NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR

(AN AUTONOMOUS INSTITUTE)

Affiliated to

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

Evaluation Scheme & Syllabus

For

Bachelor of Computer Applications (BCA)
First Year

(Effective from the Session: 2024-25)

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute)
Bachelor of Computer Applications (BCA)
Evaluation Scheme
SEMESTER I

S. No	Subject Codes	Subjects	Types of Subjects	Periods			Evaluation Schemes				End Semester		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
3 WEEKS COMPULSORY INDUCTION PROGRAM														
1	BBCA0101	Computer Fundamentals & Networking	Mandatory	3	0	0	30	20	50		100		150	3
2	BBCA0103	Basic Mathematics	Mandatory	3	1	0	30	20	50		100		150	4
3	BBCA0104	Design Thinking I	Mandatory	3	0	0	30	20	50		100		150	3
4	BBCA0102	Working with Excel	Mandatory	3	0	0	30	20	50		100		150	3
5	BBCA0105	Principles of Programming Language	Mandatory	3	1	0	30	20	50		100		150	4
6	BBCA0156	Problem solving using python	Mandatory	0	0	6				50		100	150	3
7	BBCA0151	Computer Fundamentals & Networking Lab	Mandatory	0	0	2				50		50	100	1
8	BBCA0157	Workplace Communication Lab I	Mandatory	0	0	4				50		50	100	2
9	BBCA0152	Working with Excel Lab	Mandatory	0	0	2				50		50	100	1
		*Massive Open Online Courses	*MOOCs											
		TOTAL							**250**	**200**	**500**	**250**	**1200**	**24**

List of MOOCs (Infosys Springboard) Based Recommended Courses for First Year (Semester-I) BCA

S.No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	BMC0031	Introduction to Python	Infosys Wingspan (Infosys Springboard)	24 h 6 min	
2	BMC0049	Computer Fundamentals 101	IIHT (Infosys Springboard)	8h 18m	

Abbreviation Used:

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., CE: Core Elective,OE:Open Elective, DE: Departmental Elective, PE: Practical End Semester Exam, CA: Compulsory Audit, MOOCs: Massive Open Online Courses.

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute)
Bachelor of Computer Applications (BCA)
Evaluation Scheme
SEMESTER II

S. No	Subject Codes	Subjects	Types of Subjects	Periods			Evaluation Schemes				End Semester		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	BBCA0201	Data Structures Using Python	Mandatory	3	0	0	30	20	50		100		150	3
2	BBCA0202	Digital logic & Design	Mandatory	3	0	0	30	20	50		100		150	3
3	BBCA0203	Data Analytics using Excel/ Power BI /Google Analytics	Mandatory	3	0	0	30	20	50		100		150	3
4	BBCA0204	Mathematics for Computer Applications	Mandatory	3	1	0	30	20	50		100		150	4
5	BBCA0205	Principles of Virtualization	Mandatory	3	1	0	30	20	50		100		150	4
6	BBCA0256	Advance python Lab	Mandatory	0	0	6				50		100	150	3
7	BBCA0251	Data Structure using Python Lab	Mandatory	0	0	2				50		50	100	1
8	BBCA0257	Workplace Communication Lab 2	Mandatory	0	0	4				50		50	100	2
9	BBCA0253	Data Analytics using Excel/ Power BI /Google Analytics Lab	Mandatory	0	0	2				50		50	100	1
10	BBCANC0251	Field Activities for Community Engagement	Compulsory Audit	0	0	2				50			50	NA
		*Massive Open Online Courses	*MOOCs											
		TOTAL							250	200	500	250	1200	24

List of MOOCs (Infosys Springboard) Based Recommended Courses for First Year (Semester-I) BCA

S.No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	BMC0012	Data Structures and Algorithms using Python - Part 1	Infosys Wingspan (Infosys Springboard)	29h 27m	
2	BMC0045	Microsoft Power BI	IIHT (Infosys Springboard)	11h 32m	

PLEASE NOTE: -

- **A 3-4 weeks Internship shall be conducted during summer break after semester-II and will be assessed during semester-III**
- **Compulsory Audit (CA) Courses (Non-Credit - BBCANC0251)**
  - All Compulsory Audit Courses (a qualifying exam) do not require any credit.
  - The total and obtained marks are not added in the grand total.

Abbreviation Used:

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., CE: Core Elective,OE:Open Elective, DE: Departmental Elective, PE: Practical End Semester Exam, CA: Compulsory Audit, MOOCs: Massive Open Online Courses.

Subject Name: Computer Fundamentals & Networking	**L-T-P [3-0-0]**
Subject Code: BBCA0101	**Applicable in Department: BCA**

Pre-requisite of Subject: Basic knowledge of computer terminology and input-output devices.

Course Objective: The objective of this course is to introduce computer hardware, software, and operating systems. Explore basic networking concepts including protocols and security. Develop skills in troubleshooting and understanding emerging technologies in computing and networking.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Explain computer fundamentals which include hardware, software, memory, input/output devices, and storage technologies	**K2**
CO2	Describe software systems which include system and utility software, programming languages, operating systems, open-source software, and computer security.	**K2**
CO3	Discuss data communication, network protocols, configurations, transmission methods, signal types, and modulation techniques	**K2**
CO4	Demonstrate digital modulation techniques, data transmission interfaces, communication hardware, the OSI model, transmission media, and various telecommunication technologies.	**K3**
CO5	Explain of data link layer functions and protocols, error detection and correction, TCP/IP, IP addressing, subnetting, and transport layer protocols.	**K5**

Syllabus

Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
I Introduction to	**Introduction to Computer System**	Fundamentals of Computers: Definition, Characteristics, Evolution & Generations of Computers, Classification of Computers, Basic Organization of a Digital Computer, Concepts of Hardware and Software. Hardware– Memory Unit: Primary and Secondary Memory, Input Devices – Keyboard, Scanner, Mouse, Light Pen,	Lectures, PPTs, Notes	**8L+4P**	**Assignment, LAB (1 to 3)**	**CO1**

Computer System		Bar Code Reader, OMR, OCR, MICR., Trackball, Joystick, Touch Screen etc., Output Devices: Monitors and its types, Printers and its types, Plotters and its types, Projectors etc., Storage Devices: Magnetic tapes, Floppy Disks, Hard Disks, Compact Disc, Flash Drives etc.				
II **Software & Its Type**	**Software** .	Software – System Software and Utility Software; Programming Language and its classification - Machine Level, Assembly Level & High-Level Languages, Translator Programs – Assembler, Interpreter, and Compiler.	Lectures, PPTs, Notes	**8L+4P**	**Assignment, LAB (4 to 7)**	**CO2**
	Operating System and its Type	Operating Systems: Introduction, function, and Types of OS., Introduction to DOS, Unix, Linux, Windows, and Mac OS. The concept of source software, its advantages and limitations.				
	Virus and Malware	working principles, Types of viruses, Worms and Trojan Horses, virus detection and prevention, viruses on the network, Antivirus software, some examples related to types of virus attacks.				
II **Introduction to Data Communication**	**Data Communication**	Introduction to Data Communication, Networks-protocols, advantages, disadvantages & applications, Line Configuration, topology, Transmission mode.	Lectures, PPTs, Notes	**8L+4P**	**Assignment, LAB (8 to 11)**	**CO3**
	Classification of networks	Classification of networks. Parallel & Serial Transmissions, Analog & Digital Signals, Periodic & Aperiodic Signals, Modulation--- Amplitude Modulation, Frequency Modulation, Phase Modulation, Pulse Amplitude Modulation, Pulse Code Modulation, Sampling.				
IV **Network Switchi**	. **Network Switching Techniques**	Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying, Bit/ Baud Comparison, DTE-DCE Interface, 56 K Modem, Cable Modem.	Lectures, PPTs, Notes	**8L+4P**	**Assignment, LAB (12 to 16)**	**CO4**

ng Techniques and Access Mechanisms	**Access Mechanisms**	OSI Model, Transmission Media-Twisted Pair Cable, Coaxial Cable, Fiber-Optic Cable, Radiofrequency Allocation, Terrestrial Microwave, Infrared rays, Satellite Communication, Cellular Telephony. Introduction to ISDN.				
V Data Link Layer Functions and Protocol	**Data Link Layer**	Data Link Layer Functions and Protocol- Error Detection and Error Correction Techniques, Data-Link Control- Framing and Flow Control, Error Recovery Protocols-Stop and Wait ARQ, Go-Back-N ARQ, Point to Point Protocol on Internet.	Lectures, PPTs, Notes	**8L+4P**	**Assignment, LAB (17)**	**CO5**
	Functions and Protocol	Introduction to TCP/IP, Data Link Layer in Internet-SLIP & PPP, Network Layer in Internet-IP protocol, IP addressing, Subnetting & Internet Control Protocols, Transport Layer in Internet-TCP & UDP.				
Total				**40L+20P**		

Textbooks

Sr No	Book Details
1.	Reema Thareja, “Fundamentals of Computers”, 2nd Edition, Oxford High Education, 2019
2.	Andrew S. Tanenbaum and David J. Wetherall, “Computer Networks", 6th Edition, Pearson, 2022
3.	McGraw Hill Education; Fifth edition, “"Data Communications and Networking", 5th Edition, 2017

Reference Books

Sr No	Book Details
1.	E. Balagurusamy, “Fundamentals of Computers”,8th Edition, McGraw-Hill Inc, 2021.
2.	Behrouz A. Forouzan, "Data Communication and Networking",5th Edition, McGraw-Hill Inc, 2021.

Links

Unit I	https://www.youtube.com/watch?v=27QXFdU2JE0
Unit II	https://www.youtube.com/watch?v=vghgtcmTTLQ

Unit III	https://www.youtube.com/watch?v=OmYHJShD_QM
Unit IV	https://www.youtube.com/watch?v=-HlJ4psu5aU
Unit V	https://www.youtube.com/watch?v=VBAuzvVzOQU

Subject Name: Basic Mathematics	**L-T-P [3-1-0]**
Subject Code: BBCA0103	**Applicable in Department: BCA**

Pre-requisite of Subject: Knowledge of Mathematics up to 10th standard

Course Objective:

- Enable the students to understand the basic concept of matrix and determinants and their applications.
- Enable the students to understand the basic concept of sets relations and functions and their applications.
- Enable the students to understand the basic concept of limit and continuity and differentiation of functions and their applications.
- Enable the students to understand the basic concept of integration and their applications.
- Enhance the basic aptitude skills of the students.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Apply the concept of matrix and determinants to find the solution of a system of linear equations.	**K5**
CO2	Understand the concept of sets relations and functions to solve problems based on sets and functions.	**K2**
CO3	Apply the concept of limit and continuity and differentiation for various functions.	**K3**
CO4	Apply the concept of Integration.	**K3**
CO5	Solve the problems of Profit, Loss, Number & Series, Coding & decoding.	**K3**

Syllabus

Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**

I **Matrix And Determinants**	**Matrices**	Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication, and Multiplication of Matrices.	Classroom, PPT, M.Tutor, Smart Board	**10L**	**Assignment**	**CO1**
	Determinants	Definition, Minors, Cofactors, Properties of Determinants. Adjoint, Inverse, and solution of a system of linear equations.				
II **Sets, Relations And Functions**	**Sets**	Sets, Subsets, Equal Sets Universal Sets, Finite and Infinite Sets, Operation on Sets, Union, Intersection and Complements of Sets, Cartesian Product, Cardinality of Set, Simple Applications.	Classroom, PPT, M.Tutor, Smart Board	**10L**	**Assignment**	**CO2**
	Relations	Properties of Relations, Equivalence Relation, Partial Order and Relation.				
	Functions	Domain and Range, Onto, Into and One to One Functions, Composite and Inverse Functions.				
III **Limits, Continuity Differentiation**	**Limits**	Limit at a Point, Properties of Limit, Basic concept of continuity, Derivative, Derivatives of Sum, Differences, Product & Quotients, Chain Rule, Derivatives of Composite Functions.	Classroom, PPT, M.Tutor, Smart Board	**8L**	**Assignment**	**CO3**
	Continuity Differentiation	Logarithmic Differentiation, L' Hospitals Rule, Maxima & Minima of Single Variable Function.				
IV **Integration**	**Integration**	The basic concept of Integral, Indefinite integral, Methods of Integration Substitution, By Parts, Partial Fractions, definite Integral, Fundamental Theorem of Calculus (without proof), and Basic properties of definite integral.	Classroom, PPT, M.Tutor, Smart Board	**10L**	**Assignment**	**CO4**
V **Aptitude-I**	**Aptitude-I**	Simplification, Percentage, Profit, loss &discount, Average, Number& Series, Coding & decoding, Time and Work.	Classroom, PPT, M.Tutor, Smart Board	**8L**	**Assignment**	**CO5**
Total				**46**		

Textbooks	
Sr No	**Book Details**
1.	J. P. Chauhan “BCA Mathematics Volume -1 & 2”, Krishna Publications.
Reference Books	
Sr No	**Book Details**
1.	B. S. Grewal, “Elementary Engineering Mathematics”, 34th Ed., 1998.
2.	Quantitative Aptitude by R.S. Aggarwal.
Links	
Unit I	https://youtu.be/VRZWYl24ggU?si=LcQdsV7i2ZyhaYqf https://youtu.be/W9Sg4YGAqp8?si=VgmyIxb6vy-xgeGH https://youtu.be/nm6rAUOXZ6E?si=tvrXU_Imf1bskfRr https://youtu.be/OPSqnhSCJ4U?si=c8azShG7m_FpFD1m https://youtu.be/Qw4mDt92S6g?si=0HGJ_2aaTW8w51zG
Unit II	https://www.youtube.com/watch?v=md5UCR7mcIY&list=PLbMVogVj5nJSxFihV-ec4A3z_FOGPRCo-&index=1&pp=iAQB https://www.youtube.com/watch?v=jZXHzpq-vmM&list=PLbMVogVj5nJSxFihV-ec4A3z_FOGPRCo-&index=2&pp=iAQB https://www.youtube.com/watch?v=V_xMloDlD4o&list=PLbMVogVj5nJSxFihV-ec4A3z_FOGPRCo-&index=3&pp=iAQB https://www.youtube.com/watch?v=Xx7ULr79fy0&list=PLbMVogVj5nJSxFihV-ec4A3z_FOGPRCo-&index=4&pp=iAQB https://www.youtube.com/watch?v=4sTWVBmY0Xc&list=PLbMVogVj5nJSxFihV-ec4A3z_FOGPRCo-&index=5&pp=iAQB
Unit III	https://youtu.be/E6BJWGYHEOA?si=Dt9pFLHqR3Qj4idk https://www.youtube.com/watch?v=EcoOBgGjXpw&list=PL7oBzLzHZ1wXBSiJEgqz_iwVoLiY8qhbv&index=10&pp=iAQB

	https://www.youtube.com/watch?v=18FANeSc0eA&list=PL7oBzLzHZ1wXBSiJEgqz_iwVoLiY8qhbv&index=16&pp=iAQB https://www.youtube.com/watch?v=0loRcGXAux8&list=PL7oBzLzHZ1wXBSiJEgqz_iwVoLiY8qhbv&index=26&pp=iAQB https://www.youtube.com/watch?v=0diuaf1zWCc&list=PL7oBzLzHZ1wXBSiJEgqz_iwVoLiY8qhbv&index=31&pp=iAQB
Unit IV	https://www.youtube.com/watch?v=ovKqObcXJ4Y&list=PLzJaFd3A7DZuyLLbmVpb9e9VLf3Q9cYBL&index=15&pp=iAQB https://www.youtube.com/watch?v=_EvfFc3ySYY&list=PLzJaFd3A7DZuyLLbmVpb9e9VLf3Q9cYBL&index=16&pp=iAQB https://www.youtube.com/watch?v=JDfPbRrp4WE&list=PLzJaFd3A7DZuyLLbmVpb9e9VLf3Q9cYBL&index=18&pp=iAQB https://www.youtube.com/watch?v=kDrERE17VyE&list=PLzJaFd3A7DZuyLLbmVpb9e9VLf3Q9cYBL&index=19&pp=iAQB https://www.youtube.com/watch?v=-5q5l-XajBA&list=PLEAYkSg4uSQ0q9CDkHkJGdUTQOgH1DLDj&index=26&pp=iAQB
Unit V	https://www.youtube.com/watch?v=2IU6Z7snwFg&pp=ygUYc2ltcGxpZmljYXRpb24gdW5hY2FkZW15 https://www.youtube.com/watch?v=aB_aXOWI_FI&pp=ygUvcGVyY2VudGFnZSwgcHJvZml0LCBsb3NzLCBkaXNjb3VudCBraGFuIGFjYWRlbXk%3D https://www.youtube.com/watch?v=9VZsMY15xeU&pp=ygUmQXZlcmFnZSwgTnVtYmVyICYgU2VyaWVzLCBraGFuIGFjYWRlbXk%3D https://www.youtube.com/watch?v=mzbEuZTsyMo&list=PLk7ptZcI9vmjLJMjTSV2FkSNFaDOV-6cr&index=8&pp=iAQB https://www.youtube.com/watch?v=LFkoLCtCRcY&list=PL0b9qDcBZ_XubfPcmwwXMQD96PobW3HKP&index=1&pp=iAQB https://www.youtube.com/watch?v=O4I3rqAsNo4&pp=ygUmIENPRElORyAmIERFQ09ESU5HLCB1bmFjYWRlbXkgYXB0aXR1ZGU%3D https://www.youtube.com/watch?v=cvA9rLsOb90&list=PLLtQdEJkug7uNcEFgM6fhbT1IUcT3tPNk&index=1&pp=iAQB

Subject Name: Design Thinking I	**L-T-P [3-0-0]**
Subject Code: BBCA0104	**Applicable in Department: BCA**

Course Objective: The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Develop a strong understanding of the design process and apply it in a variety of business settings.	**K3**
CO2	Analyze self, culture, and teamwork to work in a multidisciplinary environment and exhibit empathetic behavior.	**K3**
CO3	Formulate specific problem statements of real-time issues and generate innovative ideas using design tools.	**K6**
CO4	Apply critical thinking skills in order to arrive at the root cause from a set of likely causes.	**K3**
CO5	Demonstrate an enhanced ability to apply design thinking skills for the evaluation of claims and arguments.	**K4**

Syllabus

Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
I **Introduction**	**Introduction**	An overview of future skills, introduction to design thinking, traditional problem solving versus design thinking, history of design thinking, wicked problems. Innovation and creativity, the role of innovation and creativity in organizations, creativity in teams and their environments, design mindset. Introduction to elements and principles of design, 13 Musical Notes for Design Mindset, Examples of Great Design, Design Approaches across the world.	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO1**

II **Ethical Values and Empathy**	**Ethical Values and Empathy**	Understanding humans as a combination of I (self) and body, basic physical needs up to actualization, prosperity, the gap between desires and actualization. Understanding culture in family, society, institution, startup, socialization process. Ethical behaviors: effects on self, society, understanding core values and feelings, negative sentiments and how to overcome them, definite human conduct: universal human goal, developing human consciousness in values, policy, and character. Understand stakeholders, techniques to empathize, identify key user problems. Empathy tools- Interviews, empathy maps, emotional mapping, immersion and observations, Emotional Intelligence, customer journey maps, classifying insights after Observations, Classifying Stakeholders, Individual activity- 'Moccasin Walk'.	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO2**
III Problem Statement and Ideation	**Problem Statement and Ideation**	Defining the problem statement, creating personas, Point of View (POV) statements. Research identifying drivers, information gathering, target groups, samples and feedback. Idea Generation basic design directions, Themes of Thinking, inspirations and references, brainstorming, inclusion, sketching and presenting ideas, idea evaluation, double diamond approach, analyze – four W's, 5 why's, "How Might We", Defining the problem using Ice-Cream Sticks, Metaphor & Random Association Technique, Mind-Map, ideation activity games - six thinking hats, million-dollar idea, introduction to visual collaboration and brainstorming tools - Mural, Jam Board.	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO3**
IV **Critical Thinking**	**Critical Thinking**	Fundamental concepts of critical thinking, the difference between critical and ordinary thinking, characteristics of critical thinkers, critical thinking skills- linking ideas, structuring arguments, recognizing incongruences, five pillars of critical thinking, argumentation versus rhetoric, cognitive bias, tribalism, and politics. Case study on applying critical thinking on different scenarios.	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO4**
V **Logic and Argum**	**Logic and Argumentation**	The argument, claim, and statement, identifying premises and conclusion, truth and logic conditions, valid/invalid arguments, strong/weak arguments, deductive argument, argument diagrams, logical reasoning, scientific reasoning, logical fallacies, propositional logic, probability, and judgment, obstacles to critical thinking. Group activity/role plays on	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO5**

entation		evaluating arguments.				
Total				**40L**		

Textbooks	
Sr No	**Book Details**
1.	Arun Jain, UnMukt : Science & Art of Design Thinking, 2020, Polaris
2.	Jeanne Liedta, Andrew King and Kevin Benett, Solving Problems with Design Thinking – Ten Stories of What Works,2013,Columbia Business School Publishing
3.	RR Gaur, R Sangal, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, First Edition, 2009, Excel Books: New Delhi
Reference Books	
Sr No	**Book Details**
1.	Vijay Kumar, 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization, 2013, John Wiley and Sons Inc, New Jersey
2.	Mootee, I. (2013). Design thinking for strategic innovation: What they can't teach you at business or design school. John Wiley & Sons.
3.	Gavin Ambrose and Paul Harris, Basics Design 08: Design Thinking, 2010, AVA Publishing SA
4.	Roger L. Martin, Design of Business: Why Design Thinking is the Next Competitive Advantage, 2009, Harvard Business Press, Boston MA
Links	
Unit I	https://nptel.ac.in/courses/110/106/110106124/ https://nptel.ac.in/courses/109/104/109104109/ https://designthinking.ideo.com/ https://blog.hypeinnovation.com/an-introduction-to-design-thinking-for-innovation-managers https://www.creativityatwork.com/design-thinking-strategy-for-innovation/ https://www.youtube.com/watch?v=GFffb2H-gK0
Unit II	https://aktu.ac.in/hvpe/ http://aktu.uhv.org.in/ https://nptel.ac.in/courses/110/106/110106124/ https://swayam.gov.in/nd1_noc19_mg60/preview
Unit III	https://nptel.ac.in/courses/110/106/110106124/ https://swayam.gov.in/nd1_noc19_mg60/preview

	https://www.udemy.com/course/design-thinking-for-beginners/ https://www.designthinking-methods.com/en/ https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them
Unit IV	https://www.forbes.com/sites/sap/2016/08/25/innovation-with-design-thinking-demands-critical-thinking/#340511486908 https://www.criticalthinking.org/pages/defining-critical-thinking/766
Unit V	https://www.udemy.com/course/critical-thinker-academy/ https://swayam.gov.in/nd2_aic19_ma06/preview

Subject Name: Working with Excel	**L-T-P [3-0-0]**
Subject Code: BBCA0102	**Applicable in Department: BCA**
Pre-requisite of Subject: Basic knowledge of computer system.	
Course Objective: The objective of this course is to supervise students with a comprehensive understanding of Microsoft Excel from basic operations to advanced data analysis and visualization techniques.	

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Apply operation of Excel's interface, data entry, and formatting to create and manage spreadsheets effectively.	**K4**
CO2	Apply essential formulas and functions to perform calculations and data analysis efficiently.	**K4**
CO3	Develop skills in sorting, filtering, and using tables to organize and analyze large datasets.	**K5**
CO4	Apply advanced functions, Pivot tables, and what-if analysis tools to enhance data insights and decision-making.	**K4**
CO5	Create and customize charts and dashboards to visualize data and present information clearly and effectively.	**K5**

Syllabus

Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
I Introduction to Excel	**Introduction to Excel**	Overview of Excel Interface: Ribbon, Tabs, and Quick Access Toolbar, Workbook and Worksheet Navigation, Understanding Cells, Rows, and Columns, Basic Operations: Workbook and Worksheet Navigation, Creating, Saving, and Opening Workbooks, Entering and Editing Data, Using Autofill and Flash	Lectures, PPTs, Notes	**8L+4P**	**Assignment, LAB (1 to 10)**	**CO1**

		Fill, Basic Formatting: Formatting Cells (Font, Color, Alignment), Number Formatting (Currency, Date, Percentage), Adjusting Row Height and Column Width.				
II Working with Formulas and Functions	**Formulas**	Understanding Formulas and Calculation Operators, Creating Simple Formulas (Addition, Subtraction, Multiplication, Division), Common.	Lectures, PPTs, Notes	**8L+4P**	**Assignment, LAB (11 to 20)**	**CO2**
	Functions	Using SUM, AVERAGE, MIN, MAX, and COUNT, Understanding and Using Absolute and Relative References, Logical and Lookup Functions: IF Statements, VLOOKUP and HLOOKUP, Using the AND, OR, and NOT Functions.				
III Data Management and Analysis	**Data Sorting and Filtering**	Sorting Data (Ascending, Descending, Custom), Applying Filters and Creating Filtered Views, Data Validation and Conditional Formatting: Setting Up Data Validation Rules, Using Conditional Formatting for Data Highlights,	Lectures, PPTs, Notes	**8L+4P**	**Assignment, LAB (21 to 30)**	**CO3**
	Working with Tables	Creating and Formatting Tables and Table Features (Total Row, Slicers, Structured References).				
IV Advanced Formulas and Data Analysis Tools	**Advanced Formulas and Function**	TEXT Functions (LEFT, RIGHT, MID, CONCATENATE), DATE Functions (TODAY, NOW, DATE, DATEDIF), Array Formulas.	Lectures, PPTs, Notes	**8L+4P**	**Assignment, LAB (31 to 40)**	**CO4**
	Data Analysis Tools	PivotTables and Pivot Charts: Creating and Modifying PivotTables, Using Pivot Charts for Data Visualization, What-If Analysis Tools: Scenario Manager, Goal Seek, Data Tables.				
V Data Visualiz	**Data Visualization and Reporting**	Chart Creation and Customization: Creating Basic Charts (Column, Bar, Line, Pie), Customizing Charts (Titles, Labels, Colors), Advanced Chart Techniques: Combination Charts, Sparklines and Data Bars, Creating Dashboards: Designing Interactive	Lectures, PPTs, Notes	**8L+4P**	**Assignment, LAB (41 to 60)**	**CO5**

ation and Reporting		Dashboards, Linking Data with Interactive Elements (Buttons, Drop-downs), Best Practices for Dashboard Design. .				
Total				**40L+20P**		

Textbooks	
Sr No	**Book Details**
1.	Paul McFedries, "Microsoft Excel Formulas and Functions (Office 2021 and Microsoft 365)", 1st Edition, Pearson, 2023
2.	Ritu Arora, "Mastering Advanced Excel", 1st Edition, BPB, 2023
3.	Naveen Mishra, "Mastering Advanced Excel", 1st Edition, Penman Book, 2019
Reference Books	
Sr No	**Book Details**
1.	Prof. Michael McDonald, "200+ Excel Formulas and Functions", 1st Edition, BPB Publications, 2023
2.	CA Manmeet Singh Mehta, "Microsoft Excel Professional 2021 Guide",1st Edition, BPB Publications, 2022.
Links	
Unit I	https://www.youtube.com/watch?v=Vl0H-qTclOg
Unit II	https://www.youtube.com/watch?v=8okA22yMwTs
Unit III	https://www.youtube.com/watch?v=I1G84Wm7lns
Unit IV	https://www.youtube.com/watch?v=5tSIAwJBCP8
Unit V	https://www.youtube.com/watch?v=c4eWDpQiasM

Subject Name: Principle of Programming Language	**L-T-P [3-1-0]**
Subject Code: BBCA0105	**Applicable in Department: BCA**
Pre-requisite of Subject: Foundational knowledge and skills in computer science and programming.	
Course Objective: This course introduces students to the fundamental principles underlying programming languages. Topics include language syntax, semantics, data types, control structures, functional programming, object-oriented programming, and programming language paradigms.	

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Explain programming paradigms and techniques involved in designing and implementing modern programming languages.	**K4**
CO2	Describe the structure of a compiler and interpretation.	**K3**
CO3	Apply syntax and semantics of programming language.	**K2**
CO4	Apply programming paradigm to improve the clarity, quality, and development time of a program (structured programming).	**K3**
CO5	Develop logic of programming through Prolog.	**K4**

Syllabus

Unit No	**Module Name**	**Topic covered**	**Pedagogy**	**Lecture Required (L+P)**	**Practical/ Assignment/ Lab Nos**	**CO Mapping**
I Introduction of Progra	**Introduction of Programming Language**	Language Evaluation Criteria influence Language design, Language categories, and Programming Paradigms – Imperative, object-oriented, Functional Programming, and Logic Programming. Programming Language Implementation – Compilation and Virtual Machines, programming environments.	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO1**

mming Language		Issues in Language Translation: Syntax, Semantics, Stages, analysis and synthesis, Parse Tree, CFG and BNF grammar.				
II **Data, Data Types, and Basic Statements**	**Data, Data Types, and Basic Statements**	Data types: Introduction, primitive, character, user-defined, array, associative, record, union, Pointer, and reference types, design and implementation uses related to these types. Names, Variables, concept of binding, type checking, strong typing, type compatibility, named constants, variable initialization. Sequence control with Expressions, Conditional Statements, Loops, and Exception handling.	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO2**
III **Subprograms and Implementations**	**Subprograms and Implementations**	Subprograms and Blocks: Fundamentals of sub-programs, Scope and lifetime of a variable, static and dynamic scope, Design issues of subprograms and operations, local referencing environments, parameter passing methods, overloaded sub-programs, generic sub-programs, design issues for functions overloaded operators, co-routines.	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO3**
IV **Object-Orientation, Concurrency, and Event Handling**	**Object-Orientation, Concurrency, and Event Handling**	Abstract Data types: Abstractions and encapsulation, introductions to data abstraction, Static, and Stack-Based Storage management. Heap-based storage management. Garbage Collection. Object-oriented programming in small talk, C++, Java, C#, PHP, Perl. Concurrency. .	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO4**

V **Functional and Logic Programming Languages**	**Functional and Logic Programming Languages**	Exception handling, Exceptions, exception Propagation, and Exception handler in C++ and Java. Logic Programming Language: Introduction and overview of logic programming, basic elements of prolog, application of logic programming. Functional Programming Languages: Introduction, fundamentals. Introduction to 4GL..	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO5**
Total				**40L**		

Textbooks	
Sr No	**Book Details**
1.	Tucker, Programming Languages: Principles and paradigms, Tata McGraw–Hill, 2001
2.	Ghezzi C, Jazayeri M, "Programming Languages Concepts", Willey India, 1997
3.	Sebesta, "Concept of programming Language", Pearson Education, 2019
Reference Books	
Sr No	**Book Details**
1.	Robert W. Sebesta, "Concepts of Programming Languages" Pearson Education, 2023
2.	SETHI "Programming Languages: Concepts and Constructs" Pearson India, 2006
Links	
Unit I	https://www.youtube.com/watch?v=EYZ_A-Q3_pw
Unit II	https://study.com/academy/lesson/video/data-types-in-programming-numbers-strings-and-others.html
Unit III	https://www.youtube.com/watch?v=88PGeOtka58
Unit IV	https://www.youtube.com/watch?v=EYZ_A-Q3_pw
Unit V	https://www.youtube.com/watch?v=1NDnaRd2yzU

Subject Name: Problem Solving using Python	**L-T-P [0-0-6]**
Subject Code: BBCA0156	**Applicable in Department: BCA**

Pre-requisite of Subject: Students are expected to be able to open command prompt window or terminal window, edit a text file, download and install software, and understand basic programming concepts.

Course Objective: Objective of this course is to impart knowledge of basic building blocks of Python programming, provide skills to design algorithms for problem solving, implementation and debugging of programs in Python using modules & packages, disseminate the knowledge of basic data structures.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Identify python programming concepts, tools and real-world applications.	**K1**
CO2	Describe decision-making and iterative control statements in Python.	**K4**
CO3	Illustrate user-defined function and modules in Python.	**K4**
CO4	Summarize Python data structures –lists, tuples, set, dictionaries.	**K5**
CO5	Acquire the skills to manage file operations and handling exceptions in Python.	**K3**

Syllabus

Unit No	Module Name	Topic covered	Pedagogy	Lecture Required (L+P)	Practical/ Assignment/ Lab Nos	CO Mapping

I **Basics of Python Programming**	**Basics of Python Programming**	Problem Solving, Techniques, Algorithm, Building blocks of algorithms (statements, state, control flow, functions), Notation, Flow chart, Pseudo code, programming language, Categories of programming languages. A Brief History of Python, Applications areas of python, The Programming Cycle for Python, Python IDE, Interacting with Python Programs.	Lectures Code Walkthroughs, Hand-on Programming, Problem Solving, Collaborative coding, Projects, Assessments	**8L+4P**	**Assignment, LAB (1 to 22)**	**CO1**
	Elements of Python	Keywords and identifiers, variables, data types and type conversion, operators in python, expressions in python, strings.				
II **Decision Control Statements**	**Conditionals**	Conditional statement in Python (if-else statement, its working and execution). Nested-if statement and elseif statement in Python, Expression Evaluation & Float Representation.	Lectures Code Walkthroughs, Hand-on Programming, Problem Solving, Collaborative coding, Projects, Assessments	**8L+4P**	**Assignment, LAB (23 to 71)**	**CO2**
	Loops	Purpose and working of loops, while loop, For Loop, Nested Loops, Break and Continue, pass statement.				
III **Function and Modules**	**Function and Modules**	Introduction of Function, calling a function, Function arguments, built in function, scope rules. Passing function to a function, recursion, Lambda functions.	Lectures Code Walkthroughs, Hand-on Programming, Problem Solving,	**8L+4P**	**Assignment, LAB (72 to 95)**	**CO3**
	Modules and Packages:	Importing Modules, writing own modules, Standard library modules, dir() Function, Packages in Python				

			Collaborative coding, Projects, Assessments			
IV **Basic Data structures in Python**	**Strings**	Basic operations, Indexing and Slicing of Strings, Comparing strings.	Lectures Code Walkthroughs, Hand-on Programming, Problem Solving, Collaborative coding, Projects, Assessments	**8L+4P**	**Assignment, LAB (96 to 150)**	**CO4**
	Python Basic Data Structure	Regular expressions. Python Basic Data Structure: Sequence, Unpacking Sequences, Mutable Sequences, Lists, Looping in lists, Tuples, Sets, Dictionaries. Map, filter, Reduce, Comprehension.				
V **File and Exception handling**	**Files and Directories**	Introduction to File Handling in Python, Reading and Writing files, Additional file methods, Working with Directories.	Lectures Code Walkthroughs, Hand-on Programming, Problem Solving, Collaborative coding, Projects, Assessments	**8L+4P**	**Assignment, LAB (151 to 187)**	**CO5**
	Exception Handling	Exception Handling, Errors, Run Time Errors, Handling IO Exception, Try-except statement, Raise.				
Total				**40L+20P**		

Textbooks	
Sr No	**Book Details**
1.	John V Guttag, “Introduction to Computation and Programming Using Python” , Revised and expanded Edition,MITPress,2013.
2.	Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
3.	Robert Sedgewick, Kevin Wayne, Robert Dondero: Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd, 2016.
Reference Books	
Sr No	**Book Details**
1.	Ch Satyanarayana M Radhika Mani, B N Jagadesh, “Python programming”, Universities Press 2018.
2.	Wesley J. Chun, “Core Python Programming”, Pearson Education, Second Edition, 2007.
3.	Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2nd edition, Updated for Python 3, Shroff/O ‘Reilly Publishers, 2016
4.	Timothy A. Budd, Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,2015.
Links	
Unit I	https://www.youtube.com/watch?v=_uQrJ0TkZlc
Unit II	https://www.youtube.com/watch?v=PqFKRqpHrjw&list=PLsyeobzWxl7poL9JTVyndKe62ieoN-MZ3&index=23
Unit III	https://www.youtube.com/watch?v=0ZvaDa8eT5s&list=PLsyeobzWxl7poL9JTVyndKe62ieoN-MZ3&index=25
Unit IV	https://www.youtube.com/watch?v=6SPDvPK38tw
Unit V	Salim Merchant: Forging His Own Path. Now Streaming. #HouseOfGlenfiddich #WhereNext (youtube.com)

Problem Solving using Python Lab Experiments

Course Objective: Objective of this course is to impart knowledge of basic building blocks of Python programming, provide skills to design algorithms for problem solving, implementation and debugging of programs in Python using modules & packages, disseminate the knowledge of basic data structures.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Implement python programming logic.	**K3**
CO2	Develop decision-making and iterative control statements in Python.	**K4**
CO3	Create user defined functions and modules in python.	**K4**
CO4	Demonstrate the use of python data structures–lists, tuples, set, dictionaries.	**K5**
CO5	Apply file operations and exceptional handling in Python.	**K3**

List of Practical

Sr No	**Program Title**	**CO Mapping**
Basic Python (Syntax, Variable, Type Conversion)		
1.	Python Program to Print Statement.	**CO1**
2.	Swap two variables without using a temporary variable.	**CO1**
3.	Convert a string to an integer.	**CO1**
4.	Convert an integer to a string.	**CO1**
5.	WAP to demonstrate implicit and explicit type conversion.	**CO1**

Operators		
6.	Write a program to Calculate Sum of 5 Subjects and Find Percentage (Max Mark in each subject is 100).	**CO1**
7.	Write a program to find gross salary.	**CO1**
8.	Write a program to Calculate Area of Rectangle, Square.	**CO1**
9.	Write a program to Calculate Area of Scalene Triangle and Right-angle Triangle.	**CO1**
10.	Write a program to find the perimeter of a circle, rectangle and triangle.	**CO1**
11.	Write a program to Compute Simple Interest.	**CO1**
12.	Write a program to Convert Fahrenheit temperature in to Celsius.	**CO1**
13.	Write a program to apply bitwise operations on a=8, b=3.	**CO1**
14.	Write a program to apply identity operators.	**CO1**
15.	Write a program to Swap the Contents of two Numbers using Bitwise XOR Operation	**CO1**
16.	Write a program to Add two Complex Numbers.	**CO1**
17.	Write a Program to find roots of a quadratic expression.	**CO1**
Logical Operator		
18.	Write a program to apply Logical AND operator on two operands.	**CO1**
19.	Write a program to apply Logical OR operator on two operands.	**CO1**
20.	Write a program to apply Logical NOT operator on an operand.	**CO1**
Bitwise Operator		
21.	Program to perform bitwise AND, OR, XOR, left shift, and right shift operations.	**CO1**
22.	Program to check if a given number is odd or even using bitwise operators.	**CO1**
Conditional Statements		
23.	Write a program to Accept two Integers and Check if they are Equal.	**CO2**

24.	Write a program to Check if a given Integer is Positive or Negative and Odd or Even.	**CO2**
25.	Write a program to Check if a given integer is Divisible by 7 or not.	**CO2**
26.	Write a program to find the greatest of three numbers using else if ladder.	**CO2**
27.	Write a program to find the greatest of three numbers using Nested if.	**CO2**
28.	Write a program to convert an Upper-case character into lower case and vice-versa.	**CO2**
29.	Write a program to check weather an entered year is leap year or not.	**CO2**
30.	Write a Program to check whether an alphabet entered by the user is a vowel or a constant.	**CO2**
31.	Write a program to print day according to the day number entered by the user.	**CO2**
32.	Write a program to print color name, if user enters the first letter of the color name.	**CO2**
33.	WAP that accepts the marks of 5 subjects and finds the percentage marks obtained by the student. It also prints grades according to the following criteria: Between 90- 100% Print 'A', 80-90% Print 'B', 60-80% Print 'C', 50-60% Print 'D', 40-50% Print 'E', Below 40% Print 'F'.	**CO2**
34.	WAP to enter a character and then determine whether it is a vowel, consonants, or a digit.	**CO2**
Loops		
35.	Write a program to display all even numbers from 1 to 20	**CO2**
36.	Write a program to print all the Numbers Divisible by 7 from 1 to 100.	**CO2**
37.	Write a program to print table of any number.	**CO2**
38.	Write a program to Find the Sum of first 50 Natural Numbers using for Loop.	**CO2**
39.	Write a program to calculate factorial of a given number using for loop and while loop.	**CO2**
40.	Write a program to count the sum of digits in the entered number.	**CO2**
41.	Write a program to find the reverse of a given number.	**CO2**
42.	Write a program to Check whether a given Number is Perfect Number.	**CO2**
43.	Write a program to Print Armstrong Number from 1 to 1000.	**CO2**

44.	Write a program to Compute the Value of Xn.	**CO2**
45.	Write a program to Calculate the value of nCr.	**CO2**
46.	Write a program to generate the Fibonacci Series.	**CO2**
47.	Write a program to check whether a given Number is Palindrome or Not.	**CO2**
48.	Write a program to Check whether a given Number is an Armstrong Number.	**CO2**
49.	Write a program to print all prime numbers from 1-500.	**CO2**
50.	Write a program to display the following pattern: * * * * * * * * * * * * * * *	**CO2**
51.	Write a program to display the following pattern: 1 1 2 1 2 3 1 2 3 4 1 2 3 4 5	**CO2**
52.	Write a program to display the following pattern: A B B C C C D D D D	**CO2**

	E E E E E	
53.	Write a program to display the following pattern: * * * * * * * * * * * * * * *	**CO2**
54.	Write a program to display the following pattern: 1 2 3 4 5 1 2 3 4 1 2 3 1 2 1	**CO2**
55.	Write a program to display the following pattern: *	**CO2**
56.	Write a program to display the following pattern (Pascal Triangle): 1	**CO2**

	1 1 1 2 1 1 3 3 1 1 4 6 4 1 1 5 10 10 5 1	
57.	Write a program to display the following pattern: 1 2 3 4 5 6 7 8 9 10	**CO2**
58.	Write a program to display the following pattern: A B C D E F G F E D C B A A B C D E F F E D C B A A B C D E E D C B A A B C D D C B A	**CO2** **CO2**
59.	Write a program to display the following pattern: A BAB CBABC DCBABCD EDCBABCDE	**CO2**
60.	Write a program to Find the Sum of A.P Series.	**CO2**
61.	Write a program to find the Sum of following Series:	**CO2**

	(1*1) + (2*2) + (3*3) + (4*4) + (5*5) + ... + (n*n)	
62.	Write a program to find the Sum of following Series: (1^1) + (2^2) + (3^3) + (4^4) + (5^5) + ... + (n^n)	**CO2**
63.	Write a program to find the Sum of following Series: (1!/1) + (2!/2) + (3!/3) + (4!/4) + (5!/5) + ... + (n!/n)	**CO2**
64.	Write a program to print the following Series: 1, 2, 3, 6, 9, 18, 27, 54, ... up to n terms	**CO2**
65.	Write a program to print the following Series: 2, 15, 41, 80, 132, 197, 275, 366, 470, 587	**CO2**
66.	Write a program to print the following Series:1, 3, 4, 8, 15, 27, 50, 92, 169, 311	**CO2**
67.	Write a program to Convert the given Binary Number into Decimal.	**CO2**
68.	Write a program to find out L.C.M. of two numbers.	**CO2**
69.	Write a program to find out H.C.F. of two numbers.	**CO2**
70.	Python Program to Accept Three Digits and Print all Possible Combinations from the Digits.	**CO2**
71.	Python Program to Count the Number of Digits in a Number.	**CO2**
Functions		
72.	Write a Python function to find the Max of three numbers.	**CO3**
73.	Write a Python function to sum all the numbers in a list. Sample List: (8, 2, 3, 0, 7) Expected Output: 20	**CO3**
74.	Write a Python program to reverse a string. Sample String: "1234abcd" Expected Output: "dcba4321"	**CO3**
75.	Write a Python function to check whether a number falls in a given range.	**CO3**

76.	Write a Python function that accepts a string and calculates the number of upper-case letters and lower-case letters. Sample String: 'The quick Brow Fox' Expected Output: No. of Upper case characters: 3 No. of Lower case Characters: 1	**CO3**
77.	Write a Python function that takes a number as a parameter and check the number is prime or not.	**CO3**
78.	Write a Python function that checks whether a passed string is palindrome or not.	**CO3**
79.	Write a Python function that prints out the first n rows of Pascal's triangle.	**CO3**
80.	Write a Python function that accepts a hyphen-separated sequence of words as input and prints the words in a hyphen-separated sequence after sorting them alphabetically. Sample Items: green-red-yellow-black-white	**CO3**
81.	Python function to convert height (in feet and inches) to centimeters.	**CO3**
82.	Python function to Convert Celsius to Fahrenheit.	**CO3**
83.	Implement a function to check if two strings are anagrams of each other.	**CO3**
84.	Python function to display all the Armstrong number from 1 to n.	**CO3**
Recursion		
85.	Write a program using recursion to compute factorial of a given number.	**CO3**
86.	Write a program to print Fibonacci Series using recursion.	**CO3**
87.	Write a program to calculate sum of numbers 1 to N using recursion.	**CO3**
88.	Write a program to Find Sum of Digits of the Number using Recursive Function.	**CO3**
89.	Write a program to print Tower of Hanoi using recursion.	**CO3**
90.	Python Program to Determine How Many Times a Given Letter Occurs in a String recursively	**CO3**
91.	Python Program to Find the Binary Equivalent of a Number Recursively.	**CO3**
Modules and Packages		

92.	Write a program to create a module and import the module in another python program.	**CO3**
93.	Write a program to import all objects from a modules, specific objects from module and provide custom import name to the imported object from the module.	**CO3**
94.	Create a python package having at least two modules in it.	**CO3**
95.	Create a python package having at least one subpackage in it.	**CO3**
String		
96.	Python program to check whether the string is Symmetrical or Palindrome.	**CO4**
97.	Ways to remove ith character from string in Python	**CO4**
98.	Python program to Check if a Substring is Present in a Given String	**CO4**
99.	Find length of a string in python (4 ways)	**CO4**
100.	Python program to print even length words in a string	**CO4**
101.	Python program to accept the strings which contains all vowels	**CO4**
102.	Remove all duplicates from a given string in Python	**CO4**
103.	Python program to Maximum frequency character in String	**CO4**
104.	Python Program to Replace all Occurrences of ‘a’ with $ in a String	**CO4**
105.	Python Program to Form a New String where the First Character and the Last Character have been Exchanged.	**CO4**
106.	Python Program to Count the Number of Vowels in a String.	**CO4**
107.	Python Program to Take in a String and Replace Every Blank Space with Hyphen	**CO4**
108.	Python Program to Calculate the Length of a String Without Using a Library Function	**CO4**
109.	Python Program to Remove the Characters of Odd Index Values in a String	**CO4**
110.	Python Program to Calculate the Number of Words and the Number of Characters Present in a String	**CO4**
111.	Python Program to Take in Two Strings and Display the Larger String without Using Built-in Functions.	**CO4**

112.	Python Program to Check if a String is a Pangram or Not (A pangram is a sentence that uses all 26 letters of the English alphabet at least once. like" The quick brown fox jumps over the lazy dog")	**CO4**
113.	Python Program to Accept a Hyphen Separated Sequence of Words as Input and Print the Words in a Hyphen-Separated Sequence after Sorting them Alphabetically	**CO4**
114.	Python Program to Form a New String Made of the First 2 and Last 2 characters From a Given String	**CO4**
115.	Python Program to Count the Occurrences of Each character in a Given String Sentence	**CO4**
116.	Python Program to Check if a Substring is Present in a Given String	**CO4**
117.	Python Program to Find the Most Repeated Word in a String.	**CO4**
Regular Expression		
118.	Write a python program to check the validity of a password given by the user. The passwordshould satisfy the following criteria: i) Contain at least 1 letter between a and z. ii) Contain at least 1 number between 0 and 9. iii) Contain at least 1 letter between A and Z. iv) Contain at least 1 character from $,#,@. v) Maximum length of password 6. vi) Maximum length of password:12.	**CO4**
119.	Write a python program to validate mobile number.	**CO4**
120.	Given an input file which contains a list of names and phone numbers separated by spaces inthe following: i) Phone numbers contain a 3- or 2-digit area code and a hyphen followed by an 8-digit number. ii) Find all names having phone number with a 3digit area code using regular expression.	**CO4**
List		
121.	Program to interchange first and last elements in a list.	**CO4**

122.	WAP to find min, max and average of elements of a list having numeric data.	**CO4**
123.	Program to check if element exists in list.	**CO4**
124.	Program for Reversing a List.	**CO4**
125.	Program to Multiply all numbers in the list.	**CO4**
126.	Program to find smallest and largest number in a list	**CO4**
127.	Program to find second largest number in a list	**CO4**
128.	Program to print all even numbers in a range	**CO4**
129.	Program to print all negative numbers in a range	**CO4**
130.	Program to Remove multiple elements from a list in Python	**CO4**
131.	Program to Cloning or Copying a list	**CO4**
132.	Program to Count occurrences of an element in a list	**CO4**
133.	Program to find Cumulative sum of a list.	**CO4**
134.	Program to Break a list into chunks of size N in Python.	**CO4**
135.	Python Program to transpose of Matrix.	**CO4**
136.	Python Program to Add Two Matrices.	**CO4**
137.	Python Program to Multiply Two Matrices.	**CO4**
138.	Program to get Kth Column of matrix.	**CO4**
139.	WAP to print all even numbers of a list using list comprehension.	**CO4**
140.	WAP that prompts user to enter an alphabet and then print all the words that starts with that alphabet from the list of words.	**CO4**
141.	WAP to transpose a given matrix using list comprehension.	**CO4**
142.	Print All the characters of a string using list Comprehension	**CO4**
143.	Write a program to calculate square of numbers up to n using list comprehension.	**CO4**

Tuple		
144.	Python program to Find the size of a Tuple.	**CO4**
145.	Python – Maximum and Minimum Kth elements in Tuple.	**CO4**
146.	Create a list of tuples from given list having number and its cube in each tuple.	**CO4**
147.	Python – Flatten tuple of List to tuple.	**CO4**
Set		
148.	Python Program to Count the Number of Vowels Present in a String using Sets.	**CO4**
149.	Python Program to Check Common Letters in Two Input Strings	**CO4**
150.	Python Program that Displays which Letters are in the First String but not in the Second	**CO4**
Dictionary		
151.	Python Program to Add a Key-Value Pair to the Dictionary	**CO5**
152.	Python Program to Concatenate Two Dictionaries into One.	**CO5**
153.	Python Program to Check if a Given Key Exists in a Dictionary or Not	**CO5**
154.	Python Program to Generate a Dictionary that Contains Numbers (between 1 and n) in the Form (x,x*x).	**CO5**
155.	Python program to create an instance of an Ordered dict using a given dictionary. Sort thedictionary during the creation and print the members of the dictionary in reverse order.	**CO5**
156.	Python Program to Sum All the Items in a Dictionary	**CO5**
157.	WAP to create dictionary which has characters of given string as keys and frequency ofcharacters as values.	**CO5**
158.	Python Program to Multiply All the Items in a Dictionary	**CO5**
159.	Python Program to Remove the Given Key from a Dictionary	**CO5**
160.	Python Program to Form a Dictionary from an Object of a Class	**CO5**
161.	Python Program to Map Two Lists into a Dictionary	**CO5**

Comprehension		
162.	Write a program Filtering even numbers from a list using tuple comprehension	**CO5**
163.	Creating a list of tuples from two lists using comprehension function	**CO5**
164.	Extracting the first character from each word in a list of strings	**CO5**
165.	Swapping keys and values in a dictionary.	**CO5**
166.	Filtering even numbers from a dictionary.	**CO5**
167.	Write a Program to calculate square of number using dictionary comprehension	**CO5**
File handling and Exceptional Handling		
168.	Python program to read file word by word	**CO5**
169.	Python program to read character by character from a file	**CO5**
170.	Python – Get number of characters, words, spaces and lines in a file	**CO5**
171.	Program to Find 'n' Character Words in a Text File	**CO5**
172.	Python Program to obtain the line number in which given word is present	**CO5**
173.	Count number of lines in a text file in Python	**CO5**
174.	Python Program to remove lines starting with any prefix	**CO5**
175.	Python Program to Eliminate repeated lines from a file	**CO5**
176.	Python Program to read List of Dictionaries from File	**CO5**
177.	Python – Append content of one text file to another	**CO5**
178.	Python program to copy odd lines of one file to other	**CO5**
179.	Python Program to merge two files into a third file	**CO5**
180.	Python program to Reverse a single line of a text file	**CO5**
181.	Python program to reverse the content of a file and store it in another file	**CO5**

182.	Python Program to handle divide by zero exception.	**CO5**
183.	WAP to handle multiple exception.	**CO5**
184.	Python program to combine each line from first file with the corresponding line in second file.	**CO5**
185.	Write a program to copy the contents of one file to another.	**CO5**
186.	Write a program to print First 5 line in a file.	**CO5**
187.	A) Write a program to catch the following exception: i) Value error ii) Index error iii) Name error iv) Type error v) Divide zero error B) Write a program to create user defined exceptions. C) Write a program to understand the use of else and finally block with try block. D) Write a python program that uses raise and exception class to throw an exception.	**CO5**
Required Software and Tools		
1. IDLE (Open Source) **2.** Jupyter (Open Source) **3.** Visual Studio Code (Open Source)		

Subject Name: Computer Fundamentals & Networking – Lab		**L-T-P [0-0-2]**
Subject Code: BBCA0151		**Applicable in Department: BCA**
Course Objective: The objective of this course is to introduce computer hardware, software, and operating systems. Explore basic networking concepts including protocols and security. Develop skills in troubleshooting and understanding emerging technologies in computing and networking.		
Course Outcomes (CO)		
Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Identify various components of computer system i.e motherboard, CPU, RAM, storage devices, input/output devices and file management processes.	**K2**
CO2	Apply DOS and Linux commands.	**K3**
CO3	Identify transmission media and create network topologies i.e star, bus, mesh, ring and hybrid.	**K4**
CO4	Demonstrate network protocols i.e TCP/IP, UDP, HTTP, FTP, SMTP within packet tracer environment.	**K4**
CO5	Apply security features i.e firewalls, access control lists (ACLs), and virtual private networks (VPNs) using Packet Tracer.	**K3**
List of Practicals		
Sr No	**Program Title**	**CO Mapping**
Identification of various computer components		
1	Identify and label various computer components such as motherboard, CPU, RAM, storage devices and input/output	**CO1**

	devices.	
File management		
2	Perform file management operations such as creating, copying, moving, and deleting files and folders on different storage media.	**CO2**
3	Demonstrate the process of assembling and disassembling a computer system.	**CO2**
DOS commands		
4	**e x e c u t e**	**CO2**
5	Customize the DOS prompt and learn about environment variables (e.g., PATH, TEMP).	**CO2**
Linux Commands		
6	Execute following Linux command: i) ls (list files/directories) ii) cd (change directory) iii) mkdir (create directory) iv) rmdir (remove directory) v) cp (copy files/folders) vi) mv (move files/folders) vii) rm (remove files/folders) viii)cat (display file contents)	**CO2**
7	E x e	**CO2**

Transmission Media		
8	Identify different transmission media, such as twisted-pair cables, coaxial cables, and fiber-optic cables.	**CO3**
9	To create and configure different network topologies, such as bus, ring, star, mesh, and hybrid topologies.	**CO3**
10	Demonstrate the making of RJ45 connector.	**CO3**
11	Set up a small local area network (LAN) using switches, routers, and computers or virtual machines.	**CO3**
Network Protocols		**CO3**
12	Configure different network protocols (e.g., TCP/IP, UDP, HTTP, FTP, SMTP) on devices within the Packet Tracer environment.	**CO3**
Communication Channels		
13	Set up a serial communication link between two devices (e.g., routers, switches, or computers) using Packet Tracer's serial interface modules.	**CO4**
14	Design and configure IP addressing schemes and subnetting for different network topologies.	**CO4**
15	Experiment with different subnet masks and observe the effects on network communication and routing.	**CO4**
Network address		**CO4**
16	Simulate scenarios involving network address translation (NAT) and analyze the impact on network addressing.	**CO4**
Network Security		
17	Set up various security features and configurations, such as firewalls, access control lists (ACLs), and virtual private networks (VPNs) using Packet Tracer.	**CO5**
Required Software and Tools		
1. Linux Operating System 2. Cisco Packet Tracer		

Subject Name: Workplace Communication Lab 1	**L-T-P [0-0-4]**
Subject Code: BBCA0157	**Applicable in Department: BCA**

Pre-requisite of Subject: Comprehension of basic English language

Course Objective:

- To improve proficiency in the English language to the Intermediate level of CEFR (Common European Framework of Languages).
- To motivate students to look within and create a better version of 'self.'
- To introduce the key concepts of ethics, etiquette, and life skills.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Identify key concepts of life-skills.	**K2**
CO2	Apply effective listening skills.	**K3**
CO3	Demonstrate fluency and spontaneity while speaking.	**K3**
CO4	Understand and analyze simple written texts.	**K4**
CO5	Compose clear and concise texts on a wide range of subjects.	**K6**

List of Practical

Sr No	Program Title	CO Mapping
1	**Introduction to the course and the evaluation scheme** Students will gain knowledge about Examination Pattern.	**CO1**

2	**Importance of Communication Skills and motivation to improve** Students will watch Video Clips of famous personalities who have learnt to communicate well e.g., Kapil Dev, Jahnvi Panwar, APJ Abdul Kalam, and others.	**CO1**
3	**Anubhav Activity** Students will share their expectations from the course.	**CO1**
4	**Showcasing the talents** Participants will gain confidence in expressing themselves through song/dance, overcome inhibitions, and develop a sense of freedom and creativity.	**CO1**
5	**Developing active listening and accurate communication skills** Participants will enhance their listening skills, practice conveying information accurately, and understand the importance of clear communication and active listening.	**CO1**
6	**Language Toolbox: Vocabulary enrichment** Participants will be exposed to General Service List (GSL) by West and Academic Word List (AWL); the students will be asked to keep a journal of new words learnt every day.	**CO1**
7	**Introducing others and oneself** Participants will improve their speaking skills and develop clarity in listening and retaining information.	**CO1**
8	**Think-Pair-Share for Reading Comprehension** Students will actively interact with the reading material by engaging in this activity, collaborating with their peers, and refining their comprehension skills.	**CO2**
9	**Basics of Writing** The students will practice basic writing skills through sentence construction by understanding the requisites of a good sentence.	**CO2**
10	**Listen and write** The students will practice writing exactly what they hear.	**CO2**
11	**Reading aloud**	**CO2**

	The students will improve their reading ability and vocabulary. Students will read Economic Times, Readers Digest, Fiction, National Geographic, Technology magazines etc.	
12	**Art of Listening** Participants will listen to their peers reading aloud and write down the gist; and will repeat verbatim what is read.	**CO2**
13	**Language Toolbox 2: Word association & word formation** The students will be able to improve their language proficiency.	**CO2**
14	**Writing through prompts** The students will practice writing skills through visual or verbal prompts.	**CO3**
15	**Listening to directions and instructions** Participants will improve their listening comprehension and enhance their ability to follow instructions & directions.	**CO3**
16	**Analysing Caselets** The students will improve their analytical and speaking skills by analysing & providing solutions to the issues in the caselets.	**CO3**
17	**Decoding infographics** Participants will improve their ability to interpret and analyse information presented in diagrams, graphs, and pie charts.	**CO4**
18	**Language Toolbox 3: Vocabulary Building – Homophones, homonyms, synonyms, antonyms, phrases & idioms** The students will be able to bring in variety in the usage of words.	**CO4**
19	**Filling forms** Participants will improve their ability to understand and follow instructions and develop ability in filling out forms accurately.	**CO4**
20	**Writing Captions and Identifying Topic Sentences** The students will be provided with paragraphs on a variety of topics to develop their concise & precise writing skills.	**CO5**
21	**Sharing your views in a group discussion** Participants will enhance their ability to express their opinions, actively listen to others, and engage in constructive discussions to develop well-rounded perspectives.	**CO4**

22	**Language Toolbox 4: Vocabulary Enrichment – Abbreviations and Acronyms** The exercises and activities will enhance language proficiency of the students by helping them bring in variety in their usage of words.	**CO5**
23	**Basics of Email Writing** Students will be able to write letters/applications on familiar topics and will gain knowledge to apply in real life scenarios.	**CO5**
24	**Situation-based Role Play** The students will write and present role plays to practice effective communication strategies, develop empathy and understanding, and improve their writing skills and ability to handle real-life situations through role-playing exercises.	**CO5**
25	**Language Toolbox 5: Developing concise and clear communication** The students will be able to remove verbosity from their language.	**CO5**
26	**Project Presentations** The students will be presenting their Projects	**CO5**

Required Software and Tools

- British Council English Score Mobile App

Textbooks

Sr No	Book Details
1	ABC Workbook, NIET Publishing House, Meerut, 2023

Reference Books

Sr No	Book Details
1	Cambridge English Business Benchmark (Pre-intermediate to Intermediate), 2nd edition, Norman Whitby, Cambridge University Press, 2013, UK.

2	Listening in the Language Classroom by John Field, Cambridge University Press, 2021, UK.
3	Speaking: Second Language Acquisition, from Theory to Practice by William Littlewood, **Cambridge University Press, 2022, UK.**
4	Second Language Writing in Transitional Spaces: Teaching and Learning Across Languages and Cultures edited by Viniti Vaish and Guangwei Hu, Routledge, 2019, UK.
5	The Writing Revolution: A Guide to Advancing Thinking Through Writing in All Subjects and Grades by Judith C. Hochman and Natalie Wexler, Jossey-Bass, 2022, USA.
6	The Cambridge Handbook of Corrective Feedback in Second Language Learning and Teaching edited by Hossein Nassaji and Eva Kartchava, **Cambridge University Press, 2021, UK**
7	IELTS 11: General Training with answers. Cambridge English, 2018

Subject Name: Working with Excel – Lab		**L-T-P [0-0-2]**
Subject Code: BBCA0152		**Applicable in Department: BCA**
Course Objective: The objective of this course is to supervise students with a comprehensive understanding of Microsoft Excel from basic operations to advanced data analysis and visualization techniques.		
Course Outcomes (CO)		
Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Apply operation of Excel's interface, data entry and formatting to create and manage spreadsheets effectively.	**K3**
CO2	Apply essential formulas and functions to perform calculations and data analysis efficiently.	**K4**
CO3	Develop skills in sorting, filtering and using tables to organize and analyze large datasets.	**K5**
CO4	Apply advanced functions, Pivot tables, and what-if analysis tools to enhance data insights and decision-making.	**K4**
CO5	Create and customize charts and dashboards to visualize data and present information clearly and effectively.	**K5**
List of Practical		
Sr No	**Program Title**	**CO Mapping**
Data entry and editing in MS Excel		**CO1**
1	Create a new workbook and save it as "Budget.xlsx".	**CO1**
2	Enter data into cells A1 to D5 with headers "Item", "Quantity", "Price", and "Total".	**CO1**
3	Use AutoFill to fill the months of January to December in a row.	**CO1**
4	Change the font of the headers to bold and size 14.	**CO1**
5	Format cells B2 to B5 to display currency.	**CO1**
6	Adjust the width of column A to fit the content.	**CO1**

7	Apply a border around the range A1.	**CO1**
8	Merge and center the title "Monthly Budget" across columns A to D.	**CO1**
9	Apply a background color to the header row (A1).	**CO1**
10	Insert a new worksheet and rename it "Summary".	**CO1**
General Formulas in Excel		
11	Write a formula in cell D2 to calculate the total price (Quantity * Price).	**CO2**
12	Copy the formula in D2 down to D5 using AutoFill.	**CO2**
13	Use the SUM function to calculate the total expenditure in cell D6	**CO2**
14	In cell E2, use an IF function to check if the total is greater than 100, returning "Yes" or "No".	**CO2**
15	Apply the AVERAGE function to find the average price in column C.	**CO2**
16	Use the MIN function to find the minimum quantity in column B.	**CO2**
17	Write a formula in F2 to look up the price of an item using VLOOKUP.	**CO2**
18	Use the COUNT function to count the number of items in column A.	**CO2**
19	Create a formula in G2 to concatenate the item name and quantity.	**CO2**
20	Write a formula using the AND function to check if both conditions are met in cell H2.	**CO2**
Data Analysis		
21	Sort the data in the range A2 by the Item name alphabetically.	**CO3**
22	Apply a filter to the data in the range A1.	**CO3**
23	Use a filter to display only items with a price greater than 50.	**CO3**
24	Apply conditional formatting to highlight cells in column D that are greater than 200.	**CO3**
25	Set up data validation in cell E2 to allow only whole numbers between 1 and 100.	**CO3**
26	Create a table from the range A1 and apply a table style.	**CO3**

27	Add a total row to the table to sum the values in the "Total" column.	**CO3**
28	Insert a slicer for the "Item" column in the table.	**CO3**
29	Use structured references to sum the total prices in the table.	**CO3**
30	Remove duplicates from a list of items in column A.	**CO3**
Pivot tables and specific formulas in MS Excel		
31	Create a Pivot Table from the data in the range A1.	**CO4**
32	Add "Item" to the Rows area and "Total" to the Values area in the PivotTable.	**CO4**
33	Create a PivotChart based on the PivotTable.	**CO4**
34	Use the TEXT function to format a date in cell B2 as "Month Day, Year".	**CO4**
35	Write an array formula to multiply the quantities and prices in columns B and C.	**CO4**
36	Use the DATE function to create a date from year, month, and day in separate cells.	**CO4**
37	Implement the Goal Seek tool to find the necessary quantity to reach a total of 500.	**CO4**
38	Set up a Scenario Manager to compare different budget scenarios.	**CO4**
39	Create a data table to show the effect of varying prices on total expenditure.	**CO4**
40	Use the INDEX and MATCH functions to retrieve data from a table.	**CO4**
Charts creation in Excel		
41	Create a column chart from the data in the range A1.	**CO5**
42	Add a title to the chart "Monthly Expenditure".	**CO5**
43	Customize the chart colors to match a specific theme.	**CO5**
44	Add data labels to the chart.	**CO5**
45	Create a pie chart to show the distribution of total expenditure by item.	**CO5**
46	Use sparklines to show trends in monthly sales data.	**CO5**

47	Insert a bar chart and change the axis titles.	**CO5**
48	Create a combination chart with both line and column series.	**CO5**
49	Design an interactive dashboard using slicers and Pivot Charts.	**CO5**
50	Link a chart to a different worksheet for a consolidated view.	**CO5**
51	Apply a custom chart template to a new chart.	**CO5**
52	Add a secondary axis to a chart to display dual metrics.	**CO5**
53	Format a chart with gradients and 3D effects.	**CO5**
54	Create a waterfall chart to show changes in values over time.	**CO5**
55	Insert a bubble chart to display data with three dimensions.	**CO5**
56	Use a gauge chart to represent a KPI (Key Performance Indicator).	**CO5**
57	Develop a sales dashboard with interactive elements.	**CO5**
58	Add a timeline slicer to a Pivot Table.	**CO5**
59	Create a heat map using conditional formatting to highlight data ranges.	**CO5**
60	Publish a dashboard to Power BI for broader sharing and collaboration.	**CO5**

Required Software and Tools

1. MS Excel

Subject Name: Data Structures using python	**L-T-P [3-0-0]**
Subject Code: BBCA0201	**Applicable in Department: BCA**

Pre-requisite of Subject: Knowledge of programming languages, basics of mathematics, organizing and problem-solving ability.

Course Objective: Learn the basic concepts of algorithm analysis, along with implementation of linear and non- linear data structures.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Describe the need of data structure and algorithms in problem solving and Analyse Time space trade-off.	**K4**
CO2	Describe the real-world applications using stack and queue.	**K2**
CO3	Discuss different Linked list operations.	**K2**
CO4	Evaluate the real-world applications using non-linear data structures.	**K4**
CO5	Identify and analyse the computational efficiencies of searching and sorting algorithms in real world problems	**K5**

Syllabus

Unit No	Module Name	Topic covered	Pedagogy	Lecture Required (L+P)	Practical/ Assignment/ Lab Nos	CO Mapping
I Introduction to	**Data Types**	Types of Data Structures- Linear & Non-Linear Data Structures, List, Tuple, Set, Dictionary. Arrays: Derivation of Index Formulae for 1-D,2-D,3-D and n-D Array	Lectures, PPTs, Notes	**8L+4P**	**Assignment, Lab (1 to 10)**	**CO1**

Data Structures	**Analysis of algorithms**	Time and Space Complexity of an algorithm, Asymptotic notations (Big Oh, Big Theta and Big Omega).				
II Stack & Queues	**Stacks**	Primitive Stack operations: Push & Pop, mutual conversion of Infix, Prefix, Postfix, Evaluation of postfix expression	Lectures, PPTs, Notes	**8L+4P**	**Assignment, Lab (11 to 20)**	**CO2**
	Recursion	Principles of recursion, Types of Recursions, Problem solving using iteration, Tower of Hanoi,Trade-offs between iteration and recursion.				
	Queues	Operations on Queue: Create, Insert, Delete, Full and Empty, Circular queues, Dequeue and Priority Queue.				
III Linked lists	**Linked lists**	Linked lists: Comparison of Array, List and Linked list Types of linked list: Singly Linked List, Doubly Linked List, Circular Linked List, Polynomial Representation and Addition of Polynomials**.**	Lectures, PPTs, Notes	**8L+4P**	**Assignment, Lab (21 to 30)**	**CO3**
IV Trees	**Trees**	Trees: Basic terminology, Binary Trees, Binary Tree Representation, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree, Extended Binary Tree, Tree Traversal algorithms: In-order, Pre-order and Post-order. Constructing Binary Tree from given Tree Traversal, Binary Heaps, Heap Operations, Threaded Binary trees, Traversing Threaded Binary trees, AVL Tree, B-Tree.	Lectures, PPTs, Notes	**8L+4P**	**Assignment, Lab (31 to 40)**	**CO4**

V Graphs	**Graphs**	Graphs: Terminology used with Graph, Graph Sorting Techniques: Representations: Adjacency matrices, Adjacency List. Connected Component, Spanning Trees, Prim's and Kruskal's algorithm, Shortest Path algorithms: Dijkstra Algorithm,Floyd Warshall's Algorithm	Lectures, PPTs, Notes	**8L+4P**	**Assignment, Lab (40 to 50)**	**CO5**
	Hashing	Sorting Algorithms. Hashing: Hash Functions, Collision-Resolution Techniques.				
Total				**40L+20P**		

Textbooks

Sr No.	Book Details
1.	Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python(An Indian Adaptation)", Wiley Publication
2.	Dr Shriram K. Vasudevan (Author), Mr Abhishek S. Nagarajan (Author), Prof Karthick Nanmaran (Author) "DATA STRUCTURES USING PYTHON" 12 March 2021, Oxford Higher Education, First Edition
3.	Hemant Jain "Problem Solving in Data Structures & Algorithms Using Python" 1 January 2022, Third Edition

Reference books

Sr No.	Book Details
1.	Kiran Gurbani, Krupa Kamdar "Data Structure (Mumbai University), Himalaya Publishing House.
2.	Harsh Bhasin (Author) "Data Structures with Python: Get familiar with the common
3.	Data Structures and Algorithms in Python", 1 May 2023, BPB Publication.
4.	Sanjay Patidar Upendra Singh Sumit Kumar Sharma "DATA STRUCTURES AND ALGORITHMS USING PYTHON " 13 April 2023, Notion Press

Links:	
Unit I	https://nptel.ac.in/courses/106/106/106106127/ https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F
Unit II	https://www.youtube.com/watch?v=4OxBvBXon5w&list=PLBF3763AF2E1C572F&index=22

Unit III	https://www.youtube.com/watch?v=cR4rxllyiCs&list=PLBF3763AF2E1C572F&index=23 https://nptel.ac.in/courses/106/106/106106127/
Unit IV	https://www.youtube.com/watch?v=9zpSs845wf8&list=PLBF3763AF2E1C572F&index=24
Unit V	https://www.youtube.com/watch?v=hk5rQs7TQ7E&list=PLBF3763AF2E1C572F&index=25

Subject Name: Digital Logic and Circuit Design	**L-T-P [3-0-0]**
Subject Code: BBCA0202	**Applicable in Department: BCA**

Pre-requisite of Subject: Basic knowledge of mathematics, physics & basic electronics.

Course Objective: This course is intended to provide the students with a comprehensive understanding of the fundamental of digital logic circuit. The design of circuits and systems whose input and outputs are represented as discrete variables. Industry runs the entire automatic system because of digital electronics. It plays a critical role in the success of businesses. It enhances communication, increases efficiency, enables remote work, and enhances security.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Apply concepts of Digital Binary System and implementation of Gates.	**K3**
CO2	Analyse and design of Combinational logic circuits.	**K4**
CO3	Analyse and design of Sequential logic circuits with their applications.	**K4**
CO4	Analyse the design of finite state machine.	**K4**
CO5	Implementation of IoT devices with sensors.	**K3**

Syllabus

Unit No	Module Name	Topic covered	Pedagogy	Lecture Required (L+P)	Practical/ Assignment/ Lab Nos	CO Mapping
I	**Digital System**	Number System and its arithmetic, signed binary numbers, compliments, Binary codes, Cyclic codes, Hamming Code,	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO1**

Digital System and Binary Numbers	**and Binary Numbers**	Simplification of Boolean Expression: K-map method up to five variables, SOP and POS Simplification Don't Care Conditions, Logic Gate, NAND and NOR Gate				
II **Combinational Logic**	**Combinational Logic**	**Combinational Circuits:** Analysis Procedure, Design Procedure, Code Converter, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, Demultiplexers	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO2**
III **Sequential Logic and Its Applications**	**Sequential Logic and Its Applications**	**Sequential Circuits:** Latches & Flip Flops, Characteristic Equations of Flip Flops, Excitation Table of Flip Flops, Flip Flop Conversion, Registers, Shift Registers, Synchronous and Asynchronous Counters, Other Counters: Johnson &Ring Counter	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO3**
IV **finite state machine**	**finite state machine**	**Introduction to finite state machine:** Pulse and fundamental mode of operation, realization of state table from verbal description, state diagram & Transition matrix, Mealy and Moore Hazards.	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO4**
V **Introduction to IoT**	**Introduction to IoT**	**Introduction to IoT:** What is IoT, Impact of IoT, IoT Challenges. IoT network architecture & design: M2M. 'Things' in IoT: Sensors, Actuators, Smart objects, Basics of Sensor Networks. Communicating smart objects: Arduino Uno, Node mcu esp8266, interfacing with sensors.	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO5**
Total				**40L**		
Textbooks						

Sr No	Book Details
1.	M. Morris Mano and M. D. Ciletti, “Digital Design”, Pearson Education5th Edition.
2.	David J. Comer, “Digital Logic & State Machine Design”, Oxford University Press, 3rd Edition.
3.	R P Jain, “Modern Digital Electronics”, Tata McGraw Hill Publication, 3rd Edition.
4.	D. Hanes, G. Salgueiro, P. Grossetete, R. Barton, J. Henry; IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 1st Edition, Pearson India Pvt. Ltd., 2018.
Reference Books	
Sr No	**Book Details**
1.	D P Kothari and J.S. Dhillon, “Digital Circuits and Design”, Pearson Education.
2.	A. Anand Kumar, “Fundamentals of Digital Circuits”, PHI Learning Pvt. Ltd.
Links	
Unit I	https://www.youtube.com/watch?v=yKPD_UkbgXo https://www.youtube.com/watch?v=L9X7XXfHYdU&list=PLxCzCOWd7aiHMonh3G6QNKq53C6oNXGrX
Unit II	https://www.youtube.com/watch?v=FavBqeTTmO0 https://www.youtube.com/watch?v=p6yPvw88BJk
Unit III	https://www.youtube.com/watch?v=LTtuYeSmJ2g https://www.youtube.com/watch?v=iaIu5SYmWVM
Unit IV	https://www.youtube.com/watch?v=kb-Ww8HaHuE
Unit V	https://www.youtube.com/watch?v=bVFfcYh6UBw https://www.youtube.com/watch?v=hIISiYs7lDo

Subject Name: Data Analytics using Excel/Power BI/ Google Analytics	L-T-P [3-0-0]
Subject Code: BBCA0203	**Applicable in Department: BCA**
Pre-requisite of Subject: Basic understanding of computers and familiarity with Microsoft Excel.	
Course Objective: Understand the basics of Google Analytics and how to track website data.	

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Analyze set up and track website which include creating and managing goals,tracking events and analyzing audience behavior.	**K4**
CO2	Design and develop dashboards, reports and visualizations using Power BI by datamodeling, data visualization and report publishing.	**K4**
CO3	Discuss advanced Excel skills which include data manipulation, analysis andvisualization using formulas, functions and pivot tables.	**K3**
CO4	Apply data analysis techniques by regression analysis, clustering analysis and time series analysis.	**K4**
CO5	Design and present reports and dashboards that effectively communicate insights andrecommendations	**K4**

Syllabus

Unit No	Module Name	Topic covered	Pedagogy	Lecture Required (L+P)	Practical/ Assignment/ Lab Nos	CO Mapping
I Advanced Excel Skills	**Formulas and Functions**	Creating a Formula, Formula Auditing, Meaning and Advantages of functions, Insert function.	Lectures, PPTs, Notes	**8L+4P**	**Assignment, Lab (1 to 11)**	**CO1**
	Mathematical	SUM, AUTOSUM, SUMIF, SUBTOTAL PRODUCT, POWER, SQRT, ROUND. Statistical Functions: AVERAGE, AVERAGEIF				

	Functions	and AVERAGEIFS, COUNT, COUNTA, COUNTIF, COUNTIFS, MAX MIN, MEDIAN, MODE.				
	Date & time Functions	DATE, NOW, DAY, YEAR, MONTH, TIME, TODAY, WEEKDAY, DATEVALUE.				
	Look Up & Reference	VLOOKUP & HLOOKUP Financial Functions: Rate, Type, PV, FV, NPER, PMT, IPMT, CUMIPMT, NPV, IRR.				
	Names in Excel	Defining Names, Using and Managing Defined Names.				
II **Data Analysis with Excel**	**PivotTables**	Creating a PivotTable, Specifying PivotTable Data, Filtering and Sorting a PivotTable, working with Pivot Table Layout, Grouping PivotTable Items, updating a PivotTable, formatting a PivotTable using Slicers to manipulate PivotTables, Creating a PivotChart. What if Analysis: Scenario manager, Goal seek, Data table. Import external data: From Access, From Web, Fromtext, from SQL Server, From SQL Query. Macros: View Macros, Record Macros, Use relative Reference.	Lectures, PPTs, Notes	**8L+4P**	**Assignment, Lab (12 to 20)**	**CO2**
III **Introduction To Power BI and Creating Power Bi Reports, Auto Filters**	**Introduction**	Overview of Power BI, creating a new Power BI dashboard, connecting to data sources in Power BI, Understanding the different types of visualizations in Power BI Creating Power BI Reports.	Lectures, PPTs, Notes	**8L+4P**	**Assignment, Lab (21 to 35)**	**CO3**
	Report Design	Report Design with Legacy & .DAT Files, Report Design with Database Tables, Understanding Power BI Report Designer, Report Canvas.				
	Report Pages	Creation, Renames, Report Visuals, Fields and UI Option, Experimenting Visual Interactions, Advantages, Reports with Multiple Pages and Advantages, Pages with Multiple Visualizations. Data Access, PUBLISH Options and Report				

		Verification in Cloud.				
IV **Creating Interactive Dashboards in Power BI and Report Visualizations and Properties**	**Creating Interactive Dashboards**	Creating tables and charts in Power BI, creating maps and geolocation visualizations in Power BI, Creating interactive dashboards with slicers and filters.	Lectures, PPTs, Notes	**8L+4P**	**Assignment, Lab (36 to 40)**	**CO4**
	Report Visualizations and Properties	Report Visualizations and Properties: Power BI Design: Canvas, Visualizations and Fields, Import Data Options with Power BI Model, Advantages, Direct Query Options and Real-time (LIVE) Data Access, Data Fields and Filters with Visualizations, Visualization Filters, Page Filters, Report Filters, Conditional Filters and Clearing. Testing Sets, Creating Customized Tables with Power BI Editor, General Properties, Sizing, Dimensions, and Positions, Alternate Text and Tiles. Header (Column, Row) Properties, Grid Properties (Vertical, Horizontal) andStyles, Table Styles & Alternate Row Colors - Static, Dynamic, Sparse, Flashy Rows, Condensed Table Reports Focus Mode, Totals Computations, Background. Borders.				
V **Introduction to Google Analytics and Google Analytic Reports and custom**	**Overview of Google Analytics**	Overview of Google Analytics, setting up and configuring Google Analytics for a website, Understanding the Google Analytics interface, tracking website data with Google Analytics, Different types of reports in Google Analytics, Audience report to analyze website traffic, Acquisition report to analyze website traffic sources, Behavior report to analyze website behavior, Create custom dashboards in Google Analytics, custom reports in Google Analytics, filters and segments in Google Analytics.	Lectures, PPTs, Notes	**8L+4P**	**Assignment, Lab (41 to 50)**	**CO5**

Dashboard						
Total				**40L+20P**		

Textbooks	
Sr No.	**Book Details**
1.	Joe Webinar, "Excel Data Analysis", "Kindle Publication", "20 February 2022"
2.	Gerg Deckler and Brett Powell, Mastering Microsoft Power BI", "Packet Publishing", "2nd Edition," June 30 2022"

Reference books	
Sr No.	**Book Details**
1.	Avinash Kaushik, Web Analytic An Hour a Day, Sybex publication","1st edition 2007"
2.	Roger F. Silva, "Power BI 2019","2nd Edition" October 4, 2019"

Links	
Unit I	https://www.youtube.com/watch?v=8Ob8Hre_SnI
Unit II	https://www.youtube.com/watch?v=OOWAk2aLEfk
Unit III	https://www.youtube.com/watch?v=cN8AO3_vmlY
Unit IV	https://www.youtube.com/watch?v=KfxyzDjPz_4
Unit V	https://www.youtube.com/watch?v=nW7iSgmSaQ8

Subject Name: Mathematics for computer applications	**L-T-P [3-1-0]**
Subject Code: BBCA0204	**Applicable in Department: BCA**

Pre-requisite of Subject: Basic Knowledge of Statistics.

Course Objective:

- Understand the concept of correlation, moments, skewness and kurtosis and curve fitting.
- Remember the concept of probability to evaluate probability distributions.
- Understand the concept of Mathematical Expectations and Probability Distribution.
- Apply the concept of hypothesis testing and statistical quality control to create control charts.
- Enhance the basic aptitude skills of the students.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Understand the concept of correlation, moments, skewness and kurtosis and curve fitting.	**K2**
CO2	Remember the concept of probability to evaluate probability distributions.	**K1**
CO3	Understand the concept of Mathematical Expectations and Probability Distribution.	**K2**
CO4	Apply the concept of hypothesis testing and statistical quality control to create control charts.	**K3**
CO5	Solve the problems of Ratio, Proportion & Partnership, Problem of ages, Allegation & Mixture, Direction, Blood relation, Simple & Compound interest, Permutation & Combination.	**K3**

Syllabus

Unit No	Module Name	Topic covered	Pedagogy	Lecture Required	Practical/ Assignment/ Lab Nos	CO Mapping

				(L+P)		
I Descriptive Statistics	**Descriptive Statistics**	Introduction: Measures of central tendency: Mean, Median, Mode, Moment, Skewness, Kurtosis, Curve Fitting, Method of least squares, Fitting of straight lines, Fitting of second degree parabola, Correlation and Rank correlation, Linear regression, nonlinear regression and multiple linear regression.	Classroom Teaching, Smart Board, PPT, M- tutor.	**10L**	**Assignment**	**CO1**
II Probability and Random Variables	**Probability and Random Variables**	Basic concept and Problems of Probability, Random Variable, Discrete Random Variable, Continuous Random Variable, Probability mass function, Probability Density Function, Distribution functions.	Classroom Teaching, Smart Board, PPT, M- tutor.	**10L**	**Assignment**	**CO2**
III Probability Distributions	**Probability Distributions**	Expectations (For single Variable): Introduction, Expected Value of a Random Variable, Mean, Variance, Moment Generating Function, Probability Distributions: Binomial, Poisson, Normal distribution.	Classroom Teaching, Smart Board, PPT, M- tutor.	**10L**	**Assignment**	**CO3**
IV Testing of Hypothesis	**Testing of Hypothesis**	Testing a Hypothesis, Null hypothesis, Alternative hypothesis, Level of significance, Confidence limits, Test of significance of difference of means, Z-test, t-test and Chi-square test, F-test, ANOVA: One way.	Classroom Teaching, Smart Board, PPT, M- tutor.	**8L**	**Assignment**	**CO4**
V Aptitude-II	**Aptitude-II**	Ratio, Proportion & Partnership, Problem of ages, Allegation & Mixture, Direction, Blood relation, Simple & Compound interest, Permutation & Combination.	Classroom Teaching, Smart Board, PPT, M- tutor.	**8L**	**Assignment**	**CO5**
Total				**46L**		

Textbooks	
Sr No	**Book Details**

1.	S. P. Gupta, Statistical Methods, Sultan Chand & Sons.
2.	Sharma, J. K., Business Statistics, Pearson Education, New Delhi.
3.	J. N. Kapur: Mathematical Statistics; S. Chand & Sons Company Limited, New Delhi.
4.	B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher.
Reference Books	
Sr No	**Book Details**
1.	
2.	
3.	, “Quantitative Analysis for Management”, Pearson Education.
4.	Quantitative Aptitude by R.S. Aggarwal.
5.	Vishwanathan, P. K., “Business Statistics and Applied Orientation”, Pearson Education.
Links	
Unit I	https://youtu.be/XaHFNhHfXwQ?si=OJKYu_BVt4n88ONp https://youtu.be/BsVtMnp3vks?si=orRM338vLgBE-hQS https://www.youtube.com/watch?v=C9qSISDHjX4&pp=ygUtbmVwdGwgY3VydmUgZml0dGluZyBmaXR0aW5nIG9mIHN0cmFpZ2h0IGxpbmUg https://www.youtube.com/watch?v=OQV8WmUdeIo&list=PLbMVogVj5nJSpj5sl-8tdKARg1lw2wEa-&index=1&pp=iAQB https://www.youtube.com/watch?v=LhGFXO1NQLk&list=PLbMVogVj5nJSpj5sl-8tdKARg1lw2wEa-&index=6&pp=iAQB https://youtu.be/TWd42yUBZkk?si=PA4D8KQ-HgF65ebs

Unit II	https://www.youtube.com/watch?v=r1sLCDA-kNY&list=PL8AE5D5CCA85AE91D&index=1&pp=iAQB https://www.youtube.com/watch?v=bpKarwfDRIk&list=PL8AE5D5CCA85AE91D&index=4&pp=iAQB https://youtu.be/cp7_ZF2kNi4?si=AgRIQVjIZkRg4nbZ https://www.youtube.com/watch?v=p1Y4yJ1XnKY&list=PLbMVogVj5nJQWowhOG0-K-yI-bwRRmm3C&index=5&pp=iAQB https://www.youtube.com/watch?v=tD71garAJw&list=PLbMVogVj5nJQWowhOG0-K-yI-bwRRmm3C&index=8&pp=iAQB
Unit III	https://www.youtube.com/watch?v=hKsaduxYTwY&list=PLbMVogVj5nJQWowhOG0-K-yI-bwRRmm3C&index=11&pp=iAQB https://youtu.be/Hw8KHNgRaOE?si=JwNNKHla7rpHfyV- https://www.youtube.com/watch?v=uSY0WOe9mXY&pp=ygVCbmVwdGwgRXhwZWN0ZWQgVmFsdWUgb2YgYSBSYW5kb20gVmFyaWFibGUsIE1lYW4sIFZhcmlhbmNlLCBNb21lbnQg https://youtu.be/hKsaduxYTwY?si=4X-Ix174MVZq3tJb https://youtu.be/kknZuDVo2vQ?si=I7ofzmGH-7fAizyo
Unit IV	https://youtu.be/8oNGkvuRP60?si=BHzOpDH-gUAHswqq https://www.youtube.com/watch?v=RmAPM83TKc&list=PLbMVogVj5nJQWowhOG0-K-yI-bwRRmm3C&index=14&pp=iAQB https://youtu.be/-l2Y3L7Rz-o?si=uEyngO_sV2_fZMJL https://www.youtube.com/watch?v=-l2Y3L7Rz-o&t=3s&pp=ygUdbmVwdGwgenRlc3QgdCB0ZXN0IGh5cG90aGVzaXM%3D https://www.youtube.com/watch?v=OXIpBKpOHxk&pp=ygUdbmVwdGwgYW5ub3ZhIDIgd2F5IGh5cG90aGVzaXM%3D
Unit V	https://www.youtube.com/watch?v=7pxyYDUgTEg&pp=ygUgdW5hY2FkZW15ICBQYXJ0bmVyc2hpcCwgYXB0aXR1ZGU%3D https://www.youtube.com/watch?v=o_pMx5gSCkg&pp=ygUta2hhYW4gYWNhZGVteSAgUGFydG5lcnNoaXAsIFByb2JsZW0gb2YgYWdlcywg https://www.youtube.com/watch?v=Ijf_9T2svT8&pp=ygUodW5hY2FkZW15ICBBbGxlZ2F0aW9uICYgTWl4dHVyZSBhcHRpdHVkZQ%3D%3D https://www.youtube.com/watch?v=SKQGxLRSuPA&list=PLhuxFrOdsq-uOv_vVNTr-1iCWDlTIlO6 https://www.youtube.com/watch?v=ekja4lipIbc&pp=ygUddW5hY2FkZW15ICBEaXJlY3Rpb24gYXB0aXR1ZGU%3D https://www.youtube.com/watch?v=Rm6UdfRs3gw&pp=ygUxc2ltcGxlICYgY29tcG91bmQgaW50ZXJlc3QgYXB0aXR1ZGUgIGtoYW4gYWNhZGVteQ%3D%3D https://www.youtube.com/watch?v=DROZVHObeko&pp=ygUtcGVybXV0YXRpb25zIGFuZCBjb21iaW5hdGlvbnMgYnkga2hhbiBhY2FkZW15

Subject Name: Principles of Virtualization	**L-T-P [3-1-0]**
Subject Code: BBCA0205	**Applicable in Department: BCA**

Pre-requisite of Subject: Knowledge of operating systems, computer architecture, and networking. Proficiency in programming languages like C/C++. Familiarity with Linux, command-line interfaces, and virtualization tools is essential.

Course Objective: The objective of this course is to introduce the virtualization fundamentals and learn to deploy and manage virtual environments, ensuring efficient use of resources and enhancing system flexibility and management.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Describe the concept of virtualization and it's properties.	**K3**
CO2	Compare different forms of virtualization.	**K2**
CO3	Examine various architecture for implementing virtualization methods.	**K4**
CO4	Apply techniques for virtualizing and managing the hardware components of a computer system.	**K3**
CO5	Apply Virtualization concepts at server, client and desktop level.	**K3**

Syllabus

Unit No	Module Name	Topic covered	Pedagogy	Lecture Required (L+P)	Practical/ Assignment/ Lab Nos	CO Mapping
I Overvie	**Basics of Virtualization**	Basics of Virtualization - Virtualization Types, Desktop Virtualization, Network Virtualization, Server and Machine Virtualization, Storage Virtualization, System-level or Operating	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO1**

w of Virtualization		Virtualization, Application Virtualization, Virtualization Advantages, Virtual Machine Basics, Taxonomy of Virtual machines - Process Virtual Machines System Virtual Machines, Hypervisor, Key Concepts Hardware Virtualization, Virtual Hardware Overview, Sever Virtualization, Physical and Logical Partitioning, Types of Server Virtualization, Business cases for Sever Virtualization, Uses of Virtual server Consolidation, Planning for Development, Selecting server Virtualization Platform.				
II Binary Translation and Optimization	**Binary Translation and Optimization**	Virtual Machine basics, Interpretation, Interpreting Complex Instruction Set, Binary Translation, Dynamic Translation, Instruction Set issues, case Study Dynamic Binary Optimization: Program behavior, profiling, optimizing translation blocks, framework, code reordering, optimization, ISA optimization system, VM Architecture: Object-oriented high-level language virtual machines, JVM architecture, Microsoft Common Language Infrastructure.	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO2**
III Network Virtualization	**Network Virtualization**	Design of Scalable Enterprise Networks, Virtualizing the Campus WAN Design, WAN Architecture, WAN Virtualization, Virtual Enterprise Transport Virtualization, VLANs and Scalability, Theory Network Device Virtualization Layer 2, VLANs Layer 3 VRF Instances Layer 2, VFIs Virtual Firewall Contexts Network Device Virtualization, Data - Path Virtualization Layer 2: 802.1q, Trunking Generic Routing Encapsulation, IPsec L2TPv3 Label Switched Paths, Control, Plane Virtualization, Routing Protocols, VRF, Aware Routing Multi-Topology Routing.	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO3**
IV Virtualizing Storage SCSI	**Virtualizing Storage SCSI**	**Virtualizing Storage SCSI** with Power BI Editor, General Properties, Sizing, Dimensions, and Positions, Alternate Text and Tiles. Header (Column, Row) Properties, Grid Properties (Vertical, Horizontal) and Styles, Table Styles & Alternate Row Colors - Static, Dynamic, Sparse, Flashy Rows, Condensed Table Reports Focus Mode, Totals Computations, Background. Borders.	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO4**
V Security	**Security in Virtualization**	Security in Virtualization: Security challenges in virtual environments, Isolation and containment, Security best practices and tools, Performance Tuning and Optimization: Performance	Lectures, PPTs, Notes	**8L**	**Assignment**	**CO5**

in Virtualization		metrics and monitoring, Techniques for optimizing virtual environments, Load balancing and high availability, Virtualization Tools and Technologies: Overview of popular virtualization platforms (VMware, Hyper-V, KVM, Xen), Hands-on labs with VMware vSphere and Microsoft Hyper-V, Comparative analysis of virtualization tools.				
Total				**40L**		

Textbooks	
Sr No.	**Book Details**
1.	Mrs. Lavanya S, Dr. Balamurugan S, Dr. Venkatachalam K, Dr. Saravanakumar N M, "Building Cloud and Virtualization Infrastructure: A Hands-on Approach to Virtualization and Implementation of a Private Cloud Using Real-time Use-cases", bpb, First Edition, 2021
2.	Eguibar Vicente Rodriguez, "Instant Hyper-V Server Virtualization Starter", Packet Publishing Limited, 2013.

Reference Books	
Sr No.	**Book Details**
1.	Matthew Portnoy, "Virtualization Essentials", Sybex, 2012
2.	Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More", Jones & Bartlett Learning, 2012.

Links:	
Unit I	https://www.youtube.com/watch?v=AkST9AO01x0
Unit II	https://www.youtube.com/watch?v=bTY4DrkLhW8
Unit III	https://archive.nptel.ac.in/courses/106/105/106105167/#
Unit IV	https://www.youtube.com/watch?v=cR1GOYKgx1I
Unit V	https://www.youtube.com/watch?v=NWyOfiTI7Cs

Subject Name: Advance Python Lab	**L-T-P [0-0-6]**
Subject Code: BBCA0256	**Applicable in Department: BCA**

Pre-requisite of Subject: Basic knowledge of Python, you should have solid computer literacy. Basic knowledge of mathematics, including proof by induction and contradiction.

Course Objective: To become familiar with Python's Object-Oriented Concepts, functional programmingand create GUI application and to gain the knowledge of Python libraries.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Describe OOPs concepts in Python.	**K2**
CO2	Explain functional and GUI programming.	**K3**
CO3	Discuss Python libraries for data handling.	**K2**
CO4	Analyze data using visualization libraries.	**K4**
CO5	Examine web scraping application for real world data.	**K4**

Syllabus

Unit No	Module Name	Topic covered	Pedagogy	Lecture Required (L+P)	Practical/ Assignment/ Lab Nos	CO Mapping
I Classes	**Classes and Objects**	Introduction of Python Classes and objects, User-Defined Classes, Class Variables and Instance Variables, Instance methods, Class method, static methods, constructor in python, parametrized	Lectures Code Walkthroughs, Hand-on Programming,	**4L+10P**	**Assignment, Lab (1 to 32)**	**CO1**

and Objects		constructor, Magic Methods in python, Object as an argument, Instances as Return Values, namespaces, Introduction to inheritance and polymorphism, Abstract Class, Introduction to Abstraction and Encapsulation.	Problem Solving, Collaborative coding, Projects, Assessments			
II **Functional and GUI Programming**	**Functional and GUI Programming**	Immutability, Closures and Decorators, generators, Co-routines, iterators, Declarative programming.	Lectures Code Walkthroughs, Hand-on Programming, Problem Solving, Collaborative coding, Projects, Assessments	**4L+10P**	**Assignment, Lab (33 to 76)**	**CO2**
	GUI Programming	Intro to GUI Programming, Settling widgets in the window's interior, Numeric Widgets, Boolean Widgets, Selection Widgets, String Widgets, Date Picker, Color Picker, Container Widgets, Comparison of Array, List and Linked list, Types of linked list: Singly Linked List, Doubly Linked List, Circular Linked List, Polynomial Representation and Addition of Polynomials. Creating a GUI Application, Tkinter, button, canvas.				
III **Libraries for Data Handling**	**NumPy**	Basic Operation, Indexing, slicing and Iterating, Multidimensional arrays, NumPy Data types, Reading and writing data on Files.	Lectures Code Walkthroughs, Hand-on Programming, Problem Solving, Collaborative Coding, Projects, Assessments	**4L+10P**	**Assignment, Lab (77 to 111)**	**CO3**
	Pandas	Series and Data Frames, Grouping, aggregation, Merge Data Frames, Generate summary tables, Group data into logical pieces, Manipulation of data.				
IV **Libraries in Data Visualization**	**Matplotlib**	Scatter plot, Bar charts, histogram, Stack charts, Legend title Style, Figures and subplots, plotting function in pandas, Labelling and arranging figures, Save plots.	Lectures Code Walkthroughs, Hand-on Programming, Problem Solving,	**4L+10P**	**Assignment, Lab (112 to 157)**	**CO4**
	Seaborn	Style function, color palettes, heatmaps, distribution plots, category plot, regression plot.				

	Plotly	Lineplots, Areaplots, Scatterplots, Bubbleplots, stacked bar charts, Grouped bar charts, Pie charts, Tables, Dashboards.	Collaborative coding, Projects, Assessments			
V Web Scraping with Python	**Web Scraping**	Introduction, Web Crawling v/s Web Scraping, Uses of Web Scraping, Components of a Web Scraper, working of a Web Scraper, Crawl, Parse and Transform Store the Data.	Lectures Code Walkthroughs, Hand-on Programming, Problem Solving, Collaborative coding, Projects, Assessments	**4L+10P**	**Assignment, Lab (158 to 188)**	**CO5**
	Beautiful Soup	Introduction to Beautiful Soup library, Accessing Tags, Navigable Strings, Navigating and searching with Beautiful Soup, Web Scraping.				
	Example	Scraping Flipkart Website, Introduction to Github.				
Total				**20L+50P**		

Advance Python Lab Experiments		
Course Objective: Develop proficiency in Python programming for effective problem-solving. Cover algorithms, data structures, debugging and application across domains, emphasizing efficiency, documentation, and ethical considerations.		
Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Implement OOPs concepts in Python.	**K3**
CO2	Create functional and GUI programming.	**K5**
CO3	Demonstrate the use of Python libraries for data handling.	**K3**
CO4	Construct visualization libraries concepts in python.	**K5**
CO5	Apply web scraping application for data extraction.	**K3**
List of Practical		
Sr No	**Program Title**	**CO Mapping**
Class and object		
1	Write a program illustrating class definition and accessing class members.	**CO1**
2	Write a program to implement default constructor, parameterized constructor, and destructor.	**CO1**
3	Create a Python class named Rectangle constructed by a length and width. Create a method called area which will compute the area of a rectangle.	**CO1**
4	Create a class called Numbers, which has a single class attribute called MULTIPLIER, and a constructor which takes the parameters x and y (these should all be numbers). Write an instance method called add which returns the sum of the attributes x and y. Write a class method called multiply, which takes a single number parameter and return the product of a and MULTIPLIER.	**CO1**
5	Create a class named Student to store the name and marks in three subjects. Use List to store the marks.	**CO1**

	Write an instance method called compute to compute total marks and average marks of a student. Write a method called display to display student information.	
6	Create a Python class named Circle constructed by a radius. Use a class variable to define the value of constant PI. Write two methods to be named as area and circumference to compute the area and the perimeter of a circle respectively by using class variable PI. Write a method called display to print area and perimeter.	**CO1**
7	Write a program that has a class called Fraction with attributes numerator and denominator. Write a method called get data to enter the values of the attributes. Write a method show to print the fraction in simplified form.	**CO1**
8	Write a program that has class Numbers with a list as an instance variable. Write a method called insert_element that takes values from user. Write a class method called find_max to find and print largest value inthe list.	**CO1**
9	Create a class called Complex. Write a menu driven program to read, display, add and subtract two complex numbers by creating corresponding instance methods.	**CO1**
10	Write a program that has a class Point with attributes x and y. Write a method called midpoint that returns a midpoint of a line joining two points. Write a method called length that returns the length of a line joining two points.	**CO1**
11	Create a class called Complex. Write a menu driven program to read, display, add and subtract two complex numbers by creating corresponding instance methods.	**CO1**
12	Write a Python program to create a class called "Rectangle" with attributes length and width. Include methods to calculate the perimeter and area of the rectangle.	**CO1**
13	Implement a Python class called "Bank Account" with attributes account number, account holder name, and balance. Include methods to deposit and withdraw money from the account.	**CO1**

14	Write a Python program to create a class called "Student" with attributes roll number, name, and marks in three subjects. Include a method to calculate the average marks of the student.	**CO1**
15	Implement a Python class called "Car" with attributes make, model, and year. Include methods to start the car, stop the car, and display its details.	**CO1**
16	Write a Python program to create a class called "Book" with attributes title, author, and price. Include methods to calculate the discounted price of the book based on a discount percentage provided.	**CO1**
17	Implement a Python class called "Bank" with attributes bank name and branch. Include methods to add a new account, display all accounts, and search for an account based on the account number.	**CO1**
18	Write a Python program to create a class called "Rectangle" with attributes length and width. Include a method to check if the rectangle is a square or not.	**CO1**
19	Implement a Python class called "Employee" with attributes name, designation, and experience. Include methods to promote an employee toa higher designation based on their experience.	**CO1**
20	Write a Python program to create a class called "Employee" with attributes name, employee ID, and salary. Include a method to display the employee details.	**CO1**
Magic Method		
21	Write a program to illustrate the use of following built-in methods: a. hasattr(obj,attr) b. getattr(object, attribute_name [, default]) c. setattr(object, name, value) d. delattr(class_name, name)	**CO1**
22	Write a Program to illustrate the use of__str__(), __repr__(), __new__, __doc__, __dict__, __name _____and___bases__methods.	**CO1**
Inheritance		
23	Write a program to create class Employee. Display the personal information and salary details of 5 employees using single inheritance.	**CO1**

24	WAP that extends the class Employee. Derive two classes Manager andTeam Leader from Employee class. Display all the details of the employee working under a particular Manager and Team Leader.	**CO1**
25	Write a program that has a class Point. Define another class Location which has two objects (Location and destination) of class Point. Also,define a function in Location that prints the reflection on the y-axis.	**CO1**
26	Write a program that create a class Distance with member's km and meters. Derive classes School and office which store the distance fromyour house to school and office along with other details.	**CO1**
27	Write a program to create an abstract class Vehicle. Derive three classes Car, Motorcycle and Truck f it. Define appropriate methods and print the details of vehicle.	**CO1**
28	Write a program to demonstrate hybrid inheritance and show MRO for each class.	**CO1**
29	Write a program to overload + operator to multiply to fraction object of fraction class which contain two instance variable numerator and denominator. Also, define the instance method simplify() to simplify the fraction objects.	**CO1**
Polymorphism		
30	Write a program to compare two-person object based on their age by overloading > operator.	**CO1**
31	Write a program to overload in operator.	**CO1**
32	WAP to create a Complex class having real and imaginary as it attributes. Overload the +, -, /, * and += operators for objects of Complex class	**CO1**
Functional Programming		
33	WAP to Show the concept of inner function.	**CO2**
34	WAP to create a decorator which will convert a string into upper case string.	**CO2**
35	WAP to show the concept of nested decorator.	**CO2**
36	WAP to decorate a function with arguments.	**CO2**
37	WAP to decorate instance method	**CO2**
38	WAP to calculate sum of 1, 2, 3, 4, 5 using reduce function.	**CO2**
39	WAP to generate numbers from 1 to 10 using generator.	**CO2**
40	WAP to decide number is even or odd using generator.	**CO2**
41	WAP to generate square of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 using generator.	**CO2**

42	WAP to generate square of even number up to 10 using generator and save in list.	**CO2**
43	WAP to make a co-routine which will print all name with prefix Dear.	**CO2**
44	WAP to close a co-routine.	**CO2**
45	WAP to iterate tuple using iter() and next() method.	**CO2**
46	WAP to iterate a string using iter and next method.	**CO2**
47	WAP to print numbers from 1 to 20 using iterator and generate Stop Iteration exception once we reach limit.	**CO2**
GUI Programming		
48	Hello World: Display a simple "Hello, World!" message box.	**CO2**
49	Button: Create a button that displays a message when clicked.	**CO2**
50	Entry: Create a text entry field and display the entered text.	**CO2**
51	Check button: Create a checkbox and display the selected options	**CO2**
52	Radio button: Create radio buttons and display the selected option.	**CO2**
53	List box: Create a list box and display the selected items.	**CO2**
54	Text: Create a text area and display the entered text.	**CO2**
55	Menu: Create a menu with different options.	**CO2**
56	Message: Display a message in a dialog box.	**CO2**
57	Progress bar: Create a progress bar that updates over time python	**CO2**
58	Scale: Create a scale widget and display the selected value.	**CO2**
59	Spin box: Create a spin box and display the selected value.	**CO2**
60	Canvas: Create a canvas and draw shapes on it.	**CO2**
61	Label Frame: Create a labeled frame with widgets inside.	**CO2**
62	Scrollbar: Add a scrollbar to a widget like a text area or list box	**CO2**

63	Frame: Create a frame and place widgets inside it.	**CO2**
64	Tree view: Create a tree view widget to display hierarchical data	**CO2**
65	Notebook: Create a notebook widget with tabs.	**CO2**
66	File Dialog: Open a file dialog to select a file.	**CO2**
67	Color Dialog: Open a color dialog to select a color.	**CO2**
68	Button Counter: Create a button that increments a counter when clicked.	**CO2**
69	Checkbox List: Display a list of checkboxes and show selected options.	**CO2**
70	Dropdown Menu: Create a dropdown menu with multiple options.	**CO2**
71	Slider Value Display: Display the current value of a slider widget.	**CO2**
72	Text Input and Button: Take user input in a text box and display it when a button is clicked.	**CO2**
73	Radio Buttons: Present a set of options as radio buttons and display the selected option.	**CO2**
74	Progress Bar: Show the progress of a task using a progress bar widget.	**CO2**
75	Password Input: Create a password input field that hides the entered characters.	**CO2**
76	File Uploader: Enable users to upload files and display the selected file name.	**CO2**
NumPy		
77	Creating Arrays: Create NumPy arrays using various methods like np.array(), np.zeros(), np.ones(), np.arange(), etc.	**CO3**
78	Array Shape and Size: Get the shape and size of a NumPy array using the shape and size attributes. NumPy	**CO3**
79	Array Indexing: Access and modify individual elements of a NumPy array using indexing	**CO3**
80	Array Slicing: Extract a subset of elements from a NumPy array using slicing.	**CO3**
81	Array Reshaping: Change the shape of a NumPy array using the reshape() function.	**CO3**
82	Array Arithmetic: Perform basic arithmetic operations (addition, subtraction, multiplication, division) on NumPy arrays.	**CO3**
83	Array Broadcasting: Perform element-wise operations on arrays with different shapes using broadcasting rules.	**CO3**

84	Array Aggregation: Calculate aggregate values on arrays, such as sum(), min(), max(), mean(), etc. using NumPy	**CO3**
85	Array Transposition: Transpose a NumPy array using the transpose(). function.	**CO3**
86	Write a program that demonstrates advanced array indexing techniques, such as indexing with Boolean arrays or using fancy indexing to select specific elements or subsets of an array.	**CO3**
87	Write a program using NumPy to perform data manipulation tasks, such as sorting arrays, removing duplicates, or finding unique elements in an array.	**CO3**
88	Array Sorting: Sort the elements of a NumPy array using the sort() function.	**CO3**
89	Array Filtering: Filter elements in a NumPy array based on a condition using Boolean indexing.	**CO3**
90	Array Statistics: Calculate statistical measures like mean, median, standard deviation using functions like np.mean(), np.median(), np.std().	**CO3**
91	Array Randomization: Generate random numbers or arrays using functions from the np.random module.	**CO3**
92	Array Dot Product: Compute the dot product of two NumPy arrays using the dot() function.	**CO3**
93	Array Matrix Operations: Perform matrix operations like matrix multiplication, matrix inverse using functions from the np.linalg module.	**CO3**
94	Array File I/O: Save and load NumPy arrays from files using functions like np.save() and np.load().	**CO3**
95	Array Masking: Create a mask array to select or manipulate specific elements of a NumPy array based on a condition.	**CO3**
96	Array Broadcasting: Understand and utilize broadcasting rules in NumPy for efficient computations.	**CO3**
97	Write a program to finds the cube root of values using scipy library.	**CO3**
Panda		
98	Read and Load a CSV File into a Pandas DataFrame using pandas.read_csv.	**CO3**
99	Access and Display the First N Rows of a DataFrame using DataFrame.head(N).	**CO3**
100	Access and Display the Last N Rows of a DataFrame using DataFrame.tail(N).	**CO3**
101	Retrieve Basic Information about a DataFrame using DataFrame.info.	**CO3**
102	Perform Descriptive Statistics on a DataFrame using DataFrame.describe.	**CO3**
103	Filter Rows of a DataFrame based on a Condition using Boolean Indexing.	**CO3**

104	Rename Columns in a DataFrame using DataFrame.rename.	**CO3**
105	Group Data in a DataFrame using DataFrame.groupby.	**CO3**
104	Perform Aggregation on Grouped Data using GroupBy.agg.	**CO3**
105	Sort a DataFrame by One or Multiple Columns using DataFrame.sort_values.	**CO3**
106	Perform Basic Arithmetic Operations on Columns of a DataFrame.	**CO3**
107	Apply a Function to Each Element or Column of a DataFrame using DataFrame.apply or Data Frame.applymap.	**CO3**
108	Reshape Data using Pivot Tables using Data Frame.pivot_table.	**CO3**
109	Perform Data Visualization using pandas.plotting or matplotlib.pyplot.	**CO3**
110	Save a DataFrame to a CSV File using DataFrame.to_csv.	**CO3**
111	Perform Data Sampling or Random Selection using DataFrame.sample.	**CO3**
Matplotlib		
112	Create a Simple Line Plot using matplotlib.pyplot.plot.	**CO4**
113	Create a Scatter Plot using matplotlib.pyplot.scatter.	**CO4**
114	Create a Bar Chart using matplotlib.pyplot.bar.	**CO4**
115	Create a Histogram using matplotlib.pyplot.hist.	**CO4**
116	Create a Pie Chart using matplotlib.pyplot.pie.	**CO4**
117	Create a Box Plot using matplotlib.pyplot.boxplot.	**CO4**
118	Create a Heatmap using matplotlib.pyplot.imshow.	**CO4**
119	Customize Plot Labels and Titles using matplotlib.pyplot.xlabel, matplotlib.pyplot.ylabel and matplotlib.pyplot.title.	**CO4**
120	Customize Plot Colors, Line Styles, and Marker Styles using matplotlib.pyplot.plot parameters.	**CO4**
121	Add Gridlines to a Plot using matplotlib.pyplot.grid.	**CO4**
122	Add Legends to a Plot using matplotlib.pyplot.legend.	**CO4**

123	Create Subplots using matplotlib.pyplot.subplots.	**CO4**
124	Save a Plot as an Image File using matplotlib.pyplot.savefig.	**CO4**
125	Create 3D Plots using mpl_toolkits.mplot3d module.	**CO4**
126	Create Error Bars on a Plot using matplotlib.pyplot.errorbar.	**CO4**
127	Customize Axis Ticks and Tick Labels using matplotlib.pyplot.xticks and matplotlib.pyplot.yticks.	**CO4**
128	Create a Bar Plot with Stacked Bars using matplotlib.pyplot.bar and the bottom parameter.	**CO4**
Seaborn		
129	Create a Scatter Plot using seaborn.scatterplot.	**CO4**
130	Create a Line Plot using seaborn.lineplot.	**CO4**
131	Create a Bar Plot using seaborn.barplot.	**CO4**
132	Create a Histogram using seaborn.histplot.	**CO4**
133	Create a Box Plot using seaborn.boxplot.yh9.**	**CO4**
134	Create a Violin Plot using seaborn.violinplot.	**CO4**
135	Create a Heatmap using seaborn.heatmap.	**CO4**
136	Create a Pair Plot using seaborn.pairplot.	**CO4**
137	Create a Joint Distribution Plot using seaborn.jointplot.	**CO4**
138	Create a KDE (Kernel Density Estimate) Plot using seaborn.kdeplot.	**CO4**
139	Create a Categorical Scatter Plot using seaborn.stripplot.	**CO4**
140	Create a Categorical Bar Plot using seaborn.countplot.	**CO4**
141	Create a Facet Grid using seaborn.FacetGrid.	**CO4**
142	Customize Plot Colors and Styles using seaborn.set_palette and seaborn.set_style.	**CO4**
143	Add Error Bars to a Plot using seaborn.barplot or seaborn.pointplot with the ci parameter.	**CO4**

144	Create a Clustered Heatmap using seaborn.clustermap.	**CO4**
145	Create a Regression Plot using seaborn.regplot.	**CO4**
146	Create a Pairwise Relationship Plot using seaborn.pairplot or seaborn.scatterplot with multiple variables.	**CO4**
147	Create a Boxen Plot using seaborn.boxenplot.	**CO4**
148	Create a Stacked Bar Plot using seaborn.barplot with the hue parameter.	**CO4**
Plotly		
149	Write a program to draw a line chart using Plotly	**CO4**
150	Write a program to draw a Bar chart using Plotly	**CO4**
151	Write a program to draw a Histogram chart using Plotly	**CO4**
152	Write a program to draw a scatter plot using Plotly	**CO4**
153	Write a program to draw a Bubble chart using Plotly	**CO4**
154	Write a program to draw a pie chart using Plotly	**CO4**
155	Write a program to draw a Boxplot using Plotly	**CO4**
156	Write a program to draw a Violin Plots using Plotly	**CO4**
157	Write a program to draw a Gant chart using Plotly	**CO4**
Web scrapping		
158	Write a Python program to find the title tags from a given html document.	**CO5**
159	Write a Python program to retrieve all the paragraph tags from a given html document.	**CO5**
160	Write a Python program to get the number of paragraph tags of a given html document.	**CO5**
161	Write a Python program to extract the text in the first paragraph tag of a given html document.	**CO5**
162	Write a Python program to find the length of the text of the first <h2> tag of a given html document.	**CO5**
163	Write a Python program to find the text of the first <a> tag of a given html text.	**CO5**

164	Write a Python program to find the href of the first <a> tag of a given html document.	**CO5**
165	Write a Python program to a list of all the h1, h2, h3 tags from the webpage python.org.	**CO5**
166	Write a Python program to extract all the text from a given web page.	**CO5**
167	Write a Python program to print the names of all HTML tags of a given web page going through the document tree.	**CO5**
168	Write a Python program to retrieve children of the html tag from a given web page.	**CO5**
169	Write a Python program to retrieve all descendants of the body tag from given web page.	**CO5**
170	Write a Python program to print content of elements that contain a specified string of a given web page.	**CO5**
171	Write a Python program to print the element(s) that has a specified id of a given web page.	**CO5**
172	Write a Python program to create a Beautiful Soup parse tree into a nicely matted Unicode string, with a separate line for each HTML/XML tag and string.	**CO5**
173	Write a Python program to find the first tag with a given attribute value in an html document.	**CO5**
174	Write a Python program to find tag(s) beneath other tag(s) in a given html document.	**CO5**
175	Write a Python program to find tag(s) directly beneath other tag(s) in a given html document.	**CO5**
176	Write a Python program to find the siblings of tags in a given html document.	**CO5**
177	Write a Python program to find tags by CSS class in a given html document.	**CO5**
178	Write a Python program to change the tag's contents and replace with the en string.	**CO5**
179	Write a Python program to add to a tag's contents in a given html document.	**CO5**
180	Write a Python program to insert a new text within a url in a specified position	**CO5**
181	Write a Python program to insert tags or strings immediately before specified tags or strings.	**CO5**
182	Write a Python program to insert tags or strings immediately after specified tags or strings.	**CO5**
183	Write a Python program to remove the contents of a tag in a given html document.	**CO5**
184	Write a Python program to extract a tag or string from a given tree of html document.	**CO5**
185	Write a Python program to remove a tag from a given tree of html document and destroy it and its contents.	**CO5**

186	Write a Python program to remove a tag or string from a given tree of html document and replace it with the given tag or string.	**CO5**
187	Write a Python program to wrap an element in the specified tag and create the new wrapper.	**CO5**
188	Write a Python program to replace a given tag with whatever's inside a given tag.	**CO5**

Required Software and Tools

2. Jupyter (Open Source)

Textbooks

Sr No	Book Details
1.	Advanced Python Guide: Master concepts, build applications, and prepare for interviews Paperback – Import, 20 June 2024 by Kriti Kumari Sinha
2.	Python: The Complete Reference Paperback – 20 March 2018 by Martin C. Brown
3.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016

Reference Books

Sr No	Book Details
1.	Dusty Phillips, Python 3 Object-oriented Programming - Second Edition 2015, O'Reilly
2.	Burkhard Meier, Python GUI Programming Cookbook, Packt, Third Edition 2020

Links

Unit I	https://www.youtube.com/watch?v=Rq_3gA2h1RA
Unit II	https://www.youtube.com/watch?v=-GhzpvvIXlM&list=PLS1QulWo1RIY6fmY_iTjEhCMsdtAjgbZM https://www.youtube.com/watch?v=rDj8EBv9ErA
Unit III	https://www.youtube.com/watch?v=aYmcRnmZVGQ&list=PL9n0l8rSshSnragNblKDBsT8Xu3otp3jA

Unit IV	https://www.youtube.com/watch?v=9GYmFXBitBw&list=PLBSCvBlTOLa8rf2kGkP_Bx5xXqT-er4Yq
Unit V	https://www.youtube.com/watch?v=XVv6mJpFOb0

Subject Name: Data Structure using Python Lab		L-T-P [0-0-2]
Subject Code: BBCA0251		**Applicable in Department: BCA**
Course Outcomes (CO)		
Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Analyse systematic approach to organizing, writing and debugging Array programs	**K4**
CO2	Implement Stack and Queue	**K3**
CO3	Develop operations of linked list.	**K5**
CO4	Construct non-linear data structure operations.	**K5**
CO5	Implement sorting and searching algorithms using relevant data structures	**K3**

List of Practical

Sr No	Program Title	CO Mapping
Array		**CO1**
1	Create a program to find the maximum element in an array.	**CO1**
2	Design a Code to calculate the sum of all elements in an array.	**CO1**
3	Write a program to reverse the elements of an array.	**CO1**
4	Design a Code to check if an array is sorted in ascending order.	**CO1**
5	Design a Code to count the occurrence of a specific element in an array.	**CO1**
6	Write a program creation and traversal of 2D Array in row major and column major order.	**CO1**
7	Write a program to print the transpose of a given matrix using function	**CO1**

8	Program to find if a given matrix is Sparse or Not and print Sparse Matrix	**CO1**
Searching		
9	Create a code to Implement Linear Search	**CO1**
10	Write a program to implement Binary Search	**CO1**
Stack		
11	Implementation of stack using a list.	**CO2**
12	Construct a python code to Infix to postfix conversion using a stack.	**CO2**
13	Construct a code for Balanced parentheses checker using a stack	**CO2**
14	Implement Reverse a string using a stack.	**CO2**
15	Implement Binary Search using Recursion.	**CO2**
16	Construct a python program to print Fibonacci Series using Recursion.	**CO2**
Queue		
17	Queue implementation using a list	**CO2**
18	Construct a code for Simulating a printer queue using a queue.	**CO2**
19	Construct a code for Implementing a circular queue.	**CO2**
20	Implement queue using stack.	**CO2**
Linked List		
21	Create a single linked list and perform basic operations (insertion, deletion, traversal).	**CO3**
22	Create a double linked list and perform basic operations (insertion, deletion, traversal).	**CO3**
23	Create a circular linked list and perform basic operations (insertion, deletion, traversal).	**CO3**
24	Reverse a single linked list.	**CO3**
25	Check if a linked list is palindrome.	**CO3**

26	Reverse a double linked list.	**CO3**
27	Find the middle element of a single linked list.	**CO3**
28	Find the middle element of a double linked list.	**CO3**
29	Merge two sorted single linked lists.	**CO3**
30	Detect and remove a loop in a circular linked list.	**CO3**
Binary Tree		
31	Construct a code to Insert, Delete and search and update a data in Binary Search Tree (BST)	**CO4**
32	Construct a code for Tree Traversal (Preorder, Inorder, Postorder).	**CO4**
33	Construct a code Count the number of Leaves in a Binary Tree	**CO4**
34	Construct a code to find the Height of a Binary Tree	**CO4**
35	Construct a code to print all Paths from the Root to Leaf Nodes in a Binary Tree	**CO4**
36	Construct a code to convert a Binary Tree to its Mirror Tree	**CO4**
BST		
37	Construct a code to find the Node with Minimum Value in a Binary Search Tree.	**CO4**
38	Construct a code for Binary Search Tree (BST) Implementation.	**CO4**
39	A program to check if a Binary Tree is a Binary Search Tree (BST)	**CO4**
AVL Tree		
40	Construct a code to check if a Binary Tree is a Balanced Binary Tree	**CO4**
Graph		
41	Construct a code to represent graph using adjacency matrix and adjacency list.	**CO5**
42	Implement BFS and DFS algorithm.	**CO5**
43	Implement the minimum cost spanning tree.	**CO5**

Sorting		
44	Implement bubble sort in a non-recursive way.	**CO5**
45	Implement selection sort in a non-recursive way.	**CO5**
46	Implement insertion sort in a non-recursive way.	**CO5**
47	Implement Merge sort in a non-recursive way.	**CO5**
48	Implement Merge sort in a recursive way.	**CO5**
49	Implement Quick sort in a recursive way.	**CO5**
50	Implement Heap sort in a non-recursive way	**CO5**
Required Software and Tools		
1. Vs Code 2. Jupyter Notebook		

Subject Name: Workplace Communication Lab 2	**L-T-P [0-0-4]**
Subject Code: BBCA0257	**Applicable in Department: BCA**

Pre-requisite of Subject: The students should have completed the Workplace Communication course in the first semester

Course Objective:

- To improve proficiency in Business English to the B1/B2 (Intermediate) of CEFR.
- To understand the nuances of communication, both verbal and non-verbal.
- To train for career enhancement.
- To incorporate the key concepts of ethics, etiquette, and life skills.

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level (KL)**
CO1	Understand the role and importance of various communication skills essential for career development.	**K2**
CO2	Develop and apply effective listening skills in both personal and professional contexts.	**K6**
CO3	Demonstrate fluency and spontaneity while speaking.	**K3**
CO4	Read and interpret complex written texts.	**K2**
CO5	Construct clear and concise texts on a variety of topics.	**K6**

List of Practical

Sr No	Program Title	CO Mapping
1	**Introduction to the course and the evaluation scheme**	**CO1**

	Students will gain knowledge about the Examination pattern.	
2	**Active Listening Role-Play** Students pair up and take turns playing the roles of speaker and listener in various scenarios. They practice active listening techniques such as paraphrasing and asking clarifying questions.	**CO2**
3	**Professional Self-Introduction** Students prepare and deliver brief introductions, focusing on clarity and professionalism. They receive peer feedback on content and delivery.	**CO3**
4	**Annotating Professional Documents** Students read sample professional documents and practice annotating them to highlight main ideas, key terms, and important details. This activity enhances their reading comprehension and analytical skills.	**CO4**
5	**Writing Reflective Journal Entries** Students maintain a reflective journal throughout the session, documenting their learning experiences, insights, and reflections on communication practices. This activity encourages self-awareness and critical thinking while strengthening writing skills.	**CO5**
6	**Active Listening in Group Networking Sessions** Students participate in group networking sessions where they actively listen to others' introductions and conversations. They practice building connections based on what they hear.	**CO2**
7	**Small Talk Practice Sessions** Students participate in small group discussions where they practice initiating and sustaining small talk conversations.	**CO3**
8	**Reading for Tone and Intention** Students will read paragraphs of different genres and try to comprehend the tone and intention of the writer.	**CO4**
9	**Writing Responses to Common Text Messages** Students practice writing short and effective text responses to hypothetical scenarios or prompts. They learn to convey their message clearly and concisely.	**CO5**

10	**Listening Comprehension Quiz** Students listen to a recorded webinar or online meeting and then take a comprehension quiz based on the content discussed.	**CO2**
11	**Virtual Panel Discussion** Students participate in a virtual panel discussion on a topic related to digital communication. Each student takes on a role and presents their perspective clearly and confidently, fostering effective communication skills in virtual settings.	**CO3**
12	**Analysing Digital Content** Students analyze online articles or posts and evaluate the evidence and logic presented.	**CO4**
13	**Creating Digital Etiquette Guides** Students research and compile guidelines for digital writing ethics and etiquette. They create informative documents or presentations outlining best practices for communication in digital environments.	**CO5**
14	**Identifying Barriers to Effective Listening** Students participate in a listening exercise where they encounter various barriers such as distractions, preconceptions, and multitasking. They reflect on how these barriers affect their ability to listen effectively and discuss strategies for overcoming them.	**CO2**
15	**Role-Playing Handling Interruptions and Objections** Students engage in role-play where they practice handling interruptions in professional conversations. They learn to respond calmly and confidently while maintaining control of the discussion, improving their ability to manage challenging communication situations.	**CO3**
16	**Speed-Reading and Comprehension Exercise** Students engage in a speed-reading exercise where they read a passage at an accelerated pace. They then reflect on their comprehension and discuss strategies for balancing reading speed with understanding effectively.	**CO4**
17	**Miscommunication Reflection**	**CO5**

	Students reflect on instances of miscommunication in writing. They learn to avoid miscommunication.	
18	**Listen and speak** Participants will listen to their peers reading aloud and write down the gist; and will repeat verbatim what is read.	**CO2**
19	**Choosing a topic and speaking on it** Students experiment with different opening techniques, such as storytelling, asking a thought-provoking question, or sharing a surprising statistic, to hook the audience's attention at the beginning of their presentations. They receive feedback on the effectiveness of their openings.	**CO3**
20	**Group Talk** Students find out relevant and trending presentation topics from their field and justify their choice.	**CO4**
21	**Case Study Analysis** The students will learn critical analysis through real time situations presented in case studies.	**CO4**
22	**Language Toolbox 3: Language concord** The students will be able to develop and improve their language proficiency.	**CO4**
23	**Conversations in different situations (through caselets)** Participants will learn to converse in different professional situations.	**CO5**
24	**Hansei Activity** The students will reflect on the course and share their key learnings.	**CO5**
	Total= 48 Hours	

Required Software and Tools

- British Council English Score Mobile App

Textbooks

Sr No	Book Details

1	ABC Workbook, NIET Publishing House, Meerut, 2023
Reference Books	
Sr No	**Book Details**
1	Cambridge English Business Benchmark (Pre-intermediate to Intermediate), 2nd edition, Norman Whitby, Cambridge University Press, 2013, UK.
2	Listening in the Language Classroom by John Field, Cambridge University Press, 2021, UK.
3	Speaking: Second Language Acquisition, from Theory to Practice by William Littlewood, **Cambridge University Press, 2022, UK.**
4	Second Language Writing in Transitional Spaces: Teaching and Learning Across Languages and Cultures edited by Viniti Vaish and Guangwei Hu, Routledge, 2019, UK.
5	The Writing Revolution: A Guide to Advancing Thinking Through Writing in All Subjects and Grades by Judith C. Hochman and Natalie Wexler, Jossey-Bass, 2022, USA.
6	The Cambridge Handbook of Corrective Feedback in Second Language Learning and Teaching edited by Hossein Nassaji and Eva Kartchava, **Cambridge University Press, 2021, UK**
7	IELTS 11: General Training with answers. Cambridge English, 2018

Subject Name: Data Analytics using Excel/ Power BI/Google Analytics Lab		**L-T-P [0-0-2]**
Subject Code: BBCA0253		**Applicable in Department: BCA**
Course outcome: After completion of this course students will be able to:		**Bloom's Knowledge Level(KL)**
CO1	Analyze set up and track website which include creating and managing goals,tracking events and analyzing audience behavior.	**K4**
CO2	Design and develop dashboards, reports and visualizations using Power BI by datamodeling, data visualization and report publishing.	**K5**
CO3	Discuss advanced Excel skills which include data manipulation, analysis and visualization using formulas, functions and pivot tables.	**K4**
CO4	Apply data analysis techniques by regression analysis, clustering analysis and timeseries analysis.	**K3**
CO5	Design and present reports and dashboards that effectively communicate insights and recommendations.	**K5**
List of Practical		
Sr No	**Program Title**	**CO Mapping**
Advance Excel		**CO1**
1	Integrate Power BI with other Microsoft tools (e.g., Excel, SQL Server).	**CO1**
2	Explore advanced Power BI features (e.g. Machine Learning, R scripting).	**CO1**
3	Create a spreadsheet with basic formulas: SUM, AVERAGE, and COUNT	**CO1**
4	Use colors to highlight cells that meet specific conditions.	**CO1**
5	Use the PivotTable to summarize and analyze data.	**CO1**
6	Create a line chart to display data over time	**CO1**

7	Set up data validation rules to restrict user input.	**CO1**
8	Edit and modify a recorded macro	**CO1**
9	Use conditional formatting to highlight cells that contain errors	**CO1**
10	Use the VLOOKUP function to retrieve data from another table	**CO1**
11	Use the Analysis ToolPak (ATP) to perform statistical analysis	**CO1**
12	Use the PivotChart to summarize and analyze data	**CO1**
13	Create a stacked area chart to display data over time	**CO1**
14	Debug errors using the Visual Basic Editor	**CO1**
15	Create an array formula using the SUMIFS function	**CO1**
16	Use functions such as SUM, AVERAGE and COUNT in formulas	**CO1**
17	Edit and modify a recorded macro	**CO1**
18	Debug errors using the Visual Basic Editor	**CO1**
19	Highlight cells that meet multiple conditions using conditional formatting	**CO1**
20	Use the Analysis ToolPak (ATP) to perform advanced statistical analysis	**CO1**
Power BI		
21	Create a new Power BI report and explore the interface.	**CO2**
22	Connect to a sample data source (e.g., Excel file) and import data into Power BI.	**CO2**
23	Create a new table from the imported data and customize its layout.	**CO2**
24	Filter and sort data in the table using various options.	**CO2**
25	Create a simple chart (e.g., bar chart) from the table data.	**CO2**
26	Add interactivity to the chart by enabling drill-down capabilities.	**CO2**
27	Create a new dashboard with multiple visualizations (e.g., charts, tables).	**CO2**

28	Create measures in the table and use them in visualizations.	**CO2**
29	Create a matrix visualization from the table data.	**CO2**
30	Create a DAX formula to calculate a custom measure.	**CO2**
31	Create a gauge visualization from the table data.	**CO2**
32	Use various visualizations (e.g., maps, trees) to represent data in different ways.	**CO2**
33	Create a KPI card visualization from the table data.	**CO2**
34	Publish the report to Power BI Service and share it with others.	**CO2**
35	Optimize performance by working with large datasets.	**CO2**
36	Create a story in Power BI using multiple visualizations.	**CO2**
37	Use Power BI APIs to automate tasks and integrate with other applications.	**CO2**
38	Create a custom visual using Power BI's visual development tools.	**CO2**
39	Integrate Power BI with other Microsoft tools (e.g., Excel, SQL Server).	**CO2**
40	Explore advanced Power BI features (e.g., machine learning, R scripting).	**CO2**
Google Analytics		
41	Set up a Google Analytics account and track a website's basic metrics (e.g. page views, bounce rate, average session duration).	**CO5**
42	Set up goals and ecommerce tracking in Google Analytics.	**CO5**
43	Analyze audience demographics in Google Analytics.	**CO5**
44	Create segments in Google Analytics to analyze specific audience groups.	**CO5**
45	Track events in Google Analytics (e.g. form submissions, button clicks).	**CO5**
46	Analyze referral traffic in Google Analytics	**CO5**
47	Set up funnels in Google Analytics to track user flow	**CO5**
48	Create custom dashboards in Google Analytics.	**CO5**

49	Analyze user flow in Google Analytics	**CO5**
50	Set up A/B testing in Google Analytics	**CO5**

Subject Name: Field Activities for Community Engagement	**L-T-P [0-0-2]**
Subject Code: BBCANC0251	**Applicable in Department: BCA**

Pre-requisite of Subject: Basic understanding of computers and familiarity with Microsoft Excel.

Course Objective:

- To develop an appreciation of rural culture, lifestyle and wisdom amongst
- students
- To learn about the status of various agricultural and development programmes
- To understand causes for distress and poverty faced by vulnerable households and explore solutions for the same
- To apply classroom knowledge of courses to field realities and thereby improve quality of learning

Course Outcomes (CO)

Course outcome: After completion of this course students will be able to:

CO1	Understand rural life, Indian culture & ethos and social realities.	**K2**
CO2	Develop a sense of empathy and bonds of mutuality with local community.	**K3**
CO3	Appreciate significant contributions of local communities to Indian society and economy.	**K2**
CO4	Learn to value the local knowledge and wisdom of the community.	**K2**
CO5	Identify opportunities for contributing to community's socioeconomic improvements.	**K3**

List of Activities

Sr. No.	**Activity**

1.	Interaction with SHG women members, and study of their functions and challenges; planning for their skill building and livelihood activities
2.	Visit MGNREGS project sites, interact with beneficiaries and interview functionaries at the work site
3.	Field visit to Swachh Bharat project sites, conduct analysis and initiate problem solving measures
4.	Conduct Mission Antyodaya surveys to support under Gram Panchayat Development Plan (GPDP)
5.	Interactive community exercise with local leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource mobilization
6.	Visit Rural Schools / mid-day meal centres, study academic and infrastructural resources and gaps
7.	Participate in Gram Sabha meetings, and study community participation
8.	Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries
9.	Visit to local Nagarpalika office and review schemes for urban informal workers and migrants
10.	Attend Parent Teacher Association meetings, and interview school drop outs
11.	Visit local Anganwadi Centre and observe the services being provided
12.	Visit local NGOs, civil society organisations and interact with their staff and beneficiaries,
13.	Organize awareness programmes, health camps, Disability camps and cleanliness camps
14.	Conduct soil health test, drinking water analysis, energy use and fuel efficiency surveys
15.	Raise understanding of people’s impacts of climate change, building up community’s disaster preparedness

16.	Interaction with SHG women members, and study of their functions and challenges; planning for their skill building and livelihood activities
17.	Visit MGNREGS project sites, interact with beneficiaries and interview functionaries at the work site

***Students are required to complete one of the activities listed above in the Second Semester of BCA and submit the report of the same to the department.**