison to fixed networks-Mobile communication: Development – Principles of mobile communication – Overview of mobility and portability- Issues for portability- Effects of device portability – Applications-Reference model

UNIT II: Radio Transmission 9 hours

Frequency – Signals – antennas –Signal propagation- Multiplexing – Modulation-Spread Spectrum(DSSS,FHSS).

UNIT III: Medium access control 9 hours

Motivation for specialized MAC,SDMA,FDMA,TDMA,CDMA, Comparison of the Medium access mechanism-Telecommunication Networks –GSM, Satellite communication.

UNIT IV : Wireless LAN 9 hours

Advantages of Wireless LAN-Design goals-Wireless transmission technology-Settings for wireless LAN-IEEE 802.11: System architecture-Bluetooth

UNIT V : Mobile Network Layer and Transport Layer 9 hours

Mobile IP-DHCP-Traditional TCP-Congestion control – mechanism to alter the transmission - Classical TCP Improvements

Total : 45 hours

TEXT BOOKS:

1. Jochen Schiller (2014) Mobile Communications(2nd ed.), Pearson Education
2. Nithyanandam .S,Ambika.M,Gayathri K.S., ―Mobile Computing‖, Dhanpat Rai &co.(P)Ltd

REFERENCE BOOK:

1. William C.Y.Lee(1995) Mobile Cellular Telecommunications(2nd ed.) , Mc-Graw- Hill.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E06	**INFORMATION SECURITY**	**L**	**T**	**P**	**C**	**Ty/Lb/IE**
		3	**0**	**0**	**3**	**TY**
	Prerequisite: **Concept of Information handling**					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To introduce the concepts of Information Security, and its Characteristics.
- To impart thebasicconceptsofSecurityInvestigationanditsEthicalandProfessional Issues.
- To familiarize the concepts of Security Analysis and Risk Management.
- ToprovideknowledgeaboutInformationSecurityPolicyStandardsandNISTframework
- To understand the Physical design and cryptography and its technology.

COURSEOUTCOMES(Cos)

Students completing this course were able to

CO1	Understand the basic concepts of Information Security.
CO2	Applyingtheconceptsofsecurityinvestigationin Businessneeds,Legalandprofessionalethics.
CO3	Exposetheongoingprocessofidentifyingsecurityrisksandimplementingplanstoaddress them.
CO4	Implement ISO17799 (Indian Standard) and BS 7799 (British Standard) Information Security Policy standards establish guidelines and general principles for maintaining and improving InformationSecurityManagement.ProtectIndustrialassetsfromCyberthreatsusingNISTframe work.
CO5	DetectingvulnerabilityexploitsagainstatargetComputerbyIntrusionDetectionSystem.

Mapping of Course Outcome wit h Program Outcome(POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**	**PO8**	**P09**
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	2	1	3	2	1	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	3	3	2	3	2	3	3	2	3

Cos/PSOs	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	2	2
CO2	2	2	1	3
CO3	3	2	1	3
CO4	3	3	3	3
CO5	2	3	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E06 **INFORMATION SECURITY**

UNIT I: Introduction **9 hours**

History, What is Information Security? Critical Characteristics of Information - NSTISSC Security Model - Components of an Information System - Securing the Components - Balancing Security and Access - The SDLC - The Security SDLC

UNIT II: Security Investigation **9 hours**

Need for Security - Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues

UNIT III: Security Analysis **9 hours**

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk

UNIT IV: Logical Design **9 hours**

Blueprint for Security - Information Security Poicy - Standards and Practices - ISO 17799/BS 7799 - NIST Models - VISA International Security Model - Design of Security Architecture - Planning for Continuity

UNIT V : Physical Design **9 hours**

Security Technology – IDS - Scanning and Analysis Tools – Cryptography - Access Control Devices - Physical Security - Security and Personnel.

Total: 45 Hours

TEXT BOOK:

1.Michael E Whitman and Herbert J Mattord(2003) , ―Principles of Information Security‖, Vikas Publishing House, New Delhi.

REFERENCE BOOKS:

1. Micki Krause, Harold F. Tipton(2004), ― Handbook of Information Security Management‖, Vol 1-3 CRC Press LLC.

2. Stuart Mc Clure, Joel Scrambray, George Kurtz(2003), ―Hacking Exposed‖, Tata McGraw-Hill.

3. Matt Bishop(2002), " Computer Security Art and Science‖, Pearson/PHI.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E07	**SOFTWARE PROJECT MANAGEMENT**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		3	**0**	**0**	**3**	**TY**
	Prerequisite: **Basic knowledge in Software Engineering.**					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To impart the basic concepts of Project Management Frame work.
- To provide projectplanningandschedulingprojectmonitoringandselectionofappropriateproject approach.
- ToLearnaboutheProjectManagementKnowledgetodiscussthenotionofrisksandtherisk management and to study Resource allocation.
- TofollowInternationalstandardsforSoftwareQuality&Toexaminecasestudyforthe Project.

COURSEOUTCOMES(Cos)

Students completing this course were able to

CO1	Understand the fundamentals of software project management, including its scope, importance, and role in the software development life cycle.
CO2	Apply project planning techniques, including project scheduling, effort estimation, and resource allocation.
CO3	Identify, analyze, and manage risks associated with software projects.
CO4	Use project monitoring and control mechanisms to track progress and ensure project alignment with goals.
CO5	Demonstrate the ability to work as part of a project team, manage communication, and resolve conflicts effectively.

Mapping of Course Outcome wit h Program Outcome(POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**	**PO8**	**P09**
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	2	1	3	2	1	3
CO3	2	2	2	1	3	3	1	3	3
CO4	3	3	3	3	1	3	3	1	3
CO5	3	3	2	3	2	3	3	2	3

Cos/PSOs	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	2	2
CO2	2	2	2	3
CO3	3	3	1	3
CO4	3	1	3	3
CO5	2	3	3	2

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Program core	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E07 SOFTWARE PROJECT MANAGEMENT

UNIT I : Introduction to Software Projects **9 hours**

An Overview of Project Planning – Project Management and Evaluation .

UNIT II: Selection of an appropriate Project approach **9 hours**

Software effort Estimation -Activity Planning :- Project Schedules – Sequencing and Scheduling Projects – Network Planning Model – forward and backward pass-Identifying the Critical path-Activity float-Shortening Project Duration – Identifying Critical Activities-precedence networks.

UNIT III: Software quality assurance plan & Risk Management **9 hours**

Resource Allocation – Monitoring and Control, Reviews and Audits – Management.

UNIT IV : Models **9 hours**

ISO 9000 model, CMM model – Comparisons - ISO 9000 weaknesses - Managing People and Organizing Teams – Software Quality -Planning for Small Projects.

UNIT V : Case Study **9 hours**

PRINCE Project Management, BS 6079:1996

Total: 45 hours

TEXT BOOK:

1. Mike Cotterell, Bob Hughes , ―Software Project Management‖, Inclination/Thomas Computer Press, 4th Edition, 2004. Chapters : 1-13

REFERENCES BOOKS:

1. Darrel Ince, H.Sharp and M.Woodman,‖ Introduction to Software Project Management and Quality Assurance‖, Tata McGraw Hill, 1995.
2. Philip.B.Crosby, Quality is Free: The Art of Making Quality Certain, Mass Market, 1992.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E08	**INTERNET OF THINGS**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		3	**0**	**0**	**3**	**TY**
	Prerequisite: **Basic knowledge in Networks and Internet Concepts**					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To impart the basic design and communication model of Internet of Things.
- To understand State of the Art- Internet of Things Architecture.
- To provide knowledge about protocols used in Internet of Things.
- To introduce about various interface sapplied in Internet of Things.
- To classify the real worldI nternet of Things Design constraints and its implementation.
- To provide ideas of automation and its applications using Internet of Things.

COURSEOUTCOMES(Cos)

Students completing this course were able to

CO1	Understand the fundamental concepts, architecture, and components of IoT systems
CO2	Identify and apply various sensors, actuators, and embedded systems used in IoT applications.
CO3	Demonstrate the ability to interface hardware components (e.g., Arduino, Raspberry Pi) and implement basic IoT solutions.
CO4	Collect, process, and transmit data from IoT devices to cloud platforms for storage and analysis.
CO5	Evaluate security, privacy, and ethical concerns in IoT systems.

Mapping of Course Outcome wit h Program Outcome(POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**	**PO8**	**P09**
CO1	3	2	2	2	3	2	2	3	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	3	2	3	1	3	3	1	3
CO4	3	3	3	2	3	3	2	3	3
CO5	3	2	3	1	3	2	1	3	2

Cos/PSOs	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	2	3
CO2	2	1	2	2
CO3	2	3	2	2
CO4	3	3	3	3
CO5	3	3	2	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E08 **INTERNET OF THINGS**

UNIT I : IOT INTRODUCTION 9 hours

Introduction - Physical Design - Logical Design - IOT Communication Model - IOT Enabling Technologies - IOT Levels and Deployment Templates.

UNIT II: IOT NETWORK ARCHITECTURE 9 hours

One M2M IOT Standardized Network Architecture- IOTWF (IOT World Forum) - IOT Architecture- M2M (Machine to Machine) –SDN (Software Defined Network) –NFV (Network Function Virtualization).

UNIT III: IOT PROTOCOLS 9 hours

NFC (Near Field Communication)- RFID (Radio Frequency Identification System) -ZIGBEE SPMI (System Power Management Interface)-SPI (Serial Peripheral Interface)-Wireless vs. Wired Communication GSM-GPRS-LTE (Long Term Evolution).

UNIT IV : IOT DESIGN 9 hours

Design Methodology-Microcontroller- System on Chip (SoC)-IOT System Building Blocks- Arduino- Raspberry-pi

UNIT V : DOMAIN SPECIFIC IOT 9 hours

Home Automation- Cities- Agriculture- Environment-Health and Life Style- Industry

Total: 45 hours

TEXT BOOKS:

1. From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence by Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos and David Boyle

2. Vijay Madisetti and ArshdeepBahga, ―Internet of Things (A Hands-on-Approach)‖, 1st Edition, VPT, 2014.

REFERENCE BOOK:

1. Francis daCosta, ―Rethinking the Internet of Things: A Scalable Approach to Connecting Everything‖, 1st Edition, Apress Publications, 2013

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E09	**MANAGEMENT INFORMATION SYSTEM**	**L**	**T**	**P**	**C**	**Ty/Lb/IE**
		3	**0**	**0**	**3**	**TY**
	Prerequisite: **Basic Knowledge in Information System**					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- Enables to know the basic purpose of studying MIS and how it is important in the field of computer applications.
- BriefingabouthowMISplayskeyroleincommunicatingtheinformationinefficientmanner.
- To identify the challenges and enabling to choose the best course of action.
- Enabling MIS to bring out the strength of the management &making it as opportunity for overall growth of the organization.
- ImpartingknowledgeonhowMISismakingdecisionaseffective,quick&timely manner.

COURSE OUTCOMES(Cos)

Students completing this course were able to

CO1	Understand the role and importance of Management Information Systems in business decision-making and organizational strategy.
CO2	Identify and explain the components and types of information systems, including TPS, MIS, DSS, and ERP.
CO3	Analyze how information systems support business operations, management, and competitive strategies.
CO4	Evaluate the ethical, legal, and security issues associated with information systems in organizations.
CO5	Apply knowledge of MIS to solve real-world business problems through case studies or projects.

Mapping of Course Outcome wit h Program Outcome(POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**	**PO8**	**P09**
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	2	3	2	2	3
CO5	3	3	2	3	2	3	3	2	3

Cos/PSOs	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	2	2
CO2	2	2	1	3
CO3	3	3	1	3
CO4	3	3	2	3
CO5	2	3	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E09 MANAGEMENT INFORMATION SYSTEM

UNIT I: Foundation of Information System **9 hours**

Introduction to Information System and MIS – Decision support and decision making systems - systems approach - the systems view of business - MIS organization within company - Management information and the systems approach

UNIT II: Information Technology **9 hours**

A manager‘s overview - managerial overviews - computer hardware and software - DBMS - RDBMS – Telecommunication

UNIT III: Conceptual system design **9 hours**

Define the problems - set systems objective - establish system – constraints - determine information needs determine information sources - develop alternative conceptual design and select one document the system concept - prepare the conceptual design report

UNIT IV: Detailed system design **9 hours**

Inform and involve the organization - aim of detailed design - project management of MIS detailed design - identify dominant and trade of criteria - define the sub systems - sketch the detailed operating sub systems and information flow - determine the degree of automation of each operation - inform and involve the organization again - inputs outputs and processing - early system testing – software - hardware and tools propose an organization to operate the system - document the detailed design - revisit the manager user

UNIT V : Implementation evaluation and maintenance of the MIS **9 hours**

Plan the implementation - acquire floor space and plan space layouts - organize for implementation - develop procedures for implementation - train the operating personnel - computer related acquisitions - develop forms for data collection and information dissemination - develop the files test the system - cut-over - document the system - evaluate the MIS control and maintain the system - Pitfalls in MIS development.

Total: 45 hours

TEXT BOOK:

1. W. S. Jawadekar(2002), Management Information System, Tata McGraw Hill.

REFERENCES BOOKS:

1. Robert G. Murdick, Loel E. Ross &James R. Claggett, Information System for Modern Management (3rd Ed),PHI.

2. Brian,O, Management Information System, TMH. 3. Davis Olson, Management Information System, McGraw Hill.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E10	**OPEN SOURCE PROGRAMMING**	**L**	**T**	**P**	**C**	**Ty/Lb/IE**
		4	**1**	**0**	**5**	**TY**
	Prerequisite: **Concept of Information handling**					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- Understand concepts,strategies,and methodologies related to opensource software development.
- Impart thebusiness,economy, societal and intellectual property issues of opensource software.
- Be familiar with opensource software products and development tools currently available on the market.
- To provide knowledge about IoT.
- To understand knowledge about Big Data through case studies.

COURSEOUTCOMES(Cos)

Students completing this course were able to

CO1	Understand the basic concepts of Open Source Programming.
CO2	Applying the Principles and Methodologies of Free Open Source Software(FOSS) allow users to freely run,modify and also to freely distribute copies of either the original version or their modified version.
CO3	Implement the case studies like Apache,BSD,Linux,Mozilla(Firefox),Wikipedia,Joomla,GCC, Open Office
CO4	Imparting the Definitions,overview,definitions and concepts of IoT,things that are embedded with software,electronics,network,and sensors that allows these objects to collect and exchange data.
CO5	Understand the Introduction to BigData, Distributed file system gets analytics using the map reduce algorithms.

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**	**PO8**	**P09**
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	3	3	2	3	2	3	3	2	3

Cos/PSOs	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	2	2
CO2	2	2	1	3
CO3	3	3	1	3
CO4	3	3	2	3
CO5	2	3	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E10 OPEN SOURCE PROGRAMMING

UNIT I : Introduction to Open Source **12 hours**

Definition, Open Source History, Initiatives , Free Software, Free Software vs. Open Source software, Public Domain Software, FOSS does not mean no cost. History: BSD, The Free Software Foundation and Open Source GNU Project.

UNIT II : Principle and methodologies **12 hours**

Philosophy: Software Freedom, Open Source Development Model Licences and Patents: What Is A License, Important FOSS Licenses (Apache, BSD,GPL, LGPL), copyrights and copy lefts, Patents Economics of FOSS : Zero Marginal Cost, Income-generation opportunities

UNIT III : Case Studies **12 hours**

Apache, BSD, Linux, Mozilla (Firefox), Wikipedia, Joomla, GCC, Open Office. Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open source Teaching. and Open source media.

UNIT IV : IoT **12 hours**

Definitions - overview, applications, potential & challenges, and architecture. IoT examples: Case studies, e.g. sensor body-area-network and control of a smart home.

UNIT V : INTRODUCTION TO BIG DATA **12 hours**

Distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.

Total: 60 hours

TEXT BOOKS:

1. https://tavaana.org/sites/default/files/introduction_to_opensource.pdf
2. Chris Eaton, Dirk deroos et al.(2012) , ―Understanding Big data ‖, McGraw Hill.

REFERENCE BOOK:

1. Greg Elmer , Ganaele Langlois , Dr. Joanna Redden (2015), ― Compromised Data: From Social Media to Big Data‖, Bloomsbury Academic Publishing.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E11	SOFTWARE TESTING	L	T	P	C	Ty/Lb/IE
		4	1	0	5	TY
	Prerequisite: OOAD & Programming Knowledge in Software					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To introduce the fundamental concept of Software Testing.
- To describe the principles,issuesandsolutionsofBlackbox,Whiteboxand various types of Testing
- To illustrate Software Testing Lifecycle Model and RAD,Web and DatabaseTesting
- To impart the essential characteristics of Automation Testing Tools
- To discuss the function of quality factors

COURSEOUTCOMES(Cos)

Students completing this course were able to

CO1	Understand the fundamental principles of software testing.
CO2	Apply various software testing techniques and strategies.
CO3	Design effective test cases and test plans.
CO4	Use software testing tools and frameworks.
CO5	Evaluate software quality using testing metrics and standards.

Mapping of Course Outcome wit h Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	3	3	2	3	2	3	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	2	2
CO2	2	2	1	3
CO3	3	3	1	3
CO4	3	3	2	3
CO5	2	3	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E11 SOFTWARE TESTING

UNIT I: Testing Environment And Test Processes 12 hours

Introduction – World Class Software Testing Model – Building a Software Testing Environment - Overview of Software Testing Process – Organizing for Testing : Requirement Specifications (Software, User, market, Business) – Static & Dynamic Testing : Verification & Validation - Analyzing and Reporting Test Results – Post Implementation Analysis

UNIT II: Developing the Test Plan 12 hours

Using White Box Approach to Test design – Code Functional Testing – Coverage and Control Flow Graphs – Using Black Box Approaches to Test Case Design – Random Testing – Requirements based testing –Decision tables –State-based testing – Cause-effect graphing – Error guessing – Compatibility testing – Levels of Testing : Functionality Testing - Performance Testing - Unit Testing - Integration Testing - System Testing – User Acceptance Testing - Compatibility Testing

UNIT III: Software Testing Life Cycle 12 hours

Software Testing Life Cycle: SDLC & STLC , Stages – System Study – Test case design, Review, Approval, Execution - Test case Templates: Header - Body & Footer Templates – Traceability Matrix - Defect Tracking Templates – Postmortem Report (Achievements & Comments) – Rapid Application Development Testing – Testing in a Multiplatform Environment – Testing Software System Security - Testing Web Applications – Web based system – Web Technology Evolution – Testing a Data base

UNIT IV: TEST AUTOMATION 12 hours

Introduction : Software Testing Tools (Win Runner, Load Runner) - Software Test Automation – Skills needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Tracking the Bug

UNIT V: Quality Assurance & Quality Control 12 hours

Complexity Metrics and Models – Quality Management Metrics - Defect Removal Effectiveness Quality Function Deployment – Taguchi Quality Loss Function.

Total: 60 hours

TEXT BOOK:

1. Srinivasan Desikan and Gopalaswamy Ramesh(2007) ―Software Testing – Principles and Practices‖,Pearson Education.

REFERENCES BOOKS:

1. William Perry(2007), ―Effective Methods of Software Testing‖, Third Edition,Wiley Publishing 2007
2. 2. Naresh Chauhan(2010) , ―Software Testing Principles and Practices ‖ Oxford University Press , New Delhi , 2010.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E12	BUSINESS INTELLIGENCE & ANALYTICS	L	T	P	C	Ty/Lb/ IE
		4	1	0	5	TY
	Prerequisite: Basic SQL, Excel, data warehousing concepts, familiarity with BI tools (Power BI/Tableau), and understanding of business metrics/KPIs.					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- Explain the Business Intelligence, Analytics and Decision Support system
- List the technologies for Decision making, Automated decision systems
- Explain sentiment analysis techniques
- Illustrate Multi-criteria Decision making systems, predictive modelling techniques

COURSEOUTCOMES(Cos)

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

CO1	Able to analyze Business Intelligence.
CO2	Explain the technologies for Decision making
CO3	Apply predictive modelling techniques(can be attained through assignment or CIE)
CO4	Apply sentiment analysis techniques(can be attained through assignment or CIE)
CO5	Able to analyze Analytics and Decision Support

Mapping of Course Outcome wit h Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	3	3	2	3	2	3	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	2	2
CO2	2	2	1	3
CO3	3	3	1	3
CO4	3	3	2	3
CO5	2	3	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E12 BUSINESS INTELLIGENCE & ANALYTICS

UNIT I: INTRODUCTION TO BUSINESS INTELLIGENCE 12 hours

Introduction to Digital Data and Its Types – Structured, Semi-Structured and Unstructured, Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP), BI Definitions and Concepts, BI Framework.

UNIT II: COMPONENTS OF BUSINESS INTELLIGENCE 12 hours

Data Warehousing Concepts and Its Role in BI; BI Infrastructure Components - BI Process, BI Technology, BI Roles and Responsibilities, Business Applications of BI, BI Best Practices.

UNIT III: BASICS OF DATA INTEGRATION 12 hours

Concepts of Data Integration, Needs and Advantages of using Data Integration, Introduction to Common Data Integration Approaches; Meta Data - Types and Sources, Introduction to Data Quality, Data Profiling Concepts and Applications, Introduction to ETL using Kettle.

UNIT IV: MULTI-DIMENSIONAL DATA MODELING 12 hours

Introduction to Data and Dimension Modeling, Multidimensional Data Model, ER Modeling vs. Multi-Dimensional Modeling, Concepts of Dimensions, Facts, Cubes, Attribute, Hierarchies, Star and Snowflake Schema. Introduction to Business Metrics and KPIs, Creating Cubes using Microsoft Excel.

UNIT V: BASICS OF ENTERPRISE REPORTING 12 hours

A Typical Enterprise, Malcolm Baldrige - Quality Performance Framework, Balanced Scorecard, Enterprise Dashboard, Balanced Scorecard vs. Enterprise Dashboard, Enterprise Reporting using MS Access / MS Excel, Best Practices in the Design of Enterprise Dashboards.

Total: 60 hours

TEXT BOOKS:

1. David Loshin, *Business Intelligence*, Elsevier Science and Technology, Second Edition, 2012.

REFERENCE BOOKS:

1. RN Prasad and Seema Acharya, *Fundamentals of Business Analytics*, Wiley India, 2011.
2. Mike Biere, *Business Intelligence for the Enterprise*, Pearson, 2010.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E13	CLOUD COMPUTING FOR DATA ANALYTICS	L	T	P	C	Ty/Lb/ IE
		3	0	4	5	ETL
	Prerequisite: : Basic understanding of cloud platforms (e.g., AWS), foundational programming skills					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- Cloud computing is a colloquial expression used to describe a variety of different computing concepts that involve a large number of computers involves a large number of computers that are connected through a real-time communication network.
- In science, cloud computing is a synonym for distributed computing over a network and means the ability to run a program on many connected computers at the same time.
- This course covers basic concepts of cloud types, services and security etc.

COURSE OUTCOMES(Cos)

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

CO1	Learn the underlying principles of Cloud Technology and various types of cloud computing architecture and types.
CO2	Evaluate between different cloud solutions offered by various providers based on their merits and demerits.
CO3	Understand the Cloud Cost Management and Selection of Cloud Provider
CO4	Understand the IT governance in cloud computing.
CO5	Track the Ten cloud do and do not's.

Mapping of Course Outcome wit h Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	3	2	3	2	2	3	2
CO2	2	3	3	1	3	3	1	3	3
CO3	3	2	3	2	2	3	2	2	3
CO4	3	2	3	3	1	3	3	1	3
CO5	2	2	3	3	2	3	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	2	1
CO2	3	2	3	2
CO3	2	3	3	2
CO4	3	3	2	3
CO5	3	3	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E13 CLOUD COMPUTING FOR DATA ANALYTICS

UNIT 1: Introduction **9 hours**

Characteristics,Cloud Models, Cloud Computing Concepts and Technologies, Cloud Computing Services and Platform,Virtualization, Elastic Compute Cloud,Auto Scaling, Elastic Load Balancing,Virtual Private Cloud

UNIT 2: Cloud Application Development **12 hours**

Design Considerations, Design Methodologies, Reference Architectures for Cloud Applications, Introduction to Python Framework, RESTful Web API

UNIT 3 : Serverless Applications **12 hours**

Introduction to Serverless Computing, Serverless Use Cases, Serverless Design Patterns, Lambda, Serverless Concepts

UNIT 4: Cloud Storage **12 hours**

Elastic Block Store (EBS), Storage Gateway, Relational Databases, NoSQL Databases. Batch Analytics and Real-time Analytics - HDFS, Hadoop, MapReduce, Pig, Sparks

Total: 45 hours

TEXT BOOK:

1. **Arshdeep Bahga & Vijay Madisetti**, *"Cloud Computing Solutions Architect: A Hands-On Approach"*, 2019, First Edition, VPT Publisher

REFERENCES:

1. **Douglas E. Comer**, *"The Cloud Computing Book: The Future of Computing Explained"*, 2021, First Edition, CRC Press
2. **Ian Foster and Dennis E. Gannon**, *"Cloud Computing for Science and Engineering"*, 2017, First Edition, The MIT Press, Cambridge, Massachusetts

CBCA25E13 CLOUD COMPUTING FOR DATA ANALYTICS

List of Programs:

1. Install Virtual box/VMware/ Equivalent open source cloud Workstation with different flavors of Linux or Windows OS on top of windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs
3. Find a procedure to transfer the files from one virtual machine to another virtual machine.
4. Create and host static websites using cloud service providers.
5. Create VMs to deploy simple applications.
6. Deploy SaaS/PaaS/IaaS applications.
7. Develop cloud application with Python web application framework.
8. Develop applications using Map Reduce programming model
9. Install Google App Engine. Create a hello world app and other simple web applications using python/java
10. Install Hadoop single node cluster and run simple applications like word count

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E14	BIG DATA ANALYTICS	L	T	P	C	Ty/Lb/ IE
		3	0	4	5	ETL
	Prerequisite: Basic Programming knowledge in Java or Python					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- This course aimed to Introduce the concepts of big data analytics to the students.
- Introduces the big data framework, its characteristics and use cases associated with it.
- A concise introduction to Hadoop framework will prepare students to handle industry scenarios of big data analytics.

COURSEOUTCOMES(Cos)

Students completing this course were able to

CO1	Understand the characteristics of big data
CO2	Explore Hadoop framework and its components
CO3	Use HDFS and Map Reduce to analyze various industry use cases of big data analytics.
CO4	Understand the YARN Infrastructure
CO5	Learning different Sorting, Shuffling.

Mapping of Course Outcome wit h Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	3	3	2	2	3	2	2
CO2	2	3	3	1	2	3	1	2	3
CO3	3	2	2	3	3	1	3	3	1
CO4	3	3	3	2	1	3	2	1	3
CO5	3	3	2	3	2	3	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	2	2
CO2	2	2	3	1
CO3	3	3	1	3
CO4	3	3	2	3
CO5	2	3	3	2

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E14 BIG DATA ANALYTICS

UNIT I - Introduction to Big Data, Characteristics and its Use Case 9 hours

Introduction – Why Big data - What is big data – Facts about Big Data - Importance of Big Data Evaluation of Big Data – Market Trends – Sources of Data Explosion – Types of Data – Case Study for Netflix and the house of card. Need of Big Data – Big Data and its sources – Characteristics of Big Data – Difference between Traditional IT Approach and Big Data Technology – Capabilities of Big Data – Handling Limitations of Big Data - Technologies Supporting Big Data - Big Data Use Cases.

UNIT II - Introduction to Hadoop 12 hours

Introduction – Why Hadoop – What is Hadoop – History and Milestone of Hadoop – Core Components of Hadoop – Difference between Regular File System and HDFS – Common Hadoop Shell Commands – Hadoop Configuration.

UNIT III - Hadoop Distributed File System (HDFS) 12 hours

Concepts and Architecture - Data Flow (File Read, File Write) - Fault Tolerance - Java Base API - Different Daemons in Hadoop cluster (NameNode, Secondary NameNode, Job Tracker, Task Tracker and DataNode) - Loading a dataset into the HDFS.

UNIT IV - INTRODUCTION TO YARN and MapReduce 12 hours

What is YARN – YARN Infrastructure - Introduction of MapReduce – Analogy of MapReduce – MapReduce Architecture - Example of MapReduce – Sorting, Shuffling – Reducing – Combiner – Partitioner – Creating MapReduce program by using Eclipse.

Total : 45 hours

TEXT BOOKS:

1. Seema Acharya (Author), Subhashini Chellappan, Big Data and Analytics (2015). Wiley Publication.
2. Data Science and **Big Data Analytics**: Discovering, Analyzing, Visualizing and Presenting Data (2015), EMC Education Services

REFERENCES BOOKS:

1. Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization (2016), DT Editorial Services
2. Tom White, Hadoop: The Definitive Guide, 4th Edition (2015)

CBCA25E14 **BIG DATA ANALYTICS**

List of Lab Programs:

1. Install and Configure Hadoop (Set up Hadoop and understand its processes)
2. Implement Basic Commands in Hadoop (Learn to manipulate big data using Hadoop commands)
3. Implement HDFS and Explore Its Characteristics (Understand HDFS and its features)
4. Explore the Properties of YARN (Learn about resource management in Hadoop)
5. Import Data from MySQL into HDFS (Integrate relational data with Hadoop)
6. Import Data from MS Excel into HDFS (Integrate Excel data with Hadoop)
7. Implement Reducer in Hadoop (Write reducer programs for data aggregation)
8. Implement Partitioner in Hadoop (Optimize data distribution to reducers)
9. Implement Nested MapReduce (Solve complex problems using nested MapReduce)
10. Create a scenario based on real time domain

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E15	**INTRODUCTION TO ML**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		3	**0**	**4**	**5**	**ETL**
	Prerequisite: Basic knowledge of statistics and probability. Familiarity with fundamental programming concepts and proficiency in Python					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To understand the basic concepts of machine learning.
- To understand and build supervised learning models.
- To understand and build unsupervised learning models.
- To evaluate the algorithms based on corresponding metrics identified

COURSE OUTCOMES(Cos)

Students completing this course were able to

CO1	Explain the basic concepts of machine learning.
CO2	Construct supervised learning models.
CO3	Construct unsupervised learning algorithms.
CO4	Evaluate and compare different models
CO5	Modify existing machine learning algorithms to improve classification efficiency

Mapping of Course Outcome wit h Program Outcome(POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**	**PO8**	**P09**
CO1	3	3	2	3	3	3	2	2	2
CO2	2	2	3	3	3	2	2	3	3
CO3	3	2	2	2	3	2	2	2	2
CO4	2	3	2	2	3	3	1	3	3
CO5	2	3	2	2	3	3	3	3	2

Cos/PSOs	**PS01**	**PS02**	**PS03**	**PS04**
CO1	2	2	2	1
CO2	2	3	3	1
CO3	2	2	2	2
CO4	2	2	2	1
CO5	3	2	1	1

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E15 **INTRODUCTION TO ML**

UNIT 1: Introduction to Machine Learning **9 hours**

Fundamentals of Machine Learning – Applications – Types of Machine Learning – Challenges of Machine Learning – Testing and Validating

UNIT 2: Training a ML Model **12 hours**

End-to-End Machine Learning Project – Working with Real Data – Get the Data – Explore and Visualize the Data – Prepare the Data for Machine Learning Algorithms

UNIT 3: Classification and Regression 12 hours

Support Vector Machine – Naive Bayes – Decision Tree – KNN algorithm – Regression – Linear Regression – Ridge Regression

UNIT 4: Ensemble Approaches 12 hours

Voting Classifiers – Bagging and Pasting – Random Forests – Boosting – Stacking -**Unsupervised Learning:** k-means clustering – Limits of K-means – Hierarchical clustering – Expected Maximization Algorithm.

Total:45 hours

TEXT BOOKS::

1. **Aurelien Geron**, *"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow"*, 2019, 2nd Edition, O'Reilly Media, Inc.
2. **Ethem Alpaydin**, *"Introduction to Machine Learning"*, 2020, Fourth Edition, MIT Press.

REFERENCES:

1. **Stephen Marsland**, *"Machine Learning: An Algorithmic Perspective"*, 2014, Second Edition, CRC Press.

CBCA25E15 INTRODUCTION TO ML

List of Lab programs:

1. Develop a Python program to create a NumPy array and apply matrix operations.
2. Develop a Python program to create a pandas DataFrame from a list of data.
3. Develop a Python program to analyze the dataset using pandas and matplotlib library.
4. Develop a program to compute Mean, Median, Mode, Variance, and Standard Deviation using datasets
5. Develop a Python program to implement Simple Linear Regression and plot the graph.

6. Develop a Python program to classify English text using Naive Bayes' theorem.

7. Develop a Python program to implement a single-layer perceptron.
8. Implement the Naive Bayesian classifier for a sample training dataset stored as a CSV file.
9. Compute the accuracy of the classifier, considering a few test datasets.

10. Implement the basic Averaging method & Max Voting ensemble methods to focus on a classification problem.
11. Implement the k-Nearest Neighbor algorithm to classify the iris dataset. Print both correct and wrong predictions.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E16	**DATA SECURITY AND PRIVACY**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		4	**1**	**0**	**5**	**TY**
	Prerequisite: Networking Fundamentals, Introduction to Databases, Security Fundamentals					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To become familiar with the fundamental concepts of data security and privacy mechanisms along with an understanding of hiding data in text and images.

COURSEOUTCOMES(Cos)

At the end of the Course the student will be able to

CO1	To learn the basic concepts related to data security
CO2	To understand and apply the concepts of encryption standards
CO3	To understand hash functions and to learn the basic concepts of hiding data in text and images.
CO4	To understand the concepts of privacy, authentication, web and email security.
CO5	To understand the different types of symmetric key ciphers.

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**	**PO8**	**P09**
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	2	1	3	2	1	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	3	3	2	3	2	3	3	2	3

Cos/PSOs	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**	**3**	**2**	**2**
CO2	**2**	**2**	**1**	**3**
CO3	**3**	**2**	**1**	**3**
CO4	**3**	**3**	**3**	**3**
CO5	**2**	**3**	**3**	**3**

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E16 DATA SECURITY AND PRIVACY

UNIT I: SECURITY ARCHITECTURE & OPERATING SYSTEM SECURITY FUNDAMENTALS
12 hours

Security Architecture: Introduction to Information Systems, Database Management Systems (DBMS), and Information Security Architecture, Asset Types and Value, Security Methods -Operating System Security Fundamentals: Overview of Operating Systems, Security Environment, Components, Authentication Methods, User Administration, Password Policies, Vulnerabilities and E-mail Security.

UNIT II: ADMINISTRATION OF USERS & PROFILES, PASSWORD POLICIES, PRIVILEGES AND ROLES
12 hours

User Administration: Authentication: Creating Users (SQL Server), Modifying/Removing Users, Default and Remote Users, Database Links, Linked Servers, Best Practices for Administrators and Managers- Profiles, Password Policies, Privileges, and Roles: Defining and Using Profiles, Designing Password Policies, Granting/Revoking User Privileges and Roles.

UNIT III: DATABASE APPLICATION SECURITY MODELS & VIRTUAL PRIVATE DATABASES
12 hours

Database Application Security Models: Types of Users, Security Models, Application Types, Data Encryption - Virtual Private Databases (VPD): Overview of VPD, Implementation using Views and Application Context (Oracle), Row/Column-Level Security in SQL Server.

UNIT IV: AUDITING DATABASE ACTIVITIES **12 hours**

Auditing Tools and Methods: Oracle Auditing: Creating DDL Triggers, Auditing Database/Server Activity, SQL Server 2000 Auditing, Case Study: Security and Auditing Project.

UNIT V: PRIVACY-PRESERVING DATA MINING TECHNIQUES **12 hours**

Introduction to Privacy-Preserving Data Mining (PPDM) Algorithms, Randomization Methods, Group-Based Anonymization, Distributed Privacy-Preserving Data Mining, Challenges: Curse of Dimensionality, Applications of PPDM.

Total : 60 hours

TEXT BOOKS::

1. Hassan A.(2009) Afyouni, Database Security and Auditing (Third Edition)
2. Charu C. Aggarwal, Philip S. Yu(2008), Privacy Preserving Data Mining: Models and Algorithms

REFERENCES:

1. Ron Ben Natan (2005), Implementing Database Security and Auditing

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E17	NATURAL LANGUAGE PROCESSING	L	T	P	C	Ty/Lb/IE
		3	0	4	5	ETL
	Prerequisite: Basic programming (Python), understanding of probability/statistics					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To learn the fundamentals of natural language processing.
- To learn the word level analysis methods .
- To explore the syntactic analysis concepts.
- To understand the semantics and pragmatics.
- To learn to analyze discourses and Lexical Resources.

COURSEOUTCOMES(Cos)

At the end of the Course the student will be able to

CO1	To learn the fundamentals of natural language processing.
CO2	To learn the word level analysis methods.
CO3	To explore the syntactic analysis concepts.
CO4	To understand the semantics and pragmatics.
CO5	To learn to analyze discourses and Lexical Resources.

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	1	2	2	3	3	2	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	3	3	2	3	2	3	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	2	2
CO2	2	3	2	3
CO3	3	2	1	3
CO4	3	3	1	3
CO5	2	3	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E17 NATURAL LANGUAGE PROCESSING

UNIT 1: Introduction to NLP **9 hours**

Origins of NLP, Language and Knowledge. The Challenges of NLP, Language and Grammar. NLP Applications- Text Processing :Regular Expressions, Text Normalization: Tokenization – Stemming – Lemmatization, Sentence Segmentation, Edit Distance

UNIT 2: X-Fram Language Models: **12 hours**

N-grams - Evaluating Language Models - Sampling sentences from a language model - Generalization and Zeros - Smoothing. Text Classification :Supervised Text Classification - Naive Bayes, Evaluation: Precision, Recall, F-measure. Avoiding Hams in Classification. Logistic Regression - The sigmoid function - Classification with Logistic Regression. Gradient Descent.

UNIT 3: Parts of Speech and Named Entities **12 hours**

Part-of-Speech Tagging. Named Entities and Named Entity Tagging. Markov Models. Hidden Markov Models. HMM Part-of-Speech Tagging

UNIT 4: Semantic Analysis Lexical Semantics **12 hours**

Word Similarity- Word Relatedness- Semantic Frames and Roles- Connotation. Vector Semantics. Words and Vectors- Document Dimensions- Word Dimensions. Cosine for Measuring Similarity. TF-IDF

Total : 45 hours

TEXT BOOK:

1. Daniel Jurafsky, James H. and Martin, "Speech and Language Processing", 2023, Third Edition, Pearson.

REFERENCE BOOKS:

1. Siddiqui and Tiwary U.S., "Natural Language Processing and Information Retrieval", 2008, Oxford University.
2. Manning, Christopher, and Hinrich Schutze. "Foundations of statistical natural language processing". MIT press, 1999.

CBCA25E17 **Natural Language Processing**

List of Lab Programs:

1. Word Analysis
2. Word Generation
3. Morphology
4. N-Grams
5. N-Grams Smoothing
6. POS Tagging: Hidden Markov Model
7. POS Tagging: Viterbi Decoding
8. Building POS Tagger
9. Chunking
10. Building Chunker

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E18	DIGITAL IMAGE PROCESSING	L	T	P	C	Ty/Lb/ IE
		4	1	0	5	TY
	Prerequisite: Digital Signal Processing					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

To study the image fundamentals and mathematical transforms necessary for image processing.

- To study the image enhancement techniques
- To study image restoration procedures.
- To study the image compression procedures.

COURSEOUTCOMES(Cos)

At the end of the Course the student will be able to

CO1	Review the fundamental concepts of a digital image processing system
CO2	Analyze images in the frequency domain using various transforms
CO3	Evaluate the techniques for image enhancement and image restoration
CO4	Categorize various compression techniques. CO5: Interpret Image compression standards
CO5	Interpret image segmentation and representation techniques.

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	2	1	3	2	1	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	3	3	2	3	2	3	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	2	2
CO2	2	2	1	3
CO3	3	2	1	3
CO4	3	3	3	3
CO5	2	3	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E18 DIGITAL IMAGE PROCESSING

UNIT I: Digital Image Fundamentals & Image Transforms **12 hours**

Digital Image Fundamentals: Sampling and quantization, Relationship between pixels **Image Transforms**: 2-D FFT and its properties, Walsh transform, Hadamard transform, Discrete Cosine Transform (DCT), Discrete Wavelet Transform (DWT).

UNIT II: Image Enhancement **12 hours**

Spatial Domain Techniques: Point operations (types, gray-level transformations), Histogram manipulation, Local/neighborhood operations (median filter), Spatial domain high-pass filtering - **Frequency Domain Techniques**: Filtering in the frequency domain, Deriving frequency domain filters from spatial filters, Direct generation of frequency domain filters, Low-pass (smoothing) and high-pass (sharpening) filters.

UNIT III: Image Restoration **12 hours**

Degradation models, Algebraic restoration approaches, Inverse filtering, Least Mean Square (LMS) filters, Constrained Least Squares Restoration.

UNIT IV: Image Segmentation & Morphological Processing **12 hours**

Image Segmentation: Detection of discontinuities, Edge linking and boundary detection , Thresholding , Region-oriented segmentation - **Morphological Image Processing**: Dilation and erosion, Structuring element decomposition ,Combining dilation and erosion (opening, closing), Hit-or-Miss transformation

UNIT V: Image Compression **12 hours**

Redundancies and their removal methods, Fidelity criteria, Image compression models, Huffman and arithmetic coding, Error-free compression, Lossy compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

Total : 60 hours

TEXT BOOKS:

1. Digital Image Processing- Rafeal C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson, 2008 2. Digital Image Processing- S Jayaraman, S. Essakkirajan, T. Veerakumar-TMH,2010

REFERENCE BOOKS:

1. **Digital Image Processing** — Rafael C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson.
2. **Digital Image Processing and Analysis: Human and Computer Vision Applications with CVIP Tools** — Scott E. Umbaugh, 2nd Edition, CRC Press, 2011.
3. **Introduction to Digital Image Processing with Matlab** — Alasdair McAndrew, Thomson Course.
4. **Fundamentals of Digital Image Processing** — A.K. Jain, PHI, 1989.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E19	**AUGMENTED REALITY &VIRTUAL REALITY**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		4	**1**	**0**	**5**	**TY**
	Prerequisite: Programming basics (C++/Python), familiarity with computer graphics principles, and understanding of human-computer interaction (HCI) concepts.					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To learn the fundamentals of sensation, perception, and perceptual training.
- To have the scientific, technical, and engineering aspects of augmented and virtual reality systems.
- To learn the Evaluation of virtual reality from the lens of design.
- To learn the technology of augmented reality and implement it to have practical knowledge.

COURSEOUTCOMES(Cos)

At the end of the Course the student will be able to

CO1	Describe the concept of virtual reality and Communication Media. (L2)
CO2	Understand current virtual reality hardware and software. (L2)
CO3	Understand various modeling approaches. (L2)
CO4	Illustrate the concepts of Human Factors and Applications of VR. (L2)
CO5	Build a Virtual Reality Application. (L3)

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**	**PO8**	**P09**
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	2	1	3	2	1	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	3	3	2	3	2	3	3	2	3

Cos/PSOs	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	2	2
CO2	2	2	1	3
CO3	3	2	1	3
CO4	3	3	3	3
CO5	2	3	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E19 AUGMENTED REALITY &VIRTUAL REALITY

UNIT I: INTRODUCTION **12 hours**

Introduction to Virtual Reality (VR) and Augmented Reality (AR): Definitions, , Benefits of VR, Components of VR Systems, Introduction to AR and AR Technologies, Input Devices: 3D Position Trackers, Types of Trackers, Navigation and Manipulation Interfaces, Gesture Interfaces, Gesture Input Devices, Output Devices: Graphics Displays (Personal/Large Volume), Human Visual/Auditory Systems, Sound Displays.

UNIT II: VR MODELING **12 hours**

Geometric Modeling: Virtual Object Shape, Visual Appearance, Kinematics Modeling: Transformation Matrices, Object Position, Invariants, Hierarchies, Viewing the 3D World, Physical Modeling: Collision Detection, Surface Deformation, Force Computation/Smoothing/Mapping, Behavior Modeling and Model Management.

UNIT III: VR PROGRAMMING **12hours**

VR Programming Tools: Toolkits, Scene Graphs, World ToolKit vs. Java 3D (Comparison).

UNIT IV: APPLICATIONS **12 hours**

Human Factors: Methodology, Terminology, Health/Safety, Societal Impact, Medical, Military, Manufacturing, Robotics, Business, Education, Entertainment Applications, Emerging Applications and Information Visualization.

UNIT V: AUGMENTED REALITY **12 hours**

Introduction to AR, Computer Vision for AR, Interaction, Modeling, Annotation, Navigation, Wearable Devices.

Total : 60 hours

TEXT BOOKS:

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018

2. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison Wesley, 2016

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E20	**BLOCK CHAIN TECHNOLOGY**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		4	**1**	**0**	**5**	**TY**
	Prerequisite: Be well versed in concepts such as cryptography, consensus, hash functions, distributed ledgers, smart contracts And any other concepts integral to understanding block chain's inner workings.					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To assess blockchain applications in a structured manner
- To impart knowledge in blockchain techniques and able to present the concepts clearly and structured.
- To get familiarity with future currencies and to create own cryptotoken.

COURSEOUTCOMES(Cos)

Students completing this course were able to

CO1	Understand the various technologies and its business use.
CO2	Analyse the blockchain applications in a structure manner.
CO3	Explain the modern concepts of blockchain technology systematically.
CO4	Handle the cryptocurrency.
CO5	Understand the modern currencies and its market usuage

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**	**PO8**	**P09**
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	2	1	3	2	1	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	3	3	2	3	2	3	3	2	3

Cos/PSOs	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	2	2
CO2	2	2	1	3
CO3	3	2	1	3
CO4	3	3	3	3
CO5	2	3	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E20 BLOCK CHAIN TECHNOLOGY

UNIT 1: INTRODUCTION **12 hours**

Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto‘s concept with Blockchain based cryptocurrency, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.

UNIT 2: BASIC DISTRIBUTED COMPUTING & CRYPTO PRIMITIVES **12 hours**

Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems

UNIT 3: BITCOIN BASICS **12 hours**

Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use

UNIT 4: ETHEREUM BASICS 12 hours

Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript

UNIT 5: PRIVACY, SECURITY ISSUES IN BLOCKCHAIN **12 hours**

Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks

Total : 60 hours

TEXT BOOK:

1. Josh Thompson, ‗Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming‘, Create Space Independent Publishing Platform, 2017.

REFERENCE BOOKS:

1. Narayanan, Bonneau, Felten, Miller and Goldfeder, ―Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction‖, Princeton University Press.
2. Imran Bashir, ―Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained‖, Packt Publishing.
3. Merunas Grincalaitis, ―Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum supported Tools, Services, and Protocols‖, Packt Publishing.

4.Prof. Sandip Chakraborty, Dr. Praveen Jayachandran, ―Blockchain Architecture Design And Use Cases‖[MOOC], NPTEL: https://nptel.ac.in/courses/106/105/106105184

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E21	**TIME SERIES ANALYSIS**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		3	**0**	**4**	**5**	**ETL**
	Prerequisite: Basic statistics, probability, linear algebra, calculus, and familiarity with regression analysis and stochastic processes					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To understand the basic concepts of time series analysis
- To understand the elementary time series models and model evaluation techniques.
- To understand the integration process of non-stationary data set.
- To understand the importance of ARMA and ARIMA models for forecasting.

COURSEOUTCOMES(Cos)

Understand the different elementary models related to time series analysis

CO1	Apply different model evaluation technique to identify better model to forecast.
CO2	Understand the importance of stationarity in building time series models.
CO3	Understand the use of Granger Causality and Johensen Cointegration method.
CO4	Apply VAR model to the dynamic behaviour of financial time series conditions. Select the order of Vector Auto Regression model for better forecast of time series data
CO5	Build the model using ARCH and GARCH technique for non-constant variance data

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**	**PO8**	**P09**
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	2	3	1	3	2	3	3	2	3

Cos/PSOs	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	3	2
CO2	2	1	2	3
CO3	3	3	1	1
CO4	3	3	2	3
CO5	2	1	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E21 **TIME SERIES ANALYSIS**

UNIT 1: INTRODUCTION TO TREND **9 hours**

Introduction to times series data, application of time series from various fields, Components of a time series, Decomposition of time series**. Trend**: Estimation of trend by free hand curve method, method of semi averages, fitting a various mathematical curve, and growth curves.

UNIT 2: TREND AND SEASONAL COMPONENT **12 hours**

Method of moving averages. Detrending. Effect of elimination of trend on other components of the time series. **Seasonal Component**: Estimation of seasonal component by Method of simple averages, Ratio to Trend, Ratio to moving average and Link relatives.

UNIT 3: FORECASTING **12 hours**

Variate component method: Stationary Time series: Weak stationary, autocorrelationfunction and correlogram of moving average .**Forecasting**: Exponential smoothing methods, Short term forecasting methods: Brown's discounted regression, Box-Jenkins Method.

UNIT 4: CYCLIC COMPONENT **12 hours**

Deseasonalization . Cyclic Component: Harmonic Analysis. **Some Special Processes**: Moving-average (MA) process and Autoregressive (AR) process of orders one and two, Estimation of the parameters of AR (1) and AR (2) – Yule-Walker equations.

Total : 45 hours

TEXT BOOK:

1. Chatfield C. (1980): The Analysis of Time Series –An Introduction, Chapman & Hall.

REFERENCE BOOKS:

1. Kendall M.G. (1976): Time Series, Charles Griffin.

2. Mukhopadhyay P. (2011): Applied Statistics, 2nd ed. Revised reprint, Books and Allied

CBCA25E21 TIME SERIES ANALYSIS

List of Lab Programs:

1. Fitting and plotting of modified exponential curve
2. Fitting and plotting of Gompertz curve
3. Fitting and plotting of logistic curve
4. Fitting of trend by Moving Average Method
5. Measurement of Seasonal indices Ratio-to-Trend method
6. Measurement of Seasonal indices Ratio-to-Moving Average method
7. Measurement of seasonal indices Link Relative method
8. Calculation of variance of random component by variate difference method
9. Forecasting by exponential smoothing
10. Forecasting by short term forecasting methods.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E22	DEEP LEARNING WITH PYTHON	L	T	P	C	Ty/Lb/ IE
		3	0	4	5	ETL
	Prerequisite: Basic Python programming, foundational mathematics (linear algebra, calculus), introductory machine learning concepts					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To introduce the idea of artificial neural networks and their architecture
- To introduce techniques used for training artificial neural networks
- To enable design of an artificial neural network for classification
- To enable design and deployment of deep learning models for machine learning problems

COURSEOUTCOMES(Cos)

Understand the different elementary models related to time series analysis

CO1	Able to understand the mathematics behind functioning of artificial neural networks.
CO2	Able to analyze the given dataset for designing a neural network based solution
CO3	Able to carry out design and implementation of deep learning models.
CO4	Able to design and deploy simple TensorFlow-based deep learning solutions to classification problems
CO5	Able to carry out signal/image processing applications

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	2	3	1	3	2	3	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	3	2
CO2	2	1	2	3
CO3	3	3	1	1
CO4	3	3	2	3
CO5	2	1	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E22 DEEP LEARNING WITH PYTHON

UNIT I: INTRODUCTION TO NEURAL NETWORKS 9 hours

AI, ML, DL – Definitions, Differences, Neurons, Neural Networks, Applications, Perceptron – Structure, Learning Algorithm, Limitations, Multi-Layer Perceptrons (MLP), Activation Functions (Sigmoid, ReLU, Tanh, Softmax), Backpropagation Algorithm.

UNIT II: DEEP LEARNING WITH PYTHON LIBRARIES 12 hours

Python Overview, NumPy – Arrays, Operations, Pandas – DataFrames, Manipulation, TensorFlow, PyTorch – Installation, Setup, Simple Neural Networks, Keras.

UNIT III: CONVOLUTIONAL NEURAL NETWORKS (CNNS) & RECURRENT NEURAL NETWORKS (RNNS) 12 hours

CNN – Architecture, Convolutional Layers, Pooling Layers, Fully Connected Layers, Activation Functions, Image Recognition, Computer Vision.
RNN – Structure, Working, LSTM, GRU, Sequential Data, NLP, Time Series Prediction.

UNIT IV: TRAINING AND OPTIMIZING DEEP LEARNING MODELS 12 hours

Gradient Descent– Batch, Stochastic, Mini-Batch, Adam, RMSprop, Adagrad. Regularization– Dropout, L1, L2, Batch Normalization. Hyperparameter Tuning – Learning Rate Scheduling, Model Evaluation – Confusion Matrix, Accuracy, Precision, Recall, F1-Score.

Total : 45 hours

Text Book:

1. François Chollet," Deep Learning with python" second Edition,November 2021

CBCA25E22 **DEEP LEARNING WITH PYTHON**

List of Lab Programs:

1. Implement a single-layer perceptron for binary classification using NumPy (AND/OR gate).
2. Build an MLP from scratch using NumPy and train it using backpropagation.
3. Create a basic neural network using Keras to classify MNIST handwritten digits.
4. Implement a Convolutional Neural Network (CNN) using Keras and train it on CIFAR-10 dataset.
5. Implement a Recurrent Neural Network (RNN) using Keras for character-level text prediction.
6. Build an LSTM model for IMDB movie reviews sentiment analysis using TensorFlow/Keras.
7. Train an MLP with and without dropout and L2 regularization, compare performance.
8. Optimize hyperparameters (learning rate, layers, activation functions) using GridSearchCV or Keras Tuner.
9. Modify an MLP/CNN model to include batch normalization and Adam optimizer, analyze improvements.
10. Train a classification model and compute confusion matrix, accuracy, precision,

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E23	THINKING RESTFUL SERVICES	L	T	P	C	Ty/Lb/ IE
		3	0	4	5	ETL
	Prerequisite: Java Programming Fundamentals, Object-Oriented Programming Concepts, Advanced Java Concepts, Working with Spring Boot					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- Learn to develop RESTful APIs using Spring Boot, including HTTP methods and JSON handling.
- Understand NoSQL concepts and perform CRUD operations with MongoDB via Spring Data.
- Implement robust exception handling and apply unit and integration testing strategies.
- Secure RESTful services using Spring Security with JWT-based authentication.
- Build and deploy a complete, secure REST API project integrating all core concepts.

COURSEOUTCOMES(Cos)

Understand the different elementary models related to time series analysis

CO1	Build and test RESTful APIs using Spring Boot for effective backend communication.
CO2	Managesemi-structured and unstructured data using NoSQL databases like MongoDB.
CO3	Implement Spring Data Mongo Repositories to perform CRUD operations and interact with NoSQL databases.
CO4	Handle exceptions gracefully in RESTful services using Spring's exception handling features And domain-specific exceptions.
CO5	Perform unit and integration testing on service, data, and controller layers using JUnit andMockito.

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	2	3	1	3	2	3	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	3	2
CO2	2	1	2	3
CO3	3	3	1	1
CO4	3	3	2	3
CO5	2	1	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E23 THINKING RESTFUL SERVICES

UNIT1: RESTful API Development and Data Handling: 9 hours

Introduction to REST Architecture, Building RESTful APIs with Spring Boot, HTTP Methods and Status Codes, RESTful URL Design Principles, Request and Response Handling (JSON), Creating REST Controllers. Introduction to NoSQL and MongoDB, Document-oriented Storage Concepts, Spring Data MongoDB Configuration, Creating Mongo Repositories, CRUD Operations with Mongo Repository, Managing Semi-structured and Unstructured Data

UNIT 2 : Exception Handling and Testing Strategies 12 hours

Spring Boot Exception Handling, Global Exception Handling with @ControllerAdvice, Domain-Specific Exceptions, Unit Testing with JUnit and Mockito, Testing Controller, Service, and Repository Layers, Integration Testing in Spring Boot

UNIT3 : Securing RESTful Applications 12 hours

Introduction to Spring Security, JWT Authentication Flow, Generating and Validating JWT Tokens, Securing End Points with JWT, Stateless Authentication Best Practices.

UNIT4 : Project and Summative Assessment 12 hours

Build a secure,tested RESTful API with MongoDB, implement authentication with JWT, and deploy the solution. Summative Quiz.

Total : 45 hours

TEXTBOOK:

1. **Rajput, D. (2022).** *Learning Spring Boot 3.0: Simplify the development of production-grade applications using Spring Boot 3.0.* Packt Publishing.

REFERENCE BOOKS:

1. **Walls, C. (2022).** *Spring in Action* (6th ed.). Manning Publications.
2. **Gutierrez, F. (2023).** *Pro Spring Boot 3: An Authoritative Guide to Building Microservices, Web and Enterprise Applications, and Best Practices.* Apress.
3. **Bradshaw, S., & Chodorow, K. (2019).** *MongoDB: The Definitive Guide* (3rd ed.). O'Reilly Media.
4. **Gulati, S. (2021).** *Test-Driven Development with JUnit 5: Build robust software with JUnit 5, Mockito, Testcontainers, and Spring Boot.* Packt Publishing.
5. **Mak, L. (2021).** *Spring Security in Action: Powerful security for the web and cloud.* Manning Publications.

CBCA25E23 **THINKING RESTFUL SERVICES**

List of Lab programs:

1. Create a Spring Boot RESTful API that handles CRUD operations for a Product entity using standard HTTP methods.
2. Design RESTful URLs and test endpoints using Postman fo r an e-commerce backend.
3. Connect a Spring Boot application to MongoDB,create a document model(e.g., Customer), and perform CRUD operations using Mongo Repository.
4. Store and retrieves emi-structured data(like JSONwith nested fields)inMongoDB and expose it via REST endpoints.
5. Handle in valid inputs or missing data using @ExceptionHandler and @ControllerAdviceinaSpringBootservice.
6. Define and use domain-specific exceptions for better API error reporting(e.g., UserNotFoundException,InvalidOrderException).
7. Write unit tests for a service class using JUnit and mock dependencies with Mockito.
8. Test controller endpoints using @WebMvc Test and simulate HTTP requests using MockMvc.
9. Perform integration testing of the entire API workflow—from controller to repository.
10. Implement user authentication using Spring Security and JWT token generation on login.
11. Secure certain API endpoints with JWT and allow public access to others(e.g.,login, registration).
12. Validate JWT tokens in request headers and extract user information to personalize responses.
13. Use Maven commands to build and package your SpringBoot application into a deployable .jar.
14. Log requests and responses for a Spring Bootapplication using slf4jand@Slf4j annotations.
15. Create a backend service for a To DoList orTask Manager with secure login,MongoDB data persistence, and full test coverage.
16. Handle large nested JSON structures and store them efficiently in MongoDB using embedded documents.
17. Add pagination and sorting to your Mongo repository methods and expose them through API.
18. Simulate a login workflow using Postman with JWTtoken generation and secured data access.
19. Deploy the RESTful application locallyorona cloud platform(optional stretch goal).
20. Document the API using Swagger/OpenAPI(bonus practice for project-ready APIdesign)

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E24	DEEP LEARNING WITH WATSON	L	T	P	C	Ty/Lb/ IE
		3	0	4	5	ETL
	Prerequisite: Fundamentals of Deep Learning					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- To understand and apply deep learning concepts using IBM Watson's AI platform.
- This includes building, training, and deploying deep learning models for tasks such as image recognition, natural language processing, and predictive analytics, leveraging Watson's tools and cloud-based infrastructure.
- The goal is to gain hands-on experience in integrating deep learning solutions into real-world applications using Watson Studio and related services.

COURSEOUTCOMES(Cos)

Understand the different elementary models related to time series analysis

CO1	To Understand the need and applications of Deep Learning.
CO2	To Understand what a Neural Network and its functions.
CO3	To work Forward Propagation & Backward Propagation.Multi-Layer Perceptron Architecture.
CO4	To Understand issues with RNNs, CNN
CO5	To Understand the components of LSTM – Cell State, ForgetGate, Input Gate, Output Gate.

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	2	3	1	3	2	3	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	3	2
CO2	2	1	2	3
CO3	3	3	1	1
CO4	3	3	2	3
CO5	2	1	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E24 **DEEP LEARNING WITH WATSON**

UNIT I – Introduction to Deep Learning **9 Hours**

Fundamentals of Deep Learning - Neural Networks & Optimization- Deep Learning Frameworks- Advanced Deep Learning Techniques- Overview of Model Evaluation and Hyperparameter Tuning- Handling Overfitting and Regularization Techniques

UNIT II – Introduction to Neural Networks **12 Hours**

Fundamentals of Neural Networks-Introduction to Neural Networks Layers- Multi-Layer Perceptrons (MLPs)-Training and Optimization of Neural Networks - Advanced Neural Network Architectures-Neural Network Applications

UNIT III – Training a Neural Network **12 Hours**

Introduction to Forward and Backpropagation - Optimization Techniques-Activation and Loss Functions-Regularization and Generalization-Hyperparameter Tuning and Model Evaluation- Advanced Training Techniques

UNIT IV – Deep Learning Algorithms (CNN, RNN, and LSTM) **12 Hours**

Introduction to TensorFlow - Building Neural Networks with TensorFlow and Keras - Convolutional Neural Networks (CNNs) for Image Processing - Recurrent Neural Networks (RNNs) and Sequence Models- Deploying and Scaling Deep Learning Models using IBM Watson Service

Total : 45 hours

Text BOOK:

Deep Learning Unleashed on IBM Power Systems Servers" (2018)

Deep Learning with Python" by François Chollet (First published in 2017; updated in 2021)

Neural Networks and Deep Learning: A Textbook" by Charu C. Aggarwal (2018)

Reference Book:

Deep Learning: Foundations and Concepts" by Christopher Bishop (2023)

Artificial Intelligence: A Modern Approach" by Stuart J. Russell and Peter Norvig (4th Edition, 2020)

CBCA25E24 **DEEP LEARNING WITH WATSON**

List of Lab Programs:

1. Implement a simple neural network with one hidden layer using NumPy (without deep learning libraries). Train it on a small dataset.
2. Construct a Multi-Layer Perceptron (MLP) using TensorFlow/Keras for classifying handwritten digits (use MNIST dataset).
3. Compare different activation functions (ReLU, Sigmoid, Tanh) in a neural network and analyze their effect on training.
4. Build an advanced neural network (such as an autoencoder) using Keras and analyze its performance on image reconstruction.
5. Implement forward and backpropagation from scratch for a simple feedforward network and visualize the weight updates.
6. Train a neural network with different loss functions (MSE, Cross-Entropy) and evaluate their impact on model accuracy.
7. Tune hyperparameters (learning rate, batch size, number of layers) using GridSearchCV or Random Search and evaluate results.
8. Train a Convolutional Neural Network (CNN) on the CIFAR-10 dataset and evaluate its performance.
9. Implement data augmentation techniques (rotation, flipping, scaling) and observe their impact on CNN performance.
10. Build a Recurrent Neural Network (RNN) for text classification or sentiment analysis using TensorFlow/Keras.
11. Train an LSTM model on a time-series dataset (such as stock price prediction) and analyze its forecasting accuracy.
12. Deploy a trained deep learning model using IBM Watson Service, make predictions using a cloud-based API, and integrate the results into a Flask application.
13. A research team wants to generate artificial handwritten digits to expand their dataset for training better digit classifiers.
14. Spam Email Classifier:A company wants to filter spam emails. Build a simple neural network using NumPy (without TensorFlow/Keras) to classify emails as spam or not.
15. Self-Driving Car Image Recognition:Train a Convolutional Neural Network (CNN) on the CIFAR-10 dataset to classify road signs.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E25	**BUILDING APPLICATIONS USING LLM–L1**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		3	**0**	**4**	**5**	**ETL**
	Prerequisite: DigitalTools,GenAI,Database,Programming,Problem-solvingandPythonskills.					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

1. Understand the fundamentals of chatbots and virtual assistants, including types, architectures, components, and the role of NLP in conversational AI.
2. Set up a Python development environment and integrate Large Language Models (LLMs) using APIs and libraries to create basic chatbot functionalities.
3. Design and develop functional chatbots with features like intent recognition, entity extraction, context management, and dynamic response generation.

COURSEOUTCOMES(Cos)

Understand the different elementary models related to time series analysis

CO1	Understand the architecture and workflow of chatbots and virtual assistants.
CO2	Set up development environments like configuring tools like Python, relevant libraries, and LLM APIs for seamless chatbot development.
CO3	Learn to programmatically access LLMs for conversational applications using Python libraries.
CO4	Design and build functional chatbots that can handle real-world tasks, such as FAQs or customer support.
CO5	Implement key features such as intent recognition, context management,and response generation.

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**	**PO8**	**P09**
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	2	3	1	3	2	3	3	2	3

Cos/PSOs	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	3	2
CO2	2	1	2	3
CO3	3	3	1	1
CO4	3	3	2	3
CO5	2	1	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E25 BUILDING APPLICATIONS USING LLM –L1

UNIT1: Introduction to Chat bots and Virtual Assistants: 9 hours

Types of Chatbots, UseCases of Virtual Assistants, Overview of Conversational AI, Architecture of Chatbot Systems, Components of Virtual Assistant, Overview of NLP in Chatbot Development.
Setting up the Development Environment: Installing Python, Python Libraries, Configuration of Python Environment, Introduction to LLM APIs, Cloud Platforms for LLM Integration.
Integrating LLMs with Python: Introduction to LLMs, Accessing LLM APIs, Python Libraries for Chatbot Development, Simple Chatbot API Integration.

UNIT2 : Designing Functional Chatbots 12 hours

Basic FAQ Chatbot, Intent Recognition, Entity Extraction, Conversational Flow, Context Management, Dynamic Responses.
Advanced Features in Chatbot Development: Response Generation Techniques, Handling Ambiguity, Multi-turn Conversations, Intent Classification, Data Labelling for Chatbots, Machine Learning for Chatbots.
Integrating External Data Sources: Connecting to APIs, Integrating Databases, Querying Data, Handling API Responses.

UNIT3: Deploying Chatbots 12 hours

Chatbot Deployment, Web Application Integration, Messaging Platform Integration, Webhooks, Real-time Communication, Chatbot Testing, Debugging.
Performance Optimization and Error Handling: Troubleshooting, Debugging, Performance Optimization, Load Balancing, Optimizing API Calls, Handling Unexpected Inputs.

UNIT4 : Project and Summative Assessment 12 hours

Project Planning and Design, Solution Development, Testing and Debugging, Review and Refactoring, Project Documentation and Presentation, Summative Quiz.

Total : 45 hours

TEXTBOOK:

1. **Pereira, F. (2023).** ***Building Chatbots with Python: Using Natural Language Processing and Machine Learning.*** **Apress.**

REFERENCE BOOKS:

1. **Poria, S., & Cambria, E. (2021).** ***Deep Learning for Natural Language Processing.*** **Springer.**
2. **Brownlee, J. (2022).** ***Developing Chatbots with Python: NLP and AI Techniques for Conversational Interfaces.*** **Machine Learning Mastery.**

CBCA25E25 BUILDING APPLICATIONS USING LLM –L1

List of Lab programs:

1. Build a Basic FAQ Chatbot: Design and implement a simple FAQ-based chatbot that can answer predefinedquestions related to a company's services using Python and LLM APIs.
2. Intent Recognition:Create a chatbot capable of recognizing user intent by classifying input into specific categories (e.g., booking, inquiries, complaints) using NLP techniques.
3. Context Management in Chatbots:Implement context management in a chatbot to maintain the state of the conversation across multiple user interactions, ensuring a personalized user experience.
4. Dynamic Response Generation: Build a chatbot that can generate dynamic responses based on user input, utilizing LLMs for natural language processing and understanding.
5. Integrating External Data Sources: Integrate the chatbot with anexternal API(e.g., weather, productcatalog, customer database)to fetch real-time data and provide dynamic responses based on external inputs.
6. Database Integration for Chatbots: Implement a chatbot that interacts with a database to retrieve user-specific information or provide personalized responses based on stored data.
7. Handling Ambiguity in Conversations:Design a chatbot capable of handling ambiguous user Input by asking clarifying questions and refining responses based on the user'sfeedback.
8. Integrating a Chatbot with a Messaging Platform:Buildachatbotthatcanbedeployedona messaging platform (e.g., WhatsApp, Facebook Messenger), enabling it to interact with users in real time.
9. Testing and Debugging Chatbots:Develop a chatbot and perform rigorous testing to identify and fix issues, ensuring that the bot handles unexpected inputs and edge cases gracefully.
10. Deploying Chatbot on a Web Application: Design and deploy a functional chatbot within a web application, integrating it into an existing website and providing a seamless user experience.
11. Designing an E-commerce Assistant Chatbot: Build a chatbot that acts as an e-commerce assistant, helping users search fo rproducts, add them to the cart, and assist with checkout.
12. Handling Unstructured Data with LLMs:Create a chatbot that processes unstructured data, like customer feedback, and provides actionable insights through text analysis using LLMs.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E26	**BUILDING APPLICATIONS USING LLM–L2**	**L**	**T**	**P**	**C**	**Ty/Lb/IE**
		3	**0**	**4**	**5**	**ETL**
	Prerequisite:DigitalTools,GenAI,Database,Programming,Problem-solvingandPythonskills.					

OBJECTIVES

1. Learn about different AI agents (autonomous, task-based, static/dynamic) and their system architectures.
2. Design agent behaviors, manage states, schedule tasks, and implement event-driven programming.
3. Connect agents to APIs, databases, and external services for real-time data interaction.
4. Coordinate multiple agents, manage communication, resolve conflicts, and share workflows.
5. Improve system performance, scalability, handle errors, and debug multi-agent environments efficiently.

COURSEOUTCOMES(Cos)

Understand the different elementary models related to time series analysis

CO1	Develop independent AI agents capable of performing dynamic, task-based actions.
CO2	Build multi-agent systems that collaborate and interact effectively in shared workflows.
CO3	Integrate agents with external systems such as databases,APIs,and third-party services.
CO4	Implement advanced LLM capabilities, including tool use, knowledge retrieval, and decision-making.
CO5	Optimizeagentworkflowsforefficiency,scalability,anderrorhandling.

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**P07**	**PO8**	**P09**
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	2	3	1	3	2	3	3	2	3

Cos/PSOs	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	3	2
CO2	2	1	2	3
CO3	3	3	1	1
CO4	3	3	2	3
CO5	2	1	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Programcore	Program Elective	Open elective	Skill enhancing elective	Interdisciplinary/Allied	Skill component	Practical Project/ Internship	others
			√						

CBCA25E26	Course Designed by: Faculty of Computer Applications	

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25E26 BUILDING APPLICATIONS USING LLM–L2

UNIT 1: Introduction to AI Agents **9 hours**

Types of AI Agents, Autonomous Agents, Task-Based Actions, Static vs Dynamic Agents, Agent Architectures, Multi-Agent Systems.
Building Independent AI Agents: Single-Agent System, Agent Behavior Design, Actionable Tasks, Task Scheduling, State Management, Event-Driven Programming.
Interacting with External Systems: Connecting toAPIs, Database Integration, Querying External Databases, Integrating External Services, Webhooks, REST APIs for Agents.

UNIT 2: Advanced LLM Capabilities **12 hours**

Tool Use in LLMs, Knowledge Retrieval Mechanisms, Decision-Making Models, Reasoning with LLMs, Task-Oriented LLM Applications.
Multi-Agent System Design: Collaborative Agents, Shared Workflow, Agent Coordination, Agent Communication Protocols, Conflict Resolution, Synchronization of Agents.
Agent Task Management: Task Decomposition, Prioritizing Tasks, Task Assignment, Resource Allocation, Task Completion Feedback, Real-time Monitoring.

UNIT 3 : OptimizationTechniques **12 hours**

PerformanceTuning,WorkflowOptimization,ScalabilityofAgentSystems, Load Balancing, Parallel Processing for Agents.
Error Handling and Debugging: Error Types in Multi-Agent Systems, Exception Handling, Debugging Tools, Log Management, Traceback Analysis.

UNIT 4 : Project and Summative Assessment **12 hours**

Project Planning and Design, Solution Development, Testing and Debugging, Review and Refactoring, Project Documentation and Presentation, Summative Quiz

Total : 45 hours

TEXTBOOK:

1. Pereira, F. (2023). *Building Chatbots with Python: Using Natural Language Processing and Machine Learning*. Apress.

REFERENCE BOOKS:

1. Dibia, V. (2024). *Multi-Agent Systems with AutoGen*. Manning Publications.
2. Russell, S., & Norvig, P. (2020). *Artificial Intelligence: A Modern Approach* (4th ed.). Pearson
3. Auffarth, B. (2023). *Generative AI with LangChain: Build Large Language Model (LLM) Apps with Python, ChatGPT, and Other LLMs*. Packt Publishing.
4. Kleppmann, M. (2017). *Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems*. O'Reilly Media.
5. Lanham, M. (2025). *AI Agents in Action*. Manning Publications.
6. Poria, S., & Cambria, E. (2021). *Deep Learning for Natural Language Processing*. Springer.

CBCA25E26 **BUILDING APPLICATIONS USING LLM–L2**

List of Lab programs:

1. Develop a single-agent system that autonomously performs a simpletask (e.g.,scheduling a meeting) based on specific triggers. Ensure the agent's actions are stateful and respond to dynamic inputs.
2. Create an agent that listens for specific events(e.g.,new data entry in a database)and performs actions accordingly, such as sending an alert or triggering a task.
3. Design an agent that can query a database(e.g.,SQLorNoSQL)for specific records based on dynamic input and process the results to perform a task, like generating a report.
4. Develop a multi-agent system where agents communicate with each other to complete a collaborative task (e.g., scheduling resources in a project management tool).
5. Implement an AI agent that uses an LLM to retrieve and process relevant knowledge from a knowledge base (e.g., FAQs or documents) to answer user queries.
6. Create a decision-making model for an agent that makes dynamic,context-dependent decisions (e.g., route optimization for deliveries based on traffic data).
7. Develop two or more agents that must resolve conflicts(e.g.,resource allocation)when trying to complete tasks in a shared workflow, using predefined rules or negotiation protocols.
8. Integrate a third-party service (e.g.,payment gateway)into an agent system using webhooks, triggering events based on external service responses and automating subsequent actions.
9. Build an LLM-powered application where the agent assists with a task such as customer support, booking appointments, or generating reports based on user input.
10. Implement a real-time monitoring system that tracks agent progress on assigned tasks, provides feedback on task completion, and updates task statuses.
11. Optimize an AI agent’s performance by tuning various parameters(e.g.,response time, Resource usage)for an existing workflow to ensure it works efficiently underload.

Design a multi-agent system and implement advanced debugging tools to trace issues, handle errors, and ensure smooth operation with minimal downtime.

APPENDIX II

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25MDX	INDIAN KNOWLEDGE SYSTEMS	L	T	P	C	Ty/Lb/ IE
		2	0	0	2	IE
	Prerequisite: A basic understanding of Indian history, culture, and philosophical thought is essential.					
	Course Designed by: Faculty of Computer Applications					

OBJECTIVES

- **To introduce students to the richness and diversity of Indian Knowledge Systems**, including philosophy, science, mathematics, medicine, architecture, arts, language, and literature.
- **To promote interdisciplinary understanding** by integrating traditional knowledge with contemporary academic disciplines.
- To develop a critical appreciation for India's contributions to global knowledge and civilization.
- To encourage research and innovation through the application of traditional Indian knowledge in modern contexts.

COURSEOUTCOMES(Cos)

Understand the different elementary models related to time series analysis

CO1	Understand the foundational concepts, history, and evolution of Indian Knowledge Systems across diverse domains such as philosophy, science, arts, and governance.
CO2	Analyze the contributions of ancient Indian scholars in fields like mathematics, astronomy, medicine (Ayurveda), linguistics, and architecture.
CO3	Appreciate the interconnection between traditional Indian knowledge and modern scientific principles.
CO4	Apply insights from Indian ethical, ecological, and educational traditions to contemporary global challenges.
CO5	Demonstrate awareness of the relevance and application of IKS in modern-day disciplines such as sustainable development, holistic health, and integrative learning.

Mapping of Course Outcome with Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	P09
CO1	3	2	3	3	2	2	3	2	2
CO2	3	3	3	1	2	3	1	2	3
CO3	3	2	2	1	3	3	1	3	3
CO4	3	3	3	2	1	3	2	1	3
CO5	2	3	1	3	2	3	3	2	3

Cos/PSOs	PS01	PS02	PS03	PS04
CO1	3	3	3	2
CO2	2	1	2	3
CO3	3	3	1	1
CO4	3	3	2	3
CO5	2	1	3	3

3/2/1IndicatesStrengthOfCorrelation,3 –High,2-Medium,1-Low

Category	H&S	Program core	Program Elective	Open elective	Skill enhancing elective	Inter disciplinary/ Allied	Skill component	Practical Project/ Internship	others
						√			

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25MD1	INDIAN KNOWLEDGE SYSTEMS AND TRADITIONS	L	T	P	C	Ty/Lb/ IE
		2	0	0	2	IE
	Prerequisite: Knowledge of India's social structure and traditional practices.					
	Course Designed by: Faculty of Computer Applications					

IKS-I: Indian Knowledge Systems and Traditions

Course Objectives:

- To sensitize the students about context in which they are embedded i.e. Indian culture and civilisation including its Knowledge System and Tradition.
- To help students to understand the knowledge, art and creative practices, skills and values in ancient Indian system.
- To help to study the enriched scientific Indian heritage.
- To introduce the contribution from Ancient Indian system & tradition to modern science & Technology.

Detailed Contents:

Module 1: Introduction to IKS 15 hours

(Any eight of total sessions assigned for Literary activity)

Introductory lecture on the any eight topics below:

1. Indian Knowledge System
2. Indian Culture & Civilization
3. Ancient Indian Chemistry
4. Ancient Indian Metallurgy
5. Ancient Indian Mathematics
6. Ancient Indian Astronomy
7. Indian Astronomical Instruments
8. Indian Knowledge System (Upveda: Ayurveda)
9. Indian Knowledge System (Upveda: Gandharveda)
10. Indian Knowledge System (Vedangas: Shiksha, Kalpa, Vyakarana)
11. Indian Knowledge System (Vedangas: Jyotisha, Nirukta, Chandas)
12. Indian Architecture I: Sthapatya-Veda
13. Indian Architecture II: Temples
14. Indian Architecture III: Town & Planning
15. Indian Philosophical System

Module 2: Introduction to Creative Practices **15 hours**

(Twenty Lectures with at least Five different topics of total session under Creative activity)

Introductory lecture on the topics below:

1. Dhatuvada: art of metallurgy
2. Akara jnana: art of mineralogy
3. Vastuvidya: art of engineering
4. Yantmatratika: art of mechanics
5. Takshana: art of carpentry
6. Chalitakayooga: art of practicing as a builder of shrines
7. Rajjuvidya: art of testing silver and jewels
8. Maniraga jnana: art of tinging jewels
9. Sucivayakarma: art of needleworks and weaving
10. Vadya vidya: art of playing on musical instruments
11. Geet vidya: art of singing
12. Nritya vidya: art of dancing
13. Natya vidya: art of theatricals
14. Alekhya vidya: art of painting
15. Viseshakacchedaya vidya: art of painting the face and body with color
16. Udakavadya: art of playing on music in water
17. Manasi kavyakriya: art of composing verse
18. Bhushanayojana: art of applying or setting ornaments
19. Citrasakapupabhaksya vikarakriya: art of preparing varieties of delicious food
20. Dasanavasanapanganraga: art of applying preparations for cleansing the teeth, cloths and painting the body
21. Utsadana: art of healing or cleaning a person with perfumes
22. Vastragopana: art of concealment of cloths
23. Balakakridanaka: art of using children's toys
24. Tandulakusalibali: art of preparing offerings from rice and flowers
25. Pushpastaranam: art of making a covering of flowers for a bed

Total : 30 hours

References:

- Textbook on IKS by Prof. B. Mahadevan, IIM Bengaluru
- Kapur K. and Singh A.K (Eds) (2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla.
  Tatvabodh of Sankaracharya, Central Chinmaya Mission Trust, Bombay, 1995.
- The Cultural Heritage of India, Vol. I. Kolkata: Ramakrishna Mission Publication, 1972.
- Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
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- Avari, B. (2016). India: The Ancient Past: A History of the Indian Subcontinent from c. 7000 BCE to CE 1200. London: Routledge.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25MD2	INDIAN CULTURE AND CIVILIZATION	L	T	P	C	Ty/Lb/IE
		2	0	0	2	IE
	Prerequisite: Knowledge of India's social structure and traditional practices.					
	Course Designed by: Faculty of Computer Applications					

IKS-II: Indian Culture and Civilization

Course Objectives:

- To introduce fundamentals of Ancient Indian Education to understand the pattern and purpose of studying vedas, vedangas, upangas, upveda, purana & Itihasa.
- To help students to trace, identify and develop the ancient knowledge systems.
- To help to understand the apparently rational, verifiable and universal solution from ancient Indian knowledge system for the holistic development of physical, mental and spiritual wellbeing.
- To build in the learners a deep rooted pride in Indian knowledge, committed to universal human right, well-being and sustainable development.

Detailed Contents:

Module 1: Introduction to IKS **6 hours**

Caturdaśa Vidyāsthānam, 64 Kalas, Shilpa Śāstra, Four Vedas, Vedānga, Indian Philosophical Systems, Vedic Schools of Philosophy (Sāmkhya and Yoga, Nyaya and Vaiśeṣika, Pūrva-Mīmāṃsā and Vedānta), Non-Vedic schools of Philosophical Systems (Cārvāka, Buddhist, Jain), Puranas (Maha-puranas, Upa-Puranas and Sthala-Puranas), Itihasa (Ramayana, Mahabharata), Niti Sastras, Subhasitas

Module 2: Foundation concept for Science & Technology **6 hours**

Linguistics & Phonetics in Sanskrit (panini's), Computational concepts in Astadhyayi Importance of Verbs, Role of Sanskrit in Natural Language Processing, Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (Bhuta Samkhya System, Kaṭapayādi System), Pingala and the Binary system, Knowledge Pyramid, Prameya – A Vaiśeṣikan approach to physical reality, constituents of the physical reality, Pramāṇa, Saṃśaya

Module 3: Indian Mathematics & Astronomy in IKS **6 hours**

Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry (Sulba Sutras, Aryabhatīya-bhasya), value of π, Trigonometry, Algebra, Chandah Sastra of Pingala,

Indian Astronomy, celestial coordinate system, Elements of the Indian Calendar Aryabhatiya and the Siddhantic Tradition Pancanga – The Indian Calendar System Astronomical Instruments (Yantras) Jantar Mantar or Raja Jai Singh Sawal

Module 4: Indian Science & Technology in IKS **6 hours**

Indian S & T Heritage, sixty-four art forms and occupational skills (64 Kalas)
Metals and Metalworking technology (Copper, Gold, Zinc, Mercury, Lead and Silver), Iron & Steel, Dyes and Painting Technology, Town & Planning Architecture in India, Temple Architecture, Vastu Sastra

Module 5: Humanities & Social Sciences in IKS **6 hours**

Health, Wellness & Psychology, Ayurveda Sleep and Food, Role of water in wellbeing Yoga way of life Indian approach to Psychology, the Triguna System
Body-Mind-Intellect- Consciousness Complex. Governance, Public Administration & Management reference to ramayana, Artha Sastra, Kautilyan State.

Total : 30 hours

References:

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
2. Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tattvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.
3. Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
4. SK Das, The education system of Ancient hindus, Gyan publication house, India
5. BL Gupta,Value and distribution system in india, Gyan publication house, India
6. Reshmi ramdhoni, Ancient Indian Culture and Civilisation, star publication ,2018
7. Supriya Lakshmi Mishra, Culture and History of Ancient India (With Special Reference of Sudras), 2020.
8. Gambirananda, Swami, Tr. *Upanishads with the Commentary of Sankaracharya*. Kolkata: Advaita Ashrama publication Department, 2002.
9. Ranganathananda, Swami. *The Massage of the Upanishads*. Bombay: Bharathya Vidya Bhaven, 1985.
10. Om Prakash, Religion and Society in Ancient India, Bhariya Vidhya Prakashan, E 1985
11. J Auboyer, Daily Life in Ancient India from Approximately 200 BC to AD 700, Munshi ram Manoharlal publication, 1994.
12. DK Chakkrabarty, Makkan Lal, History of Ancient India (Set of 5 Volumes), Aryan book International publication, 2014
13. Dr. Girish Nath Jha, Dr. Umesh Kumar Singh and Diwakar Mishra, Science and Technology in Ancient Indian Texts, DK Print World limited,
14. Swami BB Vishnu, Vedic Science and History - Ancient Indian's Contribution to the Modern World, gosa publication, 2015
15. Chatterjee, S.C. The Nyaya Theory of Knowledge. Calcutta: University of Calcutta Press, 1950.

16. Dasgupta, Surendra. A History of Indian Philosophy. Delhi: Motilal Banarsidas, 1991.Vols III & IV.
17. Mercier, Jean L. From the Upanishads to Aurobindo. Bangalore: Asian Trading Corporation, 2001.
18. M. Hiriyanna, *Essentials of Indian Philosophy*. London: Diane Publications, 1985.
19. Hume, Robert Ernest, *The Thirteen Principal Upanishads*. Virginia: Oxford University Press, 1931.
20. Radhakrishnan, S. *Principal Upanishads*. New York: Harper Collins, 1963.
21. Satprakashananda. *The Methods of Knowledge according to Advaita Vedanta*. Calcutta: Advaita Ashram, 2005.
22. Potter, K.H. *Encyclopaedia of Indian Philosophies*, Vol.III. Delhi: Motilal Banarasidass, 2000.

CBCA25MD3	INDIAN VISION FOR HUMAN SOCIETY (VISHVA KALYAN THRU VASUDHAIVA KUTUMBKAM)	L	T	P	C	Ty/Lb/ IE
		2	0	0	2	IE
	Prerequisite: Knowledge of India's social structure and traditional practices.					
	Course Designed by: Faculty of Computer Applications					

IKS-III: Indian Vision for Human Society (Vishwa Kalyan thru Vasudhaiva Kutumbakam)

Course Objectives

- To help the learner to understand the concept of "vasudhaiva kutumbakam" and its realization process as an base for the development of vision for a humane society.
- To help to identify the universality in humans and its coexistence in existence To introduce the sense of responsibility, duties and participation of individual for establishment of fearless society.
- To help to understand the apparently rational, verifiable and universal solution from ancient Indian knowledge system for the holistic development of physical, mental and spiritual wellbeing of one and all, at the level of individual, society, nation and ultimately the whole world.

Detailed contents:

Module 1: The world view & Vision of Human Society 6 hours

The concept of non-duality of Prakriti (Jad) and Purush (Chetana), human as coexistence of Jad & Chetan, pancha-mahabhutas, the root of sorrow and suffering, freedom from sorrow, salvation, eternal peace truth (vyaharika satya), ultimate truth. The acceptance of various systems of philosophy for realization of truth and complementariness in society in ancient Indian system.

Module 2: Aspiration and Purpose of Individual and Human Society 6 hours

Aims of Human life; at individual level and societal level. At societal level; Four purusarthas Dharma, Artha, Kama, Moksha. Individual level; Abhyudaya (progress),

Nihsreyasa (perfection) Pravrtti, Nivrtti. Dharma; Dharma sutras (Gautama, apastamba, baudhayana, vasistha). Dharma-Shastra; (manusmriti, naradamriti, visnusmrti, yajnavalkya smriti) sociology, different stages of life like studenthood, householdership, retirement and renunciation, rites and duties, judicial matters, and personal laws (Aachara, Vyavahara, Prayaschitta). Artha; Kauthilya Arthashastra, Kamandakiya Nitisara, Brihaspati Sutra, Sukra Niti, Moksha: Human liberation (Ignorance to Knowledge)

Module 3: Program for Ensuring Human Purpose: at Individual and Societal level –I

6 hours

Fundamental concept of Nitishastra: Satyanishtha Aur Abhiruchi (Ethics, Integrity & aptitude), The true nature of self; Shiksha Valli, Bhrigu Valli (concept of Atman-Brahman (self, soul). The true constitution of Human: Ananda Valli (Annamaya Kosha, Pranamaya Kosha, Manomaya Kosha, Vijnanamaya Kosha, Anandamaya Kosha), The four states of consciousness (Waking state, Dreaming state, Deep Sleep State, Turiya the fourth state), Consciousness (seven limbs and nineteen mouths), Prajna, Awarness. The Life Force Prana (Praana-Apaana-Vyaana-Udaana- Samaana)

Module 4: Program for Ensuring Human Purpose: at Individual and Societal level –II

6 hours

Differentiating Vidya and Avidya, human bondages, Higher and Lower Knowledge (Para Vidhya & Apara Vidhya), Concept of Sattva, Rajas, Tamas and need of balancing the same, Patanjali yog sutra; Yama, Niyama, Asanas, pranayams, pratyahara, dharna, dhyana, Samadhi, Sixteen category of padartha, pramans (pratyaksh, anuman, upaman, shabda). Saadhana chatushṭayama (viveka, vairagya, mumukshatavam, shadsampatti (sama, dama, uparama, titiksha, shradha, samadhana), Understanding Nitya Karma, Naimittika Karma, Kamya karma, prayaschitta karma, Nishidha Karma.

Meditation and Progressive meditation (Narada's education), Ativadin to self-knowledge, Jyan yog, Karma yog, sanyas yog in aspect to harmonious practice in society

Module 5: Practices for Ensuring Human Purpose – III **6 hours**

Practice in philosophy, architecture, grammar, mathematics, astronomy, metrics, sociology, economy and polity, ethics, geography, logic, military science, weaponry, agriculture, mining, trade and commerce, metallurgy, shipbuilding, medicine, poetics, biology and veterinary science.

Total : 30 hours

References:

1. Maharaj swami chidatmanjee, Ancient Indian Society, Anmol publication pt ltd, indi
2. S. C. Maner jee, Society in Ancient India: Evolution Since the Vedic Times Based on Sanskrit, Pali, Pakrit and Other Classical Sources: No. 1 (Reconstructing Indian History and Culture), DK printing, India
3. Rao, N. 1970. The Four Values in Indian Philosophy and Culture. Mysore: University of Mysore.
4. Chakaborti, K. 2001. Religious Process: The Puranas and the Making of Regional Tradition, Delhi, OUP.
5. Kuhn, T. 1970. The Structure of Scientific Revolutions, (2nd ed.). University of Chicago Press, USA.
6. Keith, A. (1925). The religion and philosophy of the Veda and Upanishadas.

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8. Kane, P. 1941. History of Dharmashastra. Vol II, Part I. Poona: Bhandarkar Oriental Research Institute.
9. The Religion and Philosophy of the Veda and Upanishads. Delhi: Motilal Banarsidass.
10. Parpola, A. 2007. 'Human Sacrifice in India in Vedic Times and Before', Chapter VIII, in The Strange World of Human Sacrifice, ed., J. Bremmer. Leuven, Belgium: Peeters.
11. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
12. Kapur K and Singh A K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.
13. Keith, Arthur Berriedale. The Religion and Philosophy of the Veda and Upanishads. 2 Vols. Delhi: Motilal Banarsidass, 1970.
14. Keith, A. (1925). The religion and philosophy of the Veda and Upanishads. Delhi: Motilal Banarsidass Publishers.
15. Nar, Shanna N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
16. R C Dutt, A history of civilization in ancient India, vol 1, Taylor & Francis, US
17. R C Dutt, A history of civilization in ancient India, vol 2, Taylor & Francis, US
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22. Om Prakash, Religion and Society in Ancient India, Bhariya Vidhya Prakashan, 1985
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24. DK Chakkrabarty, Makkhan Lal, History of Ancient India (Set of 5 Volumes), Aryan book internation publication, 2014
25. Dr. Girish Nath Jha, Dr. Umesh Kumar Singh and Diwakar Mishra, Science and Technology in Ancient Indian Texts, DK Print World limited,
26. Swami BB Vishnu, Vedic Science and History - Ancient Indian's Contribution to the Modern World, gosai publication, 2015
27. Chatterjee, S.C. The Nyaya Theory of Knowledge. Calcutta: University of Calcutta Press, 1950.
28. Vidyabhusana, S.C. A History of Indian Logic. Delhi: Motilal Banarsidass Publication, 1971.
29. Dasgupta, Surendra. A History of Indian Philosophy. Delhi: Motilal Banarsidass, 1991. Vols. III & IV.
30. Mercier, Jean L. From the Upanishads to Aurobindo. Bangalore: Asian Trading Corporation, 2001.

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25MD4	INDIAN SCIENCE, ENGINEERING AND TECHNOLOGY (PAST, PRESENT AND FUTURE)	L	T	P	C	Ty/Lb/ IE
		2	0	0	2	IE
	Prerequisite: Knowledge of India's social structure and traditional practices.					
	Course Designed by: Faculty of Computer Applications					

IKS-IV: Indian Science, Engineering and Technology (Past, Present and Future)

Course Objectives

- To familiarize learners with major sequential development in Indian science, engineering and technology.
- To review & strengthen the ancient discovery and research in physics, chemistry, maths, metallurgy, astronomy, architecture, textile, transport, agriculture and Ayurveda etc.
- To help students to trace, identify and develop the ancient knowledge systems to make meaningful contribution to development of science today
- To help to understand the apparently rational, verifiable and universal solution from ancient Indian knowledge system for the scientific, technological and holistic development of physical, mental and spiritual wellbeing.

Detailed contents:

Module 1: Indian Traditional Knowledge; Science and Practices 6 hours

Introduction to the Science and way of doing science and research in India, Ancient Science in Intra & Inter Culture Dialogue & coevolution.

Traditional agricultural practices, Traditional water-harvesting practices, Traditional Livestock and veterinary Sciences, Traditional Houses & villages, Traditional Forecasting, Traditional Ayurveda & plant based medicine, Traditional writing Technology

Module 2: Ancient Indian Science (Physics, Chemistry, Maths) 6 hours

Physics in India: Vaisheshika darshan, Atomic theory & law of motion, theory of panchamahabhoota, Brihath Shathaka (divisions of the time, unit of distance), bhaskaracharya (theory of gravity, surya siddhanta & siddhanta shiromani), Lilavati (gurutvakashan Shakti).

Chemistry in India: Vatsyayana, Nagarjuna, Khanda, Al-Biruni, Vagbhata – building of the ras-shala (laboratory), working arrangements of ras-shala, material and equipment, Yāsodhara Bhaṭṭa - process of distillation, apparatus, saranasamskarita, saranataila.

Mathematics in India: Baudhayana's Sulbasutras, Aryabhata, Bhaskaracharya-I, Severus Sebokht, Syria, Brahmagupta, Bhaskaracharya-II, Jyeshtadeva

Module 3: Ancient Indian Science (metallurgy, Astronomy, Architecture) 6 hours

Metallurgy in India: Suvarṇa (gold) and its different types, prosperities, Rajata (silver), Tamra (copper), Loha (iron), Vanga (tin), Naga / sisa (lead), Pittala (brass)

Astronomy in India
Vedang Jyotish, aryabhatta siddhanta, Mahabhasakriya, Laghubhaskariya, vatesvarasiddhanta, Sisyadhivrddhida, Grahashay, Goladhyaya, Karabakatuhala (Aryabhata, Varahamihira, Brahmagupta, Vatesvara, Bhaskara, Paramesvara, NilakanthaSomayaji, Jyeshtadeva, SankaraVarman)

Architecture in India:
Nagara (northern style), Vesara (mixed style), and Dravida (southern style), Indian vernacular architecture, Temple style, cave architecture, rock cut architecture, kalinga architecture, chandels architecture, rajput architecture, jain architecture, sikh architecture, Maratha architecture Indo-Islamic architectural, Indo-Saracenic revival architecture, Greco Buddhist style.

Module 4: Ancient Indian Science (Textile, Agriculture, Transport) 6 hours
Textile Technology in India:
Cotton (natural cellulose fiber), silk, wool (natural protein fibers), bast and leaf fibers, mridhuhatudhapitambaram (meaning a practice of fumigating the fabric with incense smoke before use as a part of the finishing process), sthadhautavasanayugma (bleached white–a finishing process); suchasth, sutradharana (needle and thread – tools for stitching); dyeing, washing spinning and weaving technology.

Agriculture in India:
krishisuktas, Krishiparashara, Brihatsamhita, Types of crops, Manures, Types of land- devamatruka, nadimatruka, use of animals in warfare, animal husbandry, Animals for medicines. Ancient transport in India

Module 5: Ancient Indian Science (Ayurveda & Yoga) 6 hours
Ayurveda for Life, Health and Well-being:
Introduction to Ayurveda: understanding Human body and Pancha maha bhuta, the communication between body & mind, health
regimen for wellbeing, introduction to yoga (raja yoga, astang yoga, gyan yoga), understanding of Indian psychological concept, consciousness, tridosha & triguna.

Total : 30 hours

References:

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
2. Kapur K and Singh A.K (Eds) 2005. Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.
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5. R P Kulkarni, Glimpse of Indian Engineering and Technology (Ancient & Medieval period, Munshiram Manoharlal Publishers Pvt. Ltd. 2018
6. AK Pathak, Science and Technology in India, Anshika prakashan pratapgarh, 2016

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8. NVP, Unitthiri, Indian Scientific Traditions (Professor K.N. Neelakantan Elayath)
9. Anonyms, *History of Science in India - Volume-I Part-I (Physics, Mathematics and Statistics)*, The National Academy of Science, India & the Ramkrishna Mission Institute of Culture, 2014
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11. A. Gosh, *History of Science in India (Volume-I Part-II Astronomy)*, The National Academy of Science, India & the Ramkrishna Mission Institute of Culture, 2014
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13. S. Biswal, B. L. Ray, *Vedic Science and Technology*, DK Printworld, 2009
14. A. K. Bag, *History of Technology in Indian* (Set of 3 Volumes), Indian National Science Academy, 1997
15. A. R. Vasudev Murty, *Science and Technology in Ancient India as Reflected in the Mahabharata*, Sanskrit Bharati, 2019

CBCA25MD5	INDIAN TOWN PLANNING AND ARCHITECTURE	L	T	P	C	Ty/Lb/ IE
		2	0	0	2	IE
	Prerequisite: Knowledge of India's social structure and traditional practices.					
	Course Designed by: Faculty of Computer Applications					

IKS-V: Indian Town Planning and Architecture

Course Objectives

- To develop the knowledge and analysis on the understanding of eco-friendly, robust and scientific planning and architecture system of ancient India.
- To understand the importance of functional, aesthetic, psychological, culture and socio religious concept of ancient India architecture.
- To help the learners to trace, identify and develop the approach, process and material used in town and planning, construction and architecture
- To review and analyse the importance and significance of visual and performing arts and design in temples, houses, forts, caves and community places.
- To understand the various eco-friendly technology accepted in ancient civilization

Detailed contents:

Module 1: The Introduction to ancient Architecture 6 hours

Introduction to relationship between Man, Nature, Culture and city forms. Study of determinants (Natural and man-made) influencing location, growth & pattern of human settlements including types of settlements growth (Organic and Planned) and settlement forms.

Architecture as satisfying human needs: functional, aesthetic and psychological outline of components and aspects of architectural form-site, structure, skin, materials, services, use, circulation, expression, character, experience.

Understanding of the causative forces - the cultures, history, socio religious practices and institution, political and economic conditions, issues of land, climate and technology, Historical and Primitive Architecture.

Module 2: Ancient Architecture as Expression of Art & Design 6 hours

Relationship between Art and Design with man, space and environment. Expression in Art and Architecture - concept of space, sense of enclosure- openness, robustness, dynamism, spatial geometry, Eco-friendliness.

Architecture through use of elements of visual arts such as point, line, plane, form, space, colour, texture, light, solids and voids, shadow and shade etc. Understanding of effect of scale, proportions, order, material effects such as textures, patterns, light, sound, temperature etc in architectural spaces.

Allied visual and performing arts and its relationship to build environments using colour theory, symbolism, glass painting, scriptural writing, clay moulding, stone carving.

Important Indian architecture as per elements space & form Form: specific geometry form (sphere, cube, pyramid, cylinder and cone and its sections as well as their derivatives) Space: build form space, open space, Internal and External space, Continuous spaces Centralized, Linear, Radial Clustered, Grid space Different type of Materials used for construction in Ancient Indian architecture.

Clay products: Classification of bricks, Fire Brick, Fly Ash Bricks, Tiles, Terra- cotta, Earthenware, Porcelain, Stoneware. **Stones**: Uses of Stones, Qualities of Good Building Stones, Dressing, Common Building Stones of India. **Glass**: Different Glass forms and their Suitability, **Timber**: Different Forms and their Suitability **Metals**: Ferrous & Nonferrous Metals and Alloys, and, their Suitability, limitations, precautions **Paints and Varnishes**: Different types and their Suitability, limitations, precautions

Module 3: Ancient Architecture Principle & Planning **6 hours**

Design: Principles of designing - Composition of Plan. Inception and development of the early Hindu temple form with reference to Vedic and Buddhist planning principles and design elements; Development of regional styles and manifestations thereof; Evolution of temple complexes and temple towns;

Planning: Residence- site selection, site orientation- aspect, prospect, grouping, circulation, privacy, furniture requirements, services and other factors. Vastu shastra and its importance in building interrelationship with human, nature and cosmos

Town Planning: Town plans of Harappa, Mohenjodaro, Pataliputra, Delhi. Vastu shastra and its application in city layout.

Module 4: Ancient Architecture-I **6 hours**

The settlement planning pattern, elements, associated forms, typical Vedic village, towns (Dandaka, Nandyavartha etc.), typology of Shelters and civic buildings of ancient architecture in reference to following civilization: Indus Valley, Aryan/vedic Civilisation, Buddhist Architecture, Indo Aryan & Dravidian Architecture.

Role of Shilpasasthasras and Arthashasthra in settlement planning.

Important architecture: Great baths, Development of fortification, walled towns, structures developed eg: Stupas, Viharas, Chaityas, Stambhas, Toranas, sacred railing etc.

Study of worshipping places with especial reference to Indo Aryan / Nagara style & Dravidian style (Chola, Chalukya, Pallava, Satavahana, Hoysala, Vijayanagara etc.), design of shikharas & gopuram, rock-cut and structural examples of temples.

Module 5: Ancient Architecture-II **6 hours**

Evolution of Hindu Temples in different period: Gupta, Aihole, Badami, Pattadakkal, Mahalbalipuram, Indo Aryan Style in Orrisa, Khajuraho, Gujarat, Rajasthan. Dravidian Style in Chola, Chalukyan, Pandya, Pallava, Hoysala Style, Revival of Hindu architecture of South India at Vijayanagara and Madurai

Tradition Indian villages & House: Regional house construction, interior & importance e.g. Rajasthani house, bhungas of kutch, nalukettu of kerala, Ikra of assam, manduva logili or illu of Andra Pradesh, wadas of Maharashtra, Mud houses of Madhya Pradesh, kathkuni of himachal Pradesh, khanjaghara of orisa, Taq and dhajji diwari of Kashmir etc.

Scientific achievements though ancient architect: Jantar Mantar, Musical Pillars of Vitthal temple, Sundial of konark temple, construction of eight shiva temple in straight line from Kedarnath to rameshwaram at longitude 79°E 41'54, Veerbhadra temple with 70 hanging pillars, Ellora caves excavating the mountain, Jaipur plan pink city etc.

Total : 30 hours

References:

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
2. Kapur K and Singh A K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.
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4. Dr. V. Ganapati Sthapati, Building Architecture of Sthapatya Veda
5. Binode Behari Dutt, Town planning in ancient India, Life Span Publishers & Distributors
6. NR Dave, A Study of The Hindu Science of Architecture and its Practice with Special Reference to Rajavallabha, Bharti vaidhya Bhavan, 2011
7. M W Meister, South India Lower Dravidadesa - Encyclopaedia of Indian Temple Architecture (Set of 2 Books)- An Old and Rare Books, American Institute of Indian Studies, 1999
8. D N Shukla Civil Architecture in Ancient India (Part-I) Mehar chand lakshmidas publication, 2016.
9. S Maheshwari, R Garg, Ancient Indian Architecture, CBS publisher, 2001
10. B Dagens, Mayamata: An Indian Treatise on Housing Architecture and Iconography (An Updated Edition with revised Glossary), Motilal banrsidas, 2017
11. V K Bansal, Maha Vastu, Om Book Internation 2011
12. SS Das, The Miracles of Vaastu Shastra, pustak mahal, delhi, 2013,
13. Anant Shashikala, The Penguine Guide to Vaastu, the classical Indian science of architecture & design, penguin India, 2000

CBCA25MD6	INDIAN MATHEMATICS AND ASTRONOMY	L	T	P	C	Ty/Lb/ IE
		2	0	0	2	IE
	Prerequisite: Knowledge of India's social structure and traditional practices.					
	Course Designed by: Faculty of Computer Applications					

IKS-VI: Indian Mathematics and Astronomy

Course Objectives

- To provide information about great mathematicians and astronomers who given significant contribution in Indian mathematics and astronomy.
- To help students to trace, identify, practice and develop the significant Indian mathematic and astronomical knowledge.
- To help to understand the astronomic significance with the human holistic development of physical, mental and spiritual wellbeing
- Enumerate the main characteristics of education system in Vedic and post Vedic period to enrich the intellectual imagination and diminish the dogmatic assurance which closes the mind against speculation

Detailed contents:

Module 1: The Introduction to Ancient Mathematics & Astronomy 6 hours

Introduction to Brief introduction of inception of Mathematics & Astronomy from vedic periods. Details of different authors who has given mathematical & astronomical sutra (e.g. arytabhatta, bhaskara, brahmagupta, varamahira, budhyana, yajanvlkya, panini, pingala, bharat muni, sripati, mahaviracharya, madhava, Nilakantha somyaji, jyeshthadeva, bhaskara-II, shridhara)

Periodical enlisting of Mathematical & Astrological achievement in India. Evolution of Indian Numerals (Brahmi (1st century), Gupta (4th century) & Devanagri Script (11th century)

Module 2: Ancient Mathematics –I 6 hours

Veda & Sulvasutras (Pythagoras theorem, Square root & Squaring Circle) (baudhayana sulbhasutra, apastamba sulbhasutra, katyayana sulbhasutra, manava sulbhasutra, maitrayana sulbhasutra, varaha sulbhasutra, vadhula sulbhasutra, Pingala's chandrasutras, sunya, yaat-tavat, Aryabhatta (Aryabhatiya, Asanna, ardha-jya, kuttaka), bhaskara (trigonometory, shridhara, mahavira), Bhaskara Acharya (Sidantashiromani), Varamahira panchasiddhantika.

Module 3: Ancient Mathematics –II 6 hours

Brahmamgupta (vargaprakrati, bhramasphuta siddhanta, bhavana), ayatavrtta, ganitasarasamgraha, lilavathi, ganesadaivajna, randavantika, suryasiddhanta, grahalaghava, sadratnamala, mandavrtta, sighrartta, Bijaganita, Bakshali manuscript

Golavada, Madhyamanayanaprakara, Mahajyayanaprakara (Method of Computing Great Sines), Lagnaprakarana, Venvaroha, Sphutacandrapti, Aganita-grahacara, Chandravakyani (Table of Moon-mnemonics)

Module 4: Ancient Astronomy –I **6 hours**

Parahita system of astronomy and drk system of astronomy, Manda samskara, sighra samskara.

Vedanga Jyotisha (astronomical calculations, calendrical studies, and establishes rules for empirical observation), Aryabhatiya (earth rotation, shining of moon), Brahmasphutasiddhanta (motion of planets), varahmihira (pancasiddhantika), Mahabhaskariya, lahubhaskariya & arybhatiya bhashya (Planetary longitudes, heliacal rising and setting of the planets, conjunctions among the planets and stars, solar and lunar eclipses, and the phases of the moon), Sisyadhiveddhida (grahadhyaya, goladhyaya), siddantasiromani, karanakutuhala (planetary positions, conjunctions, eclipses, cosmography), siddantasekhara, yantra-kirnavali, Sphutanirnaya, Uparagakriyakrama.

Module 5: Ancient Astronomy –II **6 hours**

Positional astronomy (sun, planets, moon, coordinate systems, precision of the equinox and its effects, eclipses, comets and meteors), Mahayuga & Kalpa system Yuga system, ayanas, months, tithis and seasons, time units, sun and moon's motion, planet position, ayanachalana, zero-precision year, katapayadi system, Indian nakshatra system, astronomy

Instruments for naked eye astronomy (vedic observatories), The principal and application of Samrat Yantra, Jai Prakash Yantra, Disha Yantra, Rama Yantra, Chakra Yantra, Rashiwalya Yantra, Dingash Yantra, Utaansh Yantra

Total : 30 hours

Reference:

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
2. R P Kulkarni, Glimpses of Indian Engineering and Technology (Ancient & Medieval period, Munishiram Manoharlal Publishers Pvt. Ltd. 2018
3. AK Pathak, Science and Technology in India, Anshika prakashan pratapgarh, 2016
4. NVP, Unithiri, Indian Scientific Traditions (Professor K.N. Neelakantan Elayath Felicitation Volume), publication division univeristy of Calicut, 2006
5. Dharmpal, Indian science and technology in the eighteen century, rashtrottahana sahitya, 1983
6. S Biswal, B L ray, vedic Science and technology, DK Print world, 2009
7. A Kolachana, Studies in Indian Mathematics and Astronomy, Hindustan Book agency

8. S B Rao, Indian Mathematics and Astronomy: Some Landmarks (Revised Third Edition), Bhartiya Vidhya Bhavan, 2012,
9. GG Josheph, Indian Mathematics: Engaging with the World from Ancient to Modern Times, speaking Tiger, 2016
10. BS Yadav, Ancient Indian Leaps into Mathematics, brikausher publication, 2010
11. DP Chatopadhya, Ravinder kumar, Mathematics, Astronomy, and Biology in Indian Tradition: Some Conceptual Preliminaries (Phispc Monograph Series on History of Philosophy, Science and Culture in India, No 3), Munshiram manohalal publication, 1995
12. BV subbarayappa, The Tradition of Astronomy in India: History of Science, Philosophy and Culture in Indian Civilization Vol. IV, Part 4: Jyothisastra (History of Science, Philosophy & Culture in Indian Civilization), centre for studies in civilization, 2008
13. GE Clark, The Aryabhatiya of Aryabhata: An Ancient Indian Work on Mathematics and Astronomy, Kesinger publicaition, 2010
14. Anonyms, Hindu Astronomy: Anuradha, Bharani, Hindu Chronology, Hindu Calendar, Indian Astronomy, Kerala School of Astronomy and Mathematics, Jyoti, Book LLC, 2011
15. KV Sharma. Ganita yuktibhasa (Analytical Exposition of the Rationales of Indian Mathematics and Astronomy, Kindle, 2021
16. R Mercier, Studies on the Transmission of Medieval Mathematical Astronomy (Variorum Collected Studies), routledge publication, 2004

CBCA25MD7	INDIAN AESTHETICS (INCLUDING MUSIC AND MUSIC INSTRUMENTS)	L	T	P	C	Ty/Lb/ IE
		2	0	0	2	IE
	Prerequisite: Knowledge of India's social structure and traditional practices.					
	Course Designed by: Faculty of Computer Applications					

IKS-VII: Indian Aesthetics (including Music and Music Instruments)

Course Objectives

- To provide information about the foundations of Indian aesthetics as integral part of Indian culture
- To help to understand the importance of Indian aesthetics in individual realization of the truth arises by realizing the harmony within.
- To help learner to trace, identify and develop the Indian aesthetics to correlate human creative practices
- To build the learners a deep rooted pride in Indian aesthetic knowledge, committed to universal human right, well-being and sustainable development.

Detailed contents:

Module 1: The Introduction to Indian Aesthetics 6 hours

The nature of aesthetics, principle, its relation to philosophy and literature:

Indian traditions. Sadanga its origin and Applications of Six limbs in Indian Aesthetics Introduction to Alamkara, Rasa, Dhvani, Vakrokti, Auchitya

Module 2: Ancient Music and Music Instruments-I 6 hours

Rasa Siddhanta, the concept of Rasa, constituent of rasa (Bhav, abhinay, Sthayibhava, Vibhava, Vyabhicharibhava), number of rasa, Rasasvadana Bharata's Natya Shastra and its Critics, Abhinavagupta's Rasa Siddhanta., Kavyaprayojana, Sadhāranikarana, Sahrdaya, Rasavighna.

DhvaniSiddhanta, the Concept of Dhvani, Sphota, Pratibha, classification of Dhvani (Laukika Vyangya, Alaukika Vyangya, Avivaksita Vacya, Vivaksitanyapara Vacya) Anandavardana's Dhanyaloka, with reference to Abhidha, lakshana, Vyanjana and Tatpary, extension of dhvani siddhanta to music, dance and drama.

Alamkara Siddhanta, proponent, classification of alamkara, sabdalamkara (Anuprāsa, Yamaka, Slesha, Dhvanyātmakatā), Arthālamkāra (Upamā, Drstanta, Virodha)

Module 3: Ancient Music and Music Instruments-II **6 hours**

VakroktiSiddhanta, Kuntaka's Vakroktijivita, Classification of Vakrokti (Varna- vinyasa vakrata (Phonetic Obliquity), Pada-purvardha vakrata (Lexical Obliquity) & Pada-parardha vakrata (Grammatical Obliquity), Vakya-vakrata (Sentential obliquity), Prakarana-vakrata (Episodic obliquity), Prabandha-vakrata (Compositional obliquity)) Different Classes of Musical Instrument as per Natyashastra of Bharat, Gana Vadya, Avanaddha Vadya, sushira vadya, tata/tantu vadya. Brief introduction to following indian instruments Veena, Ghatam, Gootuvadhyam, Flute, Thavil, Nadaswaram, Mridangam, Plain- drum, Harmonium, Sitar, Sarod, Shehnai, Tabla, Maddalam, violin, morsing, Tambura.

Module 4: Ancient Dance & Drama **6 hours**

Natyaveda: inception from Veda (pathya words(rigveda), abhinaya gestures (Yajureda), geet music (samaveda), rasa emotions (atharvaveda), Natya Shastra, Nata-nritya, geet- nritya, roop-nritya, bhav-nritya

Indian traditional and fork dances (bharatnatyam, kuchipudi, kathakali, yakshagan, Bhangra, Bihu, Ghumura Dance, Sambalpuri, Chhau and Garba

Module 5: Ancient Art **6 hours**

Architecture, sculptures & popular art forms of Pallava& Cholas period, Chalukya & Rastrakuta period, Chandela/Hosalya period, Rajput period. Rock cut architecture, cave architecture, stupa, temples, sculpture Hindu Shilpa texts as per Vishnudharmotara-puran, Samaranana, Sutracharana, Sukranitisara, Silparatham.

Total : 30 hours

Reference:

1. Histroy of Indian Music by Swami Prajananda, Ram Krishna vedanta math, Kolkata
2. Prof. P. Sambomoorthy: A History of Indian Music, published by the Indian Music Publishing House, Madras-1.
3. Hutugur Krishnacharya (Hubli: Introduction to the Study, of Bharatiya Sangita- sastra, pts. I & II in the Journal of the Music Academy, Madras, vol. 1, January, 1930.
4. Dr. Saratchandra Shridhar Paranjr, Bharatiya Sangit-ki Rupa-Rekha (Hindi) upto the Gupta period, published in the Nada-Rwpa, second issue, College of Music and Fine Arts, Banaras Hindu University, 1963
5. Prof. G. S. Ghurye: Bharata-Natya and its Costume, published by the Popular Book Depot, Bombay.
6. Swami Prajnanananda: Historical Development of Indian Music, published by Firma K. L. Mukhopadhyay, Calcutta, 1960.

7. Swami Prajnanananda :(Bharatiya Sangiter Ltihasaf vols. I & II (Sangita Samskriti] from the primitive period to the 7th century A.D.) In Bengali (published by the Ramakrishna Vedanta Math, Calcutta), Second Edition.
8. Swami Prajnanananda: Raga O Rupa, vols. I & II (in Bengali) published by the Ramakrishna Vedanta Math, Calcutta.
9. Dr. R. C. Majumdar, H. C. Raychaudhuri and Kalikinkar Datta: An Advanced History of India (Second Edition) published by Macmillan & Co., Limited, London, 1953.
10. Shri K. A. Nilakanta Sastri: A History of South India (Second Edition) published by Oxford University Press, 1958.
11. Kak, S. (2002). Early Indian Music. In: Buenconsejo, J. (Ed., 2003). A search in asia for a new theory of music. P. 59-76. Quezon City: UP Center for Ethnomusicology, University of the Philippines.
12. Lalita Ramkrishna, Ancient Indian Classical Music, shubhi publications
13. E Rosenthal, The Story of Indian Music and Its Instruments: A Study of the Present and a Record of the Past, piligrims publication, 2007.
14. Swami Parmananda, A History of Indian Music - Volume One: Ancient Period, shri ram Krishna math, 1963
15. E Celementa Introduction to the Study of Indian Music; An Attempt to Reconcile Modern Hindustani Music with Ancient Musical Theory and to Propound an Accurate and ... of the Subject of Indian Musical Intonation, Franklin Classical trade press, 2018
16. SC Benerjee Fundamentals of Ancient Indian Music and Dance, Asian Book Corporation, 1976
17. Samita Redday, Ancient Indian Music, cyber Tech Publications, 2018.

CBCA25MD8	INDIAN HEALTH, WELLNESS AND PSYCHOLOGY (INCLUDING AYURVED)	L	T	P	C	Ty/Lb/ IE
		2	0	0	2	IE
	Prerequisite: Knowledge of India's social structure and traditional practices.					
	Course Designed by: Faculty of Computer Applications					

IKS-VIII: Indian Health, Wellness and Psychology (including Ayurved)

Course Objectives

- Understanding the fundamental principles of Indian health systems such as Ayurveda and yoga which are useful in maintaining the health of a healthy person
- Practical implementation of health principles to correct the intake of our food, air, water and sunlight to achieve perfect health.
- Understanding traditional way of cleansing the body regularly, strengthening body with Yogic exercises, maintaining the internal balance to prevent diseases.
- Understanding our unique Mind Body Constitution and choosing the right lifestyle suitable to maintain the internal balance.
- Understanding the influence of external environment on internal health and ways to synchronise our body and mind with nature to ensure smooth functioning of all organ systems of our body.
- Understanding mind and its dynamics through knowledge of Ayurveda and Yoga and using the knowledge to maintain harmony between body and mind to achieve perfect mental health.

Detailed contents:

Module 1: Understanding human body **6 hours**

Introduction to Ayurveda, the Knowledge of Life, Health and treatment aspects in Ayurveda, Influence of Pancha maha bhuta on Internal environment of Human being, Understanding composition of Human body through the concept of Dosha Dhatu Mala, Understanding Prakruthi, the Mind – Body Constitution.

Module 2: Understanding the communication between body & Mind **6 hours**

Establishing communication between body and mind by understanding the language of body. Understanding the concept of Agni, Koshta, Sara and Ojas and their relevance in enhancing our immunity to protect from various infections. Looking at the world through the lenses of Dravya, Guna and Karma Applying the principle of Samanya and Visesha in every aspect of life to achieve perfect health.

Module 3: Introduction to Health Regimen **6 hours**

Understanding Swastha vritta, the healthy regimen to maintain state of wellbeing Dinacharya, the Daily regimen including Daily detoxification, exercise, Intake of Food, Water, Air and Sunlight, work and ergonomics, Rest and sleep hygiene. Ritu charya, the seasonal regimen, Sadvritta and the concept of social wellbeing, understanding trividha upastambhas, three pillars to health, Concept of Shadrasa in choosing appropriate nourishment to the body and mind.

Module 4: Introduction to Yoga **6 hours**

Definition, Meaning and objectives of Yoga, Relevance of yoga in modern age. Brief Introduction of Hatha yoga, Raja yoga, Karma yoga, Gyana Yoga, Bhakti yoga Understanding eight steps of Ashtanga yoga, Understanding Shatkriyas, the six cleansing procedures of Yoga

Module 5: Introduction to Indian Psychology **6 hours**

Concept of Manas in Ayurveda and understanding Mind Body harmony, Triguna based Psychology in Ayurveda and Yoga, Influence of Tri dosha on Mind, Mind body intellect and consciousness complex, Understanding Consciousness and solution to issues within Human Mind.

Total : 30 hours

Reference:

1. The Charaka Samhita
2. The Susruta Samhita
3. Teh Ashtanga Hridaya
4. Dr Deepak Chopra, Perfect Health--Revised and Updated: The Complete Mind Body Guide, Harmony publication, 2001
5. Vasant lad, Ayurveda, the Science of Self-healing: A Practical Guide: Science of Self- healing, lotus press, 1984
6. The Hatha yoga pradipika
7. The Patanjali yoga sutras
8. The Gheranda samhita
9. BKS Iyengar, Light on Yoga: The Classic Guide to Yoga by the World's Foremost Authority, thronson publication, 2006
10. Swamy Satyananda Saraswati, Asana, Pranayama, Mudra and Bandha, Bihar School of Yoga, 2002

APPENDIX III

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25A02	TAMIL I	L	T	P	C	Ty/Lb/ IE
		1	1	0	0	IE
	Prerequisite: +2 Tamil					
	Course Designed by: Faculty of Computer Applications					

CBCA25A02 **TAMIL I**

அலகு – 1 **6 மணிநேரம்**

அ) மரபுக்கவிதை

1.செந்தமிழ்நாடு - மகாகவிபாரதியார்

2.தமிழின்இனிமை, இன்பத்தமிழ், எங்கள்தமிழ், சங்கநாதம் -பாரதிதாசன்

3.தமிழ்வளர்க்கசபதம் - நாமக்கல்கவிஞர்வெ.இராமலிங்கம்பிள்ளை

4. கோயில்வழிபாடு, வாழ்க்கைத்தத்துவங்கள் - கவிமணிதேசிகவிநாயகம்பிள்ளை

ஆ) புதுக்கவிதை

1. பாட்டாளிகளின்குரல் - பட்டுக்கோட்டைகலியாணசுந்தரம்

2.மகாத்மாகாந்தியடிகள் - கவிஞர்வாலி

3.காகிதப்பூக்கள் - நா.காமராசு

4.வள்ளுவர்வழங்கும்விடுதலை - ஈரோடுதமிழன்பன்

அலகு – 2 **6 மணிநேரம்**

நாட்டுப்புறஇலக்கியம்

1. பொதுஅறிமுகம்
2. 2. நாட்டுப்புறஇலக்கியவகைகள்

அலகு – 3 **6 மணிநேரம்அ)**

சிறுகதைகள்

1. தேங்காய்த்துண்டுகள் (மு.வரதராசனார்)
2. அறம்(மாலன்)

ஆ) உரைநடை

1. மு.வ.என்னும்மந்திரம் (இரா.மோகன்)
2. தமிழிசைஇயக்கம் (க.வெள்ளைவாரணனார்)

அலகு – 4 **6 மணிநேரம்**

புதுக்கவிதை - தோற்றமும்வளர்ச்சியும்

அலகு – 5 **6 மணிநேரம்**

அ) இலக்கணம்

1. வழக்கு
2. தொகாநிலைத்தொடர்

ஆ)மொழிப்பயிற்சி

1. தன்வினை –பிறவினை
2. ஒருமைபன்மைமயக்கம் **Total: 30 Hours**

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25A10	TAMIL – II	L	T	P	C	Ty/Lb/ IE
		1	1	0	0	IE
	Prerequisite: +2 Tamil					
	Course Designed by: Faculty of Computer Applications					

அலகு - 1 **6 மணிநேரம்**

அ) மரபுக்கவிதை

1.கும்மிப்பாடல் - சுத்தானந்தபாரதியார்

2. தமிழ்த்தாய்வாழ்த்து - மனோன்மணியம்பெ.சுந்தரம்பிள்ளை

3.விடுதலைவிளைத்தஉரிமை - கவியரசர்கண்ணதாசன்

ஆ) புதுக்கவிதை

1. உலகம் - வைரமுத்து

2. இன்னமுதமாமழை - பேரா. முனைவர்பொற்கோ

3.தமிழ்ப்பற்று – மீரா

அலகு - 2 **6 மணிநேரம்**

நாட்டுப்புறஇலக்கியம்

நாட்டுப்புறக்கலைகள்

அலகு - 3 **6 மணிநேரம்**

அ) சிறுகதைகள்

1. நாற்காலியும்நான்குதலைமுறைகளும் (திலகவதி)

2.அன்னையும்பிதாவும் (இராஜாஜி)

3. விடியுமா? (கு.ப.ராஜகோபாலன்)

ஆ) உரைநடை

மதுரைமாநகரம் (ரா.பி.சேதுப்பிள்ளை)

அலகு - 4 **6 மணிநேரம்**

1.உரைநடை - தோற்றமும்வளர்ச்சியும்

2.சிறுகதை - தோற்றமும்வளர்ச்சியும்

அலகு - 5 **6 மணிநேரம்**

அ) இலக்கணம்

1. பிறமொழிச்சொற்களைநீக்குதல்

2.விண்ணப்பம்எழுதுதல்

Total: 30 Hours

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25A03	**HINDI - I**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		1	**1**	**0**	**0**	**IE**
	Prerequisite: Knowledge of Language					
	Course Designed by: Faculty of Computer Applications					

UNIT - I **Hindi ka parichay I**

1.Swar (Vowels)

2 Vyanjan (Consonants)

3. Writing practice

UNIT - II **Hindi ka parichay II**

1. Vyanjan with matras

2. Writing practice

UNIT-III **Shabadavali Nirman I**

1. Days of the week, Months
2. Numbers (1 – 50)
3. Animals & Fruits, Writing practice

UNIT-IV **Shabadavali Nirman II**

1. Colors
2. Body Parts
3. Family members, Writing practice

UNIT-V **Shabadavali Nirman III**

1. Two and three letter formation of words
2. Identify the picture with words

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25A11	**Subject Name: HINDI - II**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		1	**1**	**0**	**0**	**IE**
	Prerequisite: Knowledge of Hindi					
	Course Designed by: Faculty of Computer Applications					

UNIT – I **Buniyadi vyakaran I (Basic Grammnar)**

1 Noun

2. Gender

UNIT – II **Buniyadi vyakaran II(Basic Grammar)**

1.Pronouns(I,you, he she etc.)

2.Verbs (Common verbs usage)

UNIT-III **Simple sentence formation**

1. Simple sentence structure(sub +verb+ object)
2. Tense(Present, past, future) basic

UNIT-IV **Speaking and Listening**

1. Introduction, asking for directions, etc.
2. Description of self, family and daily routine

UNIT-V **Daily usage words and sentences**

1. Everyday Dialogues
2. Sentence correction and rearrangement

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25A04	**SANSKRIT- I**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		1	**0**	**0**	**0**	**TY**
	Prerequisite: Nil					
	Course Designed by: Faculty of Computer Applications					

Syllabus

UNIT I : 6 hours

1. Alphabets in Sanskrit
2. Swar(Vowels)
3. Vyanjan (Consonants) & Matras.

UNIT II : 6 hours

1. Noun and Pronoun.
2. Gender (Masculine, feminine and Neuter)

UNIT III : 6 hours

1. Singular,Dual&Plural
2. Introduction of roots

UNIT IV:. 6 hours

1. Numbers 1 to 25
2. Days of the week and name of the months

UNIT V: 6 hours

1. Two and three letters words.
2. Day to day words

1. Pravesha,Parichaya,siksha and Covidha book structured by Samskrita Bharati
2. "Abhyaspustakam" - Dr. Vishwas, Samskrita-Bharti Publication, New Delh

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Program Structure for BCA AI & DS (Full Time)

CBCA25A12	**SANSKRIT- II**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		1	**0**	**0**	**0**	**TY**
	Prerequisite: Nil					
	Course Designed by: Faculty of Computer Applications					

Syllabus

Unit	Content	Hours
1	Basic grammar 1. Verb 2.Subjects / objects 3. Sentence making	3
2	1.Tenses(Dhaturoop) Different types of tenses	5
3	1. Simple sentences formation with cases	2
4.	1. Speaking - self introduction, Description of family and daily routine. 2. Technical concepts and communications	3
5	1. Writing small sentences	2

Suggested reading

1. India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd…, New Delhi.
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya SanskritSansthanam, New Delhi Publication

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Program Structure for BCA AI & DS (Full Time)

CBCA25A05	**FRENCH – I**	**L**	**T**	**P**	**C**	**Ty/Lb/IE**
		1	**0**	**0**	**0**	**TY**
	Prerequisite: Nil					
	Course Designed by: Faculty of Computer Applications					

UNIT I 6 hours

Les Salutations, Les Nombres (1-20), Les alphabets, Les Pronoms Sujets, Les Langues, Les Nationalités, Les Verbes : Parler, être, avoir,

UNIT II 6 hours

Les Nombres (21-100), L'heure, Les Pays, Les propositions des pays, Les articles définis, Les articles indéfinis, Les Verbes : s'appeler, Aimer et habiter.

UNIT III 6 hours

Les verbes : Aller, Venir, Les Articles Contractés, La Négation, Les Adjectifs Démonstratifs, Futur Prôche, Model Verbs, Adjectifs Possessifs.

UNIT IV 6 hours

Les articles partitifs, Les Verbes : Faire, Jouer. La Famille, Les Couleurs, Les lieux dans la ville,

UNIT V 6 hours

Les Verbes: Lire, Écrire, Regarder, Voir, Écouter, Entendre

Total periods: 30

TEXT BOOKS:

1. Écho A1, J.Girardet & J.Pecheur, CLE International, 2nd Edition
2. Saison A1, Jean Giraudoux, Goyal publisher, 1st Edition

REFERENCE BOOKS:

1. Alter Ego A1, Veronique M Kizirian & Annie Berthet, Hachette, 1st Edition
2. Cosmopolite A1, Nathalie Hirschsprung & Tony Tricot, Goyal Publisher 1st edition

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CBCA25A13	**FRENCH - II**	**L**	**T**	**P**	**C**	**Ty/Lb/IE**
		1	**0**	**0**	**0**	**TY**
	Prerequisite: Nil					
	Course Designed by: Faculty of Computer Applications					

UNIT - I 6 hours

FuturProche, PronomsToniques, Les Verbes : Devoir, Pouvoir, Vouloir, Savoir. Le Vocabulaire : Les Loisirs (Sports, Spectacles et Activités)

UNIT - II 6 hours

Passé Composé, Le voix Active et Passive, Comparaison, AdjectifsPossessifs.

UNIT - III 6 hours

Les Articles Partitifs, Emploi des Articles, Le Vocabulaire : Les Voyages, Les Transports, La nourriture, La Forme possessive : <<à + pronom>>

UNIT - IV 6 hours

Le ConjugaisonPronominale, L'Impératifs, L'expression de la quantité, Les activitésquotidiennes, Les achats, L'argent

UNIT - V 6 hours

Prépositions et adverbes des lieux, L'Imparfait, Les moments de la vie, La famille, Emploi du passé composé et de l'imparfait, L'enchainement des idées (alors, donc, mais)

Total periods: 30

TEXT BOOKS:

1.Écho A1, J.Girardet&J.Pecheur, CLE International, 2nd Edition
2.Saison A1, Jean Giraudoux, Goyal publisher, 1st Edition

REFERENCE BOOKS:

1. Alter Ego A1, Veronique M Kizirian& Annie Berthet, Hachette, 1st Edition
2. Cosmopolite A1, Nathalie Hirschsprung& Tony Tricot, Goyal Publisher 1st editionCosmopolite A1

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BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25A06	**Subject Name: GERMAN - I**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		1	**0**	**0**	**0**	**TY**
	Prerequisite: Nil					
	Course Designed by: Faculty of Computer Applications					

UNIT - I 6 hours

Das Alphabet, Die Zahlen von ein -hundert, Begrüßung,Verabschiedung ,Sich Vortstellen , W – Fragen. Grammatik :- W- Frage, Aussagasatz, Verban und Personnelpronomen

UNIT - II 6 hours

Genders in Deutsch,,Die Personelpronomen, Definite /Indefinite / Negative Articles, Jemanden kennenlernen,Landkarte. Grammatik – bestimmter Artikel : der,die , das , Nomen: Singular und Plural, aussagesatz, negationartikel

UNIT - III 6 hours

Possessivpronomen,Verbkonjugation, Ja/Nein Fragen, Satzstruktur Grammatik : Regelmäßige, Unregelmäßige, hilfsverben- Sein/haben, Unbestimmer Artikel

UNIT - IV 6 hours

Wie spät ist es, Tageszeiten, Die, Wochentage, Die Monate, das Wetter, Die Himmelsrichtungen,Die familie,Klassenzimmer – Substantive , Countries and Languages,Negation , Like /Dislike. Grammatik: Akkusative, Verbenmit accusative, wörterorden und lernen, artikelimdativ, Präpositionmit +Dativ

UNIT - V 6 hours

Nominativ,Dativ, Accusative, Einkaufen, Im Flugzueg, Im kaufhaus, Jobsuche. Grammatik : Personalpronomen im Akkusativ mich, dich, modelverban müssen,können,wollen

Total periods: 30

TEXT BOOKS &REFERENCE BOOKS:

1. Shritte International, Daniela Niebisch, Fraz Sppeeht, Angela Pude
2. Netzwerk A1, Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber

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Program Structure for BCA AI & DS (Full Time)

CBCA25A14	**Subject Name: GERMAN - II**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		1	**0**	**0**	**0**	**TY**
	Prerequisite: Nil					
	Course Designed by: Faculty of Computer Applications					

UNIT - I

Deutschprachige Länder, Adresse, Meine Familie, Labensmittel einkaufen, Meine Wohnung, Das Zimmer ist nicht groß, Zahlen von hunder zu eine million.

UNIT - II

Die Pronomen und Verben, Verben Stamm endung mit "s", "ss", "ß", "x" or "z" , Genders und Artikel, Mein Tag, Tageszeiten, Montag bis Freitag. Geschlecht der Substantive, Wohenende , Freizeit und Hobbys, wetter – Grammatik : Akkusativ : bestimmter Artikel, Akkusativ: unbestimmter Artikel

UNIT - III

Kinder und Schule, Akkusativ unbestimmter Artikel, Tagesablauf, Stress im Büro, Am Computer, Termine vereinbaren, Die Jahreszeiten und das Wetter , Tagesablauf, Stress im Büro, Am Computer

UNIT - IV

Verben Grundlagen der Zeitform , Die Gruppe der Substantive , Die Verneinung , Hauptsätze und Nebensätze . Verben mit Dativ und Akkusativ; Konjunktiv II ; Substantive als Indikatoren der Zeit, Kasus

UNIT - V

Grammatik : Präpositionen der Zeit, Satzverknüpfungen: Konjunktionen, Die Gruppe der Substantive, Indikatoren für den Raum, AdjektiveVisuelle Klasse für das Hören

Total periods: 30

TEXT BOOKS &REFERENCE BOOKS:

1. Shritte International, Daniela Niebisch, FrazSppeeht, Angela Pude
2. Netzwerk A1, Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber

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BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25A07	**Subject Name: JAPANESE – I**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		1	**0**	**0**	**0**	**TY**
	Prerequisite: Nil					
	Course Designed by: Faculty of Computer Applications					

UNIT - I 6 hours

Introduction, Roumaji, Hiragana, Self Introduction, Family relations,Numbers(1-100)

UNIT - II 6 hours

Numbers(101-1000), Numbers(1001-10,000),Katakana,Body parts, and Pronouns

UNIT - III 6 hours

Introduction to particles(wa,mo,ka,desu,ni,ga,de), Imasu, Arimasu,Couters

UNIT - IV 6 hours

Adjective i-ending, and Na Ending

UNIT - V 6 hours

Verbs (24 forms)

Total periods: 30

TEXT BOOKS:

1. Genki, Eri Bnno, Yoka Ikeda, Yutaka Ohno, Chikkao Shinogawa, Kyoko Tokoshiki, The Japanese Publishing Company

REFERENCE BOOKS:

1. Minna No Nihongo, 3A Corporation, Goyal Publication

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25A15	**Subject Name: JAPANESE – II**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		1	**0**	**0**	**0**	**TY**
	Prerequisite: Nil					
	Course Designed by: Faculty of Computer Applications					

UNIT - I 6 hours

Grammerpaterns Te form, Te moiidesu, Te ha ikemasen, te kara,mashouka.

UNIT - II 6 hours

Te imasu, Continuoustense, te kudasai

UNIT - III 6 hours

Te iku, Counting people

UNIT - IV 6 hours

Informal speech (dictionaryform)Using the particle « ga » Verbsformslike and dislike, negativeform te kudasai

UNIT - V 6 hours

Pasttense, - karaform(because), qualifying nouns with verbs and adjectives.

Total hours: 30

TEXT BOOKS:

1. Genki, EriBnno, Yoka Ikeda, Yutaka Ohno, ChikkaoShinogawa, Kyoko Tokoshiki, The Japanese Publishing Company

REFERENCE BOOKS:

2. Minna No Nihongo, 3A Corporation, Goyal Publication

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BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25A08	**Subject Name: SPANISH - I**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		1	**0**	**0**	**0**	**TY**
	Prerequisite: Nil					
	Course Designed by: Faculty of Computer Applications					

UNIT - I 6 hours

Los Saludos y Despedidas, Los Alfabetos, Los Numeros (1-20), Sonidos y Letras: H, C/Qa, G/J, B/V, C/Z, R, R/rr, Ch, G/Gu, Ll, N, Aficiones.

UNIT - II 6 hours

Los Numeros(21-100), PronombresPersonales: Yo, Tu, El, Eyya, Nosotros, Vosotros, Ustedes, Usted. Ser verbos: Soy, Eres, Es, Somos, Sois, Son. Nacionalidad, Profesiones.

UNIT - III 6 hours

Singular y Plural,Conversion de Singular a Plural. Masculinoy Feminino, conversion de masculino afeminino. Tener verbos: Tengo, Tienes, Tiene, Tenemos, Teneis, Tienen. Llevarverbos.

UNIT - IV 6 hours

Vocabulario de Colores, Casa, Bebidas, Ciudad, Clima, Colegio, Comida, Medios, Saludos, Verduras. Articulesdefinidos, Articulesindefinidos.

UNIT - V 6 hours

Estar verbos: Estoy, Estas, Esta, Estamos, Estais, Estan. Reflexive verbos: Me, Te, Se, Nos, Os, Se. Cuantificadores, Preguntar y Responder.

Total periods: 30

TEXT BOOK:

1. Aula internacional 1, Jaime corpas & Eva Garcia, diffusion, Nueva edicion

REFERENCE BOOK:

1. Grammatica de uso A1-B2, Luis Aragones, Ramon Palencia, smeLe, Nueva edicion

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BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25A16	**Subject Name: SPANISH - II**	**L**	**T**	**P**	**C**	**Ty/Lb/ IE**
		1	**0**	**0**	**0**	**TY**
	Prerequisite: Nil					
	Course Designed by: Faculty of Computer Applications					

UNIT – I 6 hours

El Abecedario – a saludar y a despedidas – Las nacionalidades – las profesiones y sobre las palabras - LosNumeros(1- 100) – La presentacion – hablar – dias de la semana y meses.

UNIT – II 6 hours

SobretemporadasenEspanolyotrapaises – pronombrepersonales – articulesdefinidos, indefinidos y sus usos – verbosregulares – Hablar,comer, vivir con oraciones de ejemplo – conversion de singular a plural- Identificando masculine o femenino.

UNIT – III 6 hours

Verbos irregulars mas frequentes – Ser, Estar, Ir, Tener, Decir, Poder, Querer,Pedir, Conocer con oraciones de ejemplo – Los Numerous 1000 y vocabulario – Numeros – Telefonicos – direcciones cardinals y medios de transporte – preguntarpordirecciones y describer un camino.

UNIT – IV 6 hours

El VocabulariodeAnimales – Avion – Cuerpo – Familia – Deporte – Geografia – Aficiones – Colores, Casa – Bebidas – Ciudad – Clima – Colegio –Ropa -– Saludos – Tiempo – Transporte.

UNIT – V 6 hours

A hablar de Clima – Explicar: Un/Una/Unas/Unos y oraciones – Explicar: Mucho/Muha/Muchos/Muchasy oraciones – preguntas: Que/Cual/Cuales/Cuantos/Cuantas/Donde- Escuchar y escribir

Total periods: 30

TEXT BOOK:

1. Aulainternacional 1, Jaime corpas& Eva Garcia, diffusion, Nueva edicion

REFERENCE BOOK:

1. Grammatica de uso A1-B2, Luis Aragones, Ramon Palencia, smeLe, Nueva edicion

APPENDIX IV

FACULTY OF COMPUTER APPLICATIONS

BCA- General Full Time Program - Curriculum & Syllabus

Program Structure for BCA AI & DS (Full Time)

CBCA25VAX	YOGA/SPORTS MANAGEMENT/NCC/NSS/DISASTER MANAGEMENT	L	T	P	C	TY/Lb/IE
		0	0	4	2	IE
	Prerequisite – +2					
	Course Designed by – Faculty of Management Studies					

OBJECTIVES

i. Understand yoga's significance and its practical applications for holistic well-being.
ii. Explore subtle energy systems and their role in enhancing health through yogic practices.
iii. Examine various paths of yoga to foster self-realization and spiritual growth.
iv. Master the Eight Limbs of Yoga for physical, mental, and spiritual harmony.
v. Apply yogic principles to manage psycho-somatic ailments and promote resilience

COURSE OUTCOMES (COs)

CO1	Understanding the principles and benefits of yoga
CO2	Enhancing behavior through yogic practice
CO3	Knowing the yoga and applying as a tool for stress reduction
CO4	Understanding the link between yoga and Indian Philosophy
CO5	Extrapolate the role of yoga in health care

Mapping of Course Outcomes with Program outcomes (POs)

(1/2/3 indicates strength of correlation) 3-HIGH, 2-Medium, 1-Low

1	COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO 3	PSO4
2	**CO1**	2	3					2	1	1	3			
	CO2	2	3				2	3		1	3	3		
	CO3	2	3				3	3		1	3	3		
	CO4	2	2				2	2		1	3			
	CO5	2	2				3	2		1	3	3		

3	Category	CC	AEC	MDE	VAC	SEC	DSE	OE
					✓			
4	Approval				Meeting of Academic Council			

Note: All the theoretical contents shall be delivered through the practical workshop mode only. No class room teaching is encouraged in this course.

CBCA25VA3	YOGA	L	T	P	C	TY/Lb/IE
		0	0	4	2	IE

Yoga course is designed to provide students with a comprehensive understanding of physical fitness,wellness,and nutrition.This course explores the meaning and importance of yoga in the modern era, the role of sports in maintaining physical fitness, and the various components of physical wellness. Students will also learn about the significance of nutrition and weight management, equipping them with the knowledge to promote a healthy and balanced lifestyle. Through this course, students will gain insights into the holistic approach to health and well- being.

Unit-I 6 Hours

- Yoga: Meaning and definition
- Importance of yoga in 21st century
- Introduction to Yogic Anatomy and Physiology
- Yoga & sports, Yoga for healthy lifestyle
- Types of Yoga: - Hatha yaga, laya yoga, mantra yoga,
- bhakti yoga, karma yoga, jnana yoga, raj yoga
- Study of Chakras, Koshas, Pranas, Nadis, Gunas, Vayus and its application in Yogic practices.
- Ashtang Yoga: - Yama, niyama, asana, pranayama, Pratyahar, dharna, dhyan, Samadhi : Benefits, Utilities & their psychological impact on body and mind. According to yoga concept of normality in modern psychology, concept of personality & its development, yogic management of psycho-somatic ailments: frustration, anxiety, depression

Unit- 2 **6 Hours**

- Sports for Physical Fitness: Meaning and definition
- Physical Activity – Concept, Benefits of Participation in Physical Activities
- Components and Significance of Physical Fitness -Health, Skill and Cosmetic Fitness

- Types of Physical Activities – Walking, Jogging, Running, Calisthenics, Rope Skipping, Cycling, Swimming, Circuit Training, Weight training, Adventure Sports
- Principles of Physical Fitness, Warming Up, Conditioning, Cooling Down, Methods to Develop and Measure Health and Skill related components of Physical Fitness
- Measurement of Health Related Physical Fitness (HRPF)

Unit -3 6 Hours

- Physical Wellness: Concept, Components
- Types of wellness: psychological, social, emotional, and spiritual.
- Significance with reference to Positive Lifestyle 2.2
- Concepts of Quality of Life and Body Image
- Factors affecting Wellness
- Wellness Programmes

Unit-4: Nutrition **6 Hours**

- Concept of Nutrients, Nutrition, Balanced Diet, Dietary Aids and Gimmicks
- Energy and Activity- Calorie Intake, Energy Balance Equation

Unit-5: Weight Management Obesity **6 Hours**

- Concept, Causes, Obesity Related Health Problems
- Weight Management through Behavioural Modifications

TOTAL: 30 Hours

Text Books / References (Latest Edition):

1. Anand O P. Yog Dawra Kaya Kalp. Sewasth Sahitya Perkashan. Kanpur.
2. Brown, J.E. Nutrition Now Thomson-Wadsworth.
3. Kamlesh, M. L. & Singh, M. K., Physical Education (Naveen Publications).
4. Kansal, D.K. Text book of Applied Measurement, Evaluation & Sports Selection. Sports & Spiritual Science Publications, New Delhi.

CBCA25VA4	SPORTS MANAGEMENT	L	T	P	C	TY/Lb/IE
		0	0	4	2	IE

Sports Management course is designed to provide undergraduate students with a broad, foundational understanding of the dynamic field of sports management. This course will familiarize students with the fundamental principles and concepts of sports management, including its scope, organizational structure, and ethical considerations. Students will gain insights into the roles of marketing and sponsorship in the sports industry, as well as develop proficiency in financial management techniques specific to sports organizations. Additionally, the course will explore the application of analytics and technology in sports, enhancing the strategic decision-making and fan engagement capabilities.

CourseObjective(s):

i. Understand the fundamental principles and concepts of sports management, including its scope, organizational structure, and ethical considerations.

ii. Analyse the role of marketing and sponsorship in the sports industry, with a focus onbranding, target audience segmentation, and event management.

iii. Develop proficiency in financial management techniques specific to the sports industry, including revenue generation, cost management, and investment strategies.

iv. Explore the application of analytics and technology in sports, including performance evaluation, strategic decision-making, and fan engagement.

v. Apply theoretical knowledge to practical scenarios through case studies and projects,fostering critical thinking and problem-solving skills in sports management contexts.

Course Content:

Unit 1: Introduction to Sports Management , Definition and scope of sports management ,Significance of sports management in society and its evolution over time ,Organizational structure of sports: amateur, professional, and non-profit entities ,Roles and responsibilities of key personnel: managers, coaches, and agents ,Governance bodies in sports: FIFA, IOC, and NCAA ,Legal issues: contracts, negotiations, intellectual property rights ,Ethical considerations: fair play and doping

Unit 2: Sports Marketing and Sponsorship .Unique aspects of sports marketing .Fan engagement strategies .Target audience identification and segmentation .Branding strategies for sports teams and

athletes.Sponsorship and endorsement deals .Negotiating and managing partnerships .Event management: planning, organizing, and promoting sports events.

Unit 3: Financial Management in Sports
Revenue generation in sports: ticket sales, broadcasting rights, merchandise sales ,Financial models: budgeting and forecasting ,Cost management: player salaries, facility expenses, operational costs ,Investment opportunities in sports ,Risk management techniques specific to sports organizations

Unit 4: Sports Analytics and Technology,Introduction to sports analytics,Evaluating player performance,Devising game strategies ,Fan engagement through technology ,Analytical techniques: statistical analysis, data visualization, predictive modeling,Key performance indicators (KPIs) in sports ,Applications of analytics: talent scouting, injury prevention, performance optimization.

TextBooks:

1. Pedersen,P.M.,Thibault,L.,&Pedersen,P.M.(2019).ContemporarySport Management. Human Kinetics.
2. Hoye, R., Smith, A. C. T., Nicholson, M., et al. (2021). Sports Management: Principles and Applications. Routledge.
3. Chelladurai, P., & Kerwin, S. (2017). Introduction to Sport Management: Theory and Practice. Human Kinetics.
4. Hoye,R.,Cuskelly,G.,&Nicholson,M.(2019).SportsGovernance:AGuideforSport Organizations. Routledge.
5. Conrad,M.(2018).The BusinessofSports:APrimerforJournalists.Routledge.
6. Shank,M.D.(2019).SportsMarketing:AStrategicPerspective.Pearson.
7. Collett,P.,&Fenton,W.(2019).TheSponsorshipHandbook:EssentialTools,Tipsand Techniques for Sponsors and Sponsorship Seekers. Kogan Page.
8. Fullerton,S.Jr.,&Funk,D.C.(2019).SportsMarketing:APracticalApproach. Routledge.
9. Conrad,M.(2019).WinninginSportsBusiness:EssentialMarketing,Finance,and Management Strategies. Routledge.
10. McCarty, L. A., & McPherson, G. (2019). Sports Event Management: The Caribbean Experience. Routledge.
11. Brown,M.T.,Rascher,D.,&Leeds,M.A.(2017).FinancialManagementintheSport Industry. Routledge.
12. Winfree, J. A., & Rosentraub, M. S. (2017). Sports Finance and Management: RealEstate, Entertainment, and the Remaking of the Business. Taylor & Francis.
13. Foster,G.,O'Reilly,N.,&Cuskelly,G.(2018).SportsBusinessManagement:Decis

ion Making Around the Globe. Routledge.
14. Brown, M. T., & Shick, D. M. (2019). Financial Management in the Sport Industry. Routledge.
15. Conrad,M.(2018).The BusinessofSports:APrimerforJournalists.Routledge.
16. Alamar, B. C. (2013). Sports Analytics: A Guide for Coaches, Managers, and Other Decision Makers. Columbia University Press.
17. Miller,T.W.(2019).SportsAnalyticsandDataScience:WinningtheGamewith Methods and Models. FT Press.
18. Marchi,M.,Albert,J.,&Baumer,B.(2014).AnalyzingBaseballDatawithR.Chap man and Hall/CRC.
19. Schumaker,R.P.,Hwang,R.S.Y.,&Chen,H.(2016).SportsDataMining.Routledge.
20. Alamar, B. C. (2013). Sports Analytics: A Guide for Coaches, Managers, and Other Decision Makers. Columbia University Press.

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Program Structure for BCA AI & DS (Full Time)

CBCA25VA5	National Cadet Corps (NCC)	L	T	P	C	TY/Lb/IE
		0	0	4	2	IE

This course develops essential skills in discipline, leadership, and tactical operations through structured curriculum and practical exercises. It emphasizes the role of drills in fostering discipline, leadership, and teamwork, and includes comprehensive weapon handling training withafocuson safety protocols. The course teaches map reading, understanding topographical features, and navigating diverse terrains. Practical units cover the history and objectives of the National Cadet Corps (NCC), various maneuvers, parade formations, saluting protocols, and field and battlecraft techniques. By the end, learners will master discipline, leadership, weapon handling, and tactical decision-making, effectively utilizing terrain features for strategic advantages.

Course Objective(s):

1. Understand the foundational role of drillin fostering discipline and leadership within a group, enabling effective command towards achieving common goals.
2. Appreciate the importance of grace and dignity in executing foot drill movements, recognizing their significance in enhancing performance and teamwork.
3. Comprehend the criticality of weapon handling and detailed safety measures, emphasizing the importance of accident prevention through strict adherence to safety protocols.
4. Develop an awareness of diverse terrain types and their strategic significance in battle craft, enabling informed decision-making and effective utilization of terrain features for tactical advantage.

Course Content(Practical):

Unit 1:

Overview of NCC, its history, aims, objectives, and organizational structure, Incentives and duties associated with NCC cadetship; Maneuvers: Foot drill, Word of Command, Attention, and stand at ease, and Advanced maneuvers like turning and sizing; Parade formations: Parade line,openline and closed line; Saluting protocols, parade conclusion,and dismissal procedures. Marching styles: style march, double time march, and slow march

Unit 2:

Weapon Training, Handling fire arms, Introduction and characteristics of the. 22rifle;Handling Firearm techniques, emphasizing safety protocols and Best practices.

Unit 3:

Map Reading (MR): Topographical forms and technical terms, including relief, contours, and gradients, crucial for understanding terrain features; Cardinal points , magnetic variation and grid convergence

Unit 4:

Field Craft & Battle Craft (FC & BC): Fundamental principles and techniques essential for effective field and battle craft operations; Methods of judging distance, including estimation, pacing, and visual cues

References:

- DGNCC Cadet's Hand Book-Common Subjects-AllWings
- Tiwari,R.(2019).NCC:GroomingFeelingofNationalIntegration,Leadershipa nd Discipline among Youth. Edwin Incorporation.
- Chhetri,R.S.(2010).Grooming Tomorrows Leaders,The National Cadet Corps.
- Directorate General National Cadet Corps(2003).National Cadet Corps,Youthin Action.
- Vanshpal,Ravi(2024).TheNCCDays,NotionPress.

CourseOutcome(s):

1. Mastery of Discipline and Leadership through Drill Learners would demonstrate the ability to effectively command a group, foster discipline, and work collaboratively towards achieving shared objectives.
2. Mastery of Grace and Dignity in Foot Drill Performance Learners would demonstrate an understanding of how these qualities enhance performance and foster teamwork within a group setting.
3. Proficient Weapon Handling and Safety Adherence Learners would showcase a thorough understanding of the criticality of safety measures, emphasizing accident prevention through strict adherence to safety protocols.
4. Enhanced Tactical Awareness and Strategic Decision-Making Learners would gain the ability to make informed decisions and effectively utilize terrain features to gain tactical advantage during operations.

CBCA25VA6	National Service Scheme (NSS)	L	T	P	C	TY/Lb/IE
		0	0	4	2	IE

This course provides students with an in-depth understanding of the National Service Scheme (NSS),including its history, philosophy, aims, objectives and organizational structure. It equips students with knowledge about various NSS programmes and activities, emphasizing their relevance and importance. The course also develops skills in community mobilization,teaching students effective techniques for engaging and mobilizing community stakeholders. Additionally, it cultivates an appreciation for volunteerism and shramdan (voluntary labor), highlighting their role in community development initiatives.By the end of the course, students will have a comprehensive understanding of NSS,enhanced leadershipandteam-buildingskills, and a strong sense of social awareness and patriotism.

CourseObjective(s):

1. To provide students with an understanding of the history, philosophy, and basic concepts of the National Service Scheme (NSS).
2. To familiarize students with the aims,objectives,and organizational structure of NSS.
3. To equip students with knowledge about NSS programmes, activities, and their relevance.
4. To develop an understanding ofc ommunity mobilization techniques and their importance in NSS activities.
5. To cultivate an appreciation for volunteerism, shramdan (voluntary labor), and their role in community development initiatives.

CourseContent:

Unit 1:Introduction and Basic Concepts of NSS

National Service Scheme (NSS) - history, philosophy, and fundamental concepts, aims and objectives, providing clarity on the organization's overarching goals. Symbols of NSS - Emblem, flag, motto, song, and badge; Organizational structure of NSS

Unit 2:NSS Programmes and Activities

Diverse programmes and activities conducted under the aegis of the National Service Scheme (NSS); Significance of commemorating important days recognized by the United Nations, Centre, State Government, and University; Examination of the methodology for adopting villages/slums and conducting surveys; Financial patterns of the NSS scheme

Unit 3:Community Mobilization

Dynamics of community mobilization within the framework of the National Service Scheme (NSS); Functioning of community stakeholders; The conceptual lens of community development

Unit 4: Volunteeris and Shramdan in the Indian Context:Roles and Motivations within the NSS Framework

Ethos of volunteerism and shramdan (voluntary labor) within the cultural context of India and the framework of the National Service Scheme (NSS); Motivations and constraints shaping volunteer engagement;Role of NSS volunteers in initiatives such as the Swatch Bharat Abhiyan and Digital India

References:

1. Ministry of Youth Affairs and Sports, Government of India. (2022). National Service Scheme (NSS) Manual.
2. Agarwalla,S.(2021).NSS and Youth Development. Mahaveer Publications
3. Bhattacharya,P.(2024).Stories Of NSS(English Version). Sahityasree.
4. Borah, R. and Borkakoty, B. (2022). NSS in Socioeconomic Development. Unika Prakashan.
5. Wondimu, H., & Admas, G. (2024). The motivation and engagement of student volunteers in volunteerism at the University of Gondar. *Discover Global Society*, *2*(1), 1-16.
6. Saha, A. K. (2002). Extension Education–The Third Dimension Needs and Aspirations of Indian Youth. *Journal of Social Sciences*, *6*(3), 209-214.
7. Mills, S. (2013). "An instruction in good citizenship": scouting and the historical geographies of citizenship education. *Transactions of the Institute of British Geographers*, *38*(1), 120–134. http://www.jstor.org/stable/24582445
8. Mishra,S.K.,Sachdev,S.,Marwaha,N.,&Avasthi,A.(2016).Studyofknowledgean d attitude among college-going students toward voluntary blood donation from north India. *Journal of blood medicine*, 19-26.
9. Mukherji,B.(2007).Community Development in India. Orient Longmans.
10. History Background of NSS and its Philosophy,Aims and Objectives
11. https://www.osmania.ac.in/NSS%20URL/9.%20%20Historical%20Background%20of%20NSS%20and%20its%20Philosophy,%20Aim.pdf
12. InDefenceofNationalismhttps://www.mkgandhi.org/indiadreams/chap03.htm
13. Unlocking Youth Potential for Nation Building:Strengthening NYKS and NSS
14. https://www.undp.org/india/projects/strenghtening-nyks-and-nss

CourseOutcome(s):

1. Students will demonstrate an understanding of the history, philosophy and objectives of the National Service Scheme (NSS), thereby fostering increased social awareness and patriotism among them.
2. Students will be able to organize and conduct various NSS programmes and activities effectively and through it understand the importance of leadership and team building.
3. Students will develop skills in community mobilization and partnership building.
4. Students will appreciate the importance of volunteerism and shramdan in societal development and thus, be able to understand role of community participation.

CBCA25VA7	DISASTER MANAGEMENT	L	T	P	C	TY/Lb/IE
		0	0	4	2	IE

In our rapidly evolving 21st-century world, challenges emerge in diverse forms, transcending borders and intertwining economic, societal, and environmental realms. These challenges profoundly affect vulnerable communities, magnifying their susceptibility to climate-related shocks and disasters. As we navigate through these complexities, it becomes increasingly evident that aligning strategies with global Sustainable Development Goals (SDGs) across various geographical scales is paramount. This alignment incorporates perspectives of environmental sustainability, climate adaptation, and disaster resilience. In light of these considerations, this course aims to equip students with the knowledge and skills necessary to address and mitigate the impacts of disasters in a holistic manner.

Course Objective(s):

- To provide understanding of the concepts related to disaster
- To highlight the importance and role of disaster management
- To enhance awareness of institutional processes and management strategies to mitigate the impacts of disasters

Course Content:

Unit 1:Concepts and Terminologies

Understanding key concepts of Hazards, disasters; Disaster types and causes (Geophysical, Hydrological, Meteorological, Biological and Atmospheric; Human-made); Global trends in disasters - Impacts (Physical, Social, Economic, Political, Environmental and Psychosocial); Defining Vulnerability(Physical Vulnerability; Economic Vulnerability; Social Vulnerability)

Unit 2:Key concepts of Disaster Management Cycle

Components of disaster management cycle (Phases: Response and recovery, Risk assessment, Mitigation and prevention, Preparedness planning, Prediction and warning); Disaster risk reduction (DRR), Community based disaster risk reduction

Unit 3:Initiatives at national and international level

Disaster Risk Management in India and at international level: Related policies, plans, programmes and legislation; International strategy for disaster reduction and other

initiatives

Unit 4:Emergency Management

Explosion and accidents(Industrial,Nuclear,TransportandMining)-Spill(OilandHazardous material); Threats (Bomb and terrorist attacks) - Stampede and conflictsTraining and Demonstration Workshops (at least two workshops) be organized in association with the NIDM, NDRF, NCDC, Param Military, Fire Brigade, CISF, local administration etc.

Readings

1. Sharma,S.C.(2022),DisasterManagement,KhannaBookPublishing.
2. Clements,B.W.,(2009):DisastersandPublicHealth:PlanningandResponse,ElsevierInc.
3. Dunkan, K., and Brebbia, C. A., (Eds.) (2009): Disaster Management and Human Health Risk: Reducing Risk, Improving Outcomes, WIT Press, UK.
4. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability andMitigation, Rawat Publications, New Delhi.
5. Ramkumar,Mu,(2009)GeologicalHazards:Causes,ConsequencesandMethodsof Containment, New India Publishing Agency, New Delhi.
6. Modh,S.(2010)ManagingNaturalDisaster:Hydrological,MarineandGeological Disasters, Macmillan, Delhi.
7. Carter,N.(1991)DisasterManagement:ADisasterManagementHandbook.AsianDev elopment Bank, Manila.
8. Govt.ofIndia(2008)VulnerabilityAtlasofIndia. BMTPC,New Delhi.
9. Govt.ofIndia(2011)DisasterManagementinIndia.MinistryofHomeAffairs,NewDelhi.
10. Matthews,J.A.,(2002)NaturalHazardsandEnvironmentalChange,BillMcGuire,Ian Mason.

E-Resources

http://www.ndma.gov.in/en/
- http://nidm.gov.in/
- https://www.unisdr.org/
- http://www.emdat.be
- https://www.weather.gov/safety/
- https://www.preventionweb.net/risk/vulnerability