EVALUATION SCHEME AND SYLLABUS

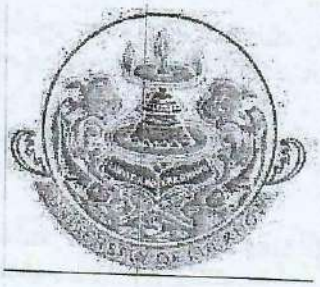
FOR

BACHELOR OF COMPUTER APPLICATION (BCA)

as per

NEP-2020

(Effective from the Session: 2023-24)



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY

UNIVERSITY OF LUCKNOW, LUCKNOW

PROGRAM OUTCOMES (POs)

PO-1. To develop skilled and professionally motivated technocrats, equipped with critical reasoning and ethical values that fosters scientific temperament with a sense of social responsibility.

PO-2. To produce knowledgeable and competent human resources who are employable in all walk of life.

PO-3. To create, identify and implement appropriate techniques, resources, and modern engineering and IT tools.

PO-4. To impart expertise required for planning, designing and building complex software systems as well as provide support to automated systems.

PO-5. To build caliber to tackle both personal and social challenges and improve the quality oflife.

PROGRAM SPECIFIC OUTCOMES (PSOs)

After completing the program students will have:

PSO-1. Ability to acquire knowledge in various fields of computer science, and to apply in industry, entrepreneurship and/or higher studies, for a thriving career.

PSO-2. Understanding to incorporate knowledge of computing and technological advances appropriate to the program.

PSO-3. Ability to develop software systems to enable the convenient use of the computing system and possess technical credentials.

PSO-4. Ability to exercise the principles of management, economics and strategic concepts required for teamwork as well as team management.

CERTIFICATE

BCA

(TWO - SEMESTER PROGRAMME, TOTAL CREDITS=48)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY
UNIVERSITY OF LUCKNOW, LUCKNOW

YEAR: FIRST, SEMESTER-I

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam ESE		
			L	T	P	CT	TA	Total			
1.	NBCA-101	Fundamentals of Computer and its Applications	3	1	0	20	10	30	70	100	4
2.	NBCA-102	Programming in C	3	1	0	20	10	30	70	100	4
3.	NBCA-103	Basics of Information System	3	0	0	20	10	30	70	100	3
4.	NBCA-104	Mathematics	3	1	0	20	10	30	70	100	4
5.	NBCA-105	Soft Skills and Personality Development	3	1	0	20	10	30	70	100	4
Practical											
6.	NBCA-106P	Computer Application Lab	0	0	3		20	20	30	50	2
7.	NBCA-107P	Programming in C Lab	0	0	3		20	20	30	50	2
8.	NBCA-108P	Soft Skills and Personality Development Lab	0	0	2		20	20	30	50	1
9.	NBCA-GP	General Proficiency	-	-	-		-	-	-	50	
10.	ABCA-101	Induction Program*	-	-	-		-	-	-		
		Total	15	4	8					650	24

*Audit Course: Three-week duration including Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Department/Branch & Innovation.

CERTIFICATE

BCA

(TWO - SEMESTER PROGRAMME, TOTAL CREDITS=48)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY
UNIVERSITY OF LUCKNOW, LUCKNOW

YEAR: FIRST, SEMESTER-II

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam		
			L	T	P	CT	TA	Total	ESE		
1.	NBCA-201	Data Structure	3	1	0	20	10	30	70	100	4
2.	NBCA-202	Database Management System	3	1	0	20	10	30	70	100	4
3.	NBCA-203	Operating System	3	1	0	20	10	30	70	100	4
4.	NBCA-204	Discrete Mathematical Structures	3	0	0	20	10	30	70	100	3
5.	NBCA-205	Digital Electronics and Computer Organization	3	1	0	20	10	30	70	100	4
Practical											
6.	NBCA-206P	Data Structure Lab	0	0	3		20	20	30	50	2
7.	NBCA-207P	DBMS Lab	0	0	2		20	20	30	50	1
8.	NBCA-208P	Operating System Lab	0	0	3		20	20	30	50	2
9.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	15	4	8					650	24

Note:

1. After Examination of Semester-II, the Industrial Technology based Training (04 to 06 weeks) to be conducted during summer break, and will be assessed during III semester. The training may be carried out at some industrial unit or under the guidance of faculty member of the institution.
2. If the student leaves the programme after completing Semester-II successfully, student will be awarded a **Certificate in Computer Application.**

DIPLOMA

BCA

(FOUR - SEMESTER PROGRAMME, TOTAL CREDITS=96)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY
UNIVERSITY OF LUCKNOW, LUCKNOW

YEAR: SECOND, SEMESTER-III

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam		
			L	T	P	CT	TA	Total	ESE		
1.	NBCA-301	Object Oriented Programming Using Java	3	1	0	20	10	30	70	100	4
2.	NBCA-302	Software Engineering	3	1	0	20	10	30	70	100	4
3.	NBCA-303	Computer Architecture	3	1	0	20	10	30	70	100	4
4.	NBCA-304	Python Programming	3	1	0	20	10	30	70	100	4
5.	NBCA-305	Accounting and Financial Management	3	0	0	20	10	30	70	100	3
Practical											
6.	NBCA-306P	Java Lab	0	0	3		20	20	30	50	2
7.	NBCA-307P	Python Programming Lab	0	0	3		20	20	30	50	2
8.	NBCA-308P	Industrial Training viva-voce	0	0	2		20	20	30	50	1
9.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	15	4	8					650	24

DIPLOMA

BCA

(FOUR - SEMESTER PROGRAMME, TOTAL CREDITS=96)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY
UNIVERSITY OF LUCKNOW, LUCKNOW

YEAR: SECOND, SEMESTER-IV

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam ESE		
			L	T	P	CT	TA	Total			
1.	NBCA-401	Advance Java Technology	3	1	0	20	10	30	70	100	4
2.	NBCA-402	Design and Analysis of Algorithm	3	1	0	20	10	30	70	100	4
3.	NBCA-403	Web Design Concepts	3	1	0	20	10	30	70	100	4
4.	NBCA-404	Computer Graphics	3	1	0	20	10	30	70	100	4
5.	NBCA-405	Managerial Economics	3	0	0	20	10	30	70	100	3
Practical											
6.	NBCA-406P	Advance Java Technology Lab	0	0	3		20	20	30	50	2
7.	NBCA-407P	Web Design Lab	0	0	3		20	20	30	50	2
8.	NBCA-408P	Computer Graphics Lab	0	0	2		20	20	30	50	1
9.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	15	4	8					650	24

Note:

1. After Examination of Semester-IV, the Industrial Project based Training (04 to 06 weeks) to be conducted during summer break, and will be assessed during V semester (BCA Degree Programme). The training may be carried out at some industrial unit or under the guidance of faculty member of the institution.
2. If the student leaves the programme after completing Semester-IV successfully, student will be awarded a **Diploma in Computer Application.**

DEGREE

BCA

(SIX - SEMESTER PROGRAMME, TOTAL CREDITS=144)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY
UNIVERSITY OF LUCKNOW, LUCKNOW

YEAR: THIRD, SEMESTER-V

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam		
			L	T	P	CT	TA	Total	ESE		
1.	NBCA-501	Computer Network	3	1	0	20	10	30	70	100	4
2.	NBCA-502	Artificial Intelligence	3	1	0	20	10	30	70	100	4
3.	NBCA-503	Cyber Law	3	0	0	20	10	30	70	100	3
4.	NBCA-504	Numerical and Reasoning Ability Development	3	0	0	20	10	30	70	100	3
5.	NBCA-505X	Departmental Elective-I	3	0	0	20	10	30	70	100	3
Practical											
6.	NBCA-506P	Computer Network Lab	0	0	3		20	20	30	50	2
7.	NBCA-507P	Industrial Training viva-voce	0	0	2		20	20	30	50	1
8.	NBCA-508P	Project Phase-I	0	0	6		50	50	100	150	4
9.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	12	2	15					650	24

Departmental Elective-I

NBCA-5051- Graph Theory
NBCA-5052- Software Testing and Audit
NBCA-5053- UNIX Operating System
NBCA-5054- Data Mining and Data Warehousing

DEGREE

BCA

(SIX - SEMESTER PROGRAMME, TOTAL CREDITS=144)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY
UNIVERSITY OF LUCKNOW, LUCKNOW

YEAR: THIRD, SEMESTER-VI

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam		
			L	T	P	CT	TA	Total	ESE		
1.	NBCA-601	Machine Learning	3	1	0	20	10	30	70	100	4
2.	NBCA-602	Multimedia System	3	1	0	20	10	30	70	100	4
3.	NBCA-603	Software Project Management	3	0	0	20	10	30	70	100	3
4.	NBCA-604X	Departmental Elective-II	3	0	0	20	10	30	70	100	3
Practical											
5.	NBCA-605P	Machine Learning Lab	0	0	3		20	20	30	50	2
6.	NBCA-606P	Seminar	0	0	3		20	20	30	50	2
7.	NBCA-607P	Project Phase-II	0	0	9		50	50	100	150	6
8.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	12	2	15					650	24

Departmental Elective-II

NBCA-6041: Open Source Software
NBCA-6042: Mobile Computing
NBCA-6043: Cryptography
NBCA-6044: Optimization Techniques

Note: If the student leaves the Programme after completing Semester-VI successfully, student will be awarded a **Bachelor Degree in Computer Application.**

DEGREE WITH RESEARCH

BCA

(EIGHT - SEMESTER PROGRAMME, TOTAL CREDITS=192)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY
UNIVERSITY OF LUCKNOW, LUCKNOW

YEAR: FOURTH, SEMESTER-VII

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam		
			L	T	P	CT	TA	Total	ESE		
1.	NBCA-701	Research Methodology	3	1	0	20	10	30	70	100	4
2.	NBCA-702	Basics of Data Science	3	1	0	20	10	30	70	100	4
3.	NBCA-703X	Departmental Elective- III	3	1	0	20	10	30	70	100	4
Practical											
4.	NBCA-704P	Data Science Lab	0	0	3		20	20	30	50	2
5.	NBCA-705P	Dissertation	0	0	15		100	100	200	300	10
6.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	9	3	18					650	24

Departmental Elective-III

NBCA-7031: Internet of Things
NBCA-7032: Digital Image Processing
NBCA-7033: Advance DBMS
NBCA-7034: Soft Computing Techniques

DEGREE WITH RESEARCH

BCA

(EIGHT - SEMESTER PROGRAMME, TOTAL CREDITS=192)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY
UNIVERSITY OF LUCKNOW, LUCKNOW

YEAR: FOURTH, SEMESTER-VIII

S. No.	Paper Code	Subject	Evaluation Scheme				Sub Total	Credit
			Sessional Exam			Exam ESE		
			CT	TA	Total			
1.	NBCA-801P	Dissertation (Final)		250	250	400	650	24
2.	NBCA-GP	General Proficiency	-	-	-		50	
		Total					650	24

Note: After completing Semester-VIII successfully, student will be awarded a **Bachelor Degree with Research in Computer Application.**

NBCA-101

FUNDAMENTALS OF COMPUTER AND ITS APPLICATIONS

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3 1 0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

1. Understand the components, characteristics and limitation of the computer system.
2. Understand different types of input devices, output devices and their advantages and disadvantages.
3. Understand various types of storage devices and their storage capacities.
4. Understand the concept of number system.
5. Understand the computer software need and types of software.

Unit-I 08

Introduction to Computer: Brief history of the development of Computers. Computer System Concept, Computer System Characteristics, Capabilities and Limitations, Types of Computer. Generations of Computers, basic components of a computer system (Control Unit, ALU, Input/ Output Functions and characteristic), Memory and types of Memory.

Unit-II 06

Processor: Introduction, types, specification, Intel, Pentium, AMD. **Motherboard**: Introduction, component, types, form factor. BIOS, CMOS, RAM, ROM, SRAM, and DRAM. **Buses**: Introduction, types, utility. Add on Cards.

Unit-III 08

Input devices- Keyboard, Mouse, Digitalizing tablet, Scanners, Bar-Code Reader, Light Pen, and Touch Screen etc. **Output Devices**-Monitors – Characteristics and types of Monitors – Digital, Analog, Size, Resolution, Refresh Rate, Video standard, Types of Printers, Plotter, Sound Card and Speakers. **Storage Devices**- Primary Vs Secondary Data Storage and Retrieval methods. Various Storage Devices – Magnetic Tape, Magnetic Disks, Cartridge tape, data drives, hard disk drives, Floppy disk and Optical disk.

Unit-IV 08

Computer Software – System Software, Application Software, and Operating System. **Basics of computer Programming Languages:** Concept of algorithms and flow charts, Types of computer languages, concept of Assemblers, Compilers, Interpreter, linker and loader.

Unit-V 10

Office Automation-MS Word: Create, save, preview, print, edit, proofreading, and formatting of documents, Data presentation in tables, graphs, and charts, Creating form letters, email message, labels, and mail merge. **MS Excel:** Create, save, and edit, print, formatting, managing and hiding workbook data, Data presentation in charts and graphs, use of formulas and functions for data processing. **MS Power Point:** Create, save, and edit, Data presentation in form of tables, graphics, charts, sound, and animation. **MS Access:** Introduction, data types, database creation, basic query, and report generation.

Text Books:

1. P. K Sinha, "Computer Fundamentals", BPB Publication.
2. V Rajaraman, Neeharika Adabala "Fundamentals of Computers", PHI.

3. Reema Thareja, "Fundamentals of computers", Oxford Higher Education.
4. MS-Office 2000 (For Windows), Steve Sagman

Reference Books:

1. Anita Goel, "Computer Fundamentals" Pearson.
2. E Balagurusamy," Fundamentals of computers", MC Graw Hill.
3. MS-Office 2007, Michael Price
4. Comdex Windows 7 with Office 2010, Vikas Gupta

NBCA-102

PROGRAMMING IN C

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3 1 0

Course Outcomes (COs)

After the completion of the course, students are expected to have the ability to:

1. Understand about writing, compiling and executing a program in C language.
2. Learn the fundamental building blocks of C Language like constants, variables, identifiers, operators, and type conversion.
3. To write programs in C-language that involves decisions and iterations.
4. Understand the implementation of functions, arrays and pointers in C programming language.

Unit-I 08

C language fundamentals: Character set, keywords, variables: declaration and initialization; scope of variables, constants, type of constants, data type, types of operators: Unary, binary, and ternary operator. Bitwise operators, type conversion and typecasting.

Unit-II 08

C Programming Construct: Components of C Language, structure of a C program, writing and executing the C programs and standard I/O in C. Concepts of operator precedence and associativity. Storage classes- automatic, register, static, and external.

Units-III 08

Conditional program execution: If, if else, nested if else, else if ladder, switch statement, use of break and default with switch; Program loops and iterations: for, while, do while, nesting of loops, use of break and continue statements.

Unit-IV 08

Functions: Introduction, types of functions, passing values to functions, recursive functions. **Arrays:** Array notation and representation, using multi-dimensional arrays, sparse matrices and their representation.

Unit-V 08

User defined data types: Structure, union, and enumerated data types. **Pointers:** Introduction and declaration, array of pointers. **C preprocessor:** Standard C preprocessors, defining and calling macros. **Dynamic Memory Allocation:** malloc(), calloc(), realloc(), and free().

Text Books:

1. Kemighan Brain W. and Ritchie Dennis M., "The C programming", Pearson Education.
2. Rajaraman, "Computer Basics and C ProgrammingV", PHI Learning Pvt. Limited - 2015.
3. Kochan Stephen G., "Programming in C", Pearson Education - 2015.

Reference Books:

1. D.S. Yadav and Rajeev Khanna, "Computer Concepts and Programming", New Age International Publication.
2. Vikas Gupta, "Computer Concepts and Programming in C", Wiley India Publication
3. Reema Thareja, "Computer Fundamentals and Programming in C", Oxford Publication

NBCA-103
BASICS OF INFORMATION SYSTEM

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3 0 0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

1. Understand fundamental of information system.
2. Visualize structure of management information system & decision support system.
3. Learn various business application of information system.
4. Explore ERP, supply chain management and CRM based information system

Unit-I

Introduction: Systems: An overview, Information and data: Definition and distinctions, features and qualities of information, types of information, process of generating information, value and cost of information, information as a corporate resource, information needs at various levels of management, and factors influencing information needs. 08

Unit-II

Information Systems: Definition and elements, information system activities, types of information systems, information systems in business management, and recent trends in information systems. 08

Unit-III

Basics of Internet: Terminology, World Wide Web, Intranets, Extranets, Internet, Internet application and Internet ethics, Connectivity types: level one, level two and level three connectivity, Setting up a connection: hardware requirement, selection of a modem, software requirement, modem configuration, Internet accounts by ISP: Telephone line options, Protocol options, Service options, Telephone line options – Dialup connections through the telephone system, dedicated connections through the telephone system. 08

Unit-IV

E-mail and other Internet Services: Structure of an Email – Email Address, Email Header, Body and Attachments, Email Clients: Netscape mail Clients, Outlook Express, Web based E-mail. Email encryption-Address Book, Signature File. Email Networks and Servers, Email protocols –SMTP, POP3, IMAp4, MIME6, Telnet, FTP, IRC and Search Engine. ISDN, Protocol options – Shell, SLIP, PPP, Service options. 08

Unit-V

Management Information System (MIS) Introduction: Definition and concept of a management information system, MIS versus data processing, MIS and decision support system, MIS and information resources management, and structure of a management information system. Advanced concepts in information system: enterprise resource planning, supply chain management, and customer relationship management. 08

Text Books:

1. Brian, "Management Information System", Tata Mcgraw-hill Education Pvt. Ltd.
2. Gordon B. Davis & Margrethe H. Olson, "Management Information System", Tata Mcgraw-hill Education Pvt. Ltd.

Reference Books:

1. Brian, "Introduction to Information System", TMH Education Pvt. Ltd.

2. Murdick, "Information System for Modern Management", PHI Learning Private Limited.
3. Jawadekar, "Management Information System", TMH Education Pvt. Ltd.

NBCA-104
MATHEMATICS

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

1. Use matrices, determinants and techniques for solving systems of linear equations in the different areas of Linear Algebra, Solve Eigen value problems and apply Cayley Hamilton Theorem.
2. Study the functions of more than one independent variable and calculate partial derivatives along with their applications.
3. Understand and implement the concept of differential equations and learn various methods to solve ordinary differential equations.
4. Identify a range of techniques to form the partial differential equations (PDF) and solutions of standard linear PDFs.
5. Compute and interpret the results of Bivariate Regression and Correlation Analysis.

Unit-I: 08

Matrices: Types of Matrices, Inverse of matrix by elementary transformations, Rank of a matrix, Consistency of linear system of equations and their solution, Characteristic equation, Eigen values and Eigen vectors, and Cayley-Hamilton Theorem.

Unit-II: 08

Differential and Integral calculus: Successive Differentiation, Partial derivatives, Euler's theorem for homogeneous functions, Total derivatives, Taylor's and Maclaurin's theorem: Expansion of function of several variables. Integral Calculus: Definite and Indefinite integration.

Unit-III: 10

Ordinary Differential Equations: Definition and examples, order and degree of differential equations, Solutions of first order first degree differential equations, Variable Separable, Equations reducible to variable separable, Linear differential equations, Bernoulli's differential equations, Linear differential equations of n^{th} order with constant coefficients, Complementary function and Particular integral.

Unit-IV: 08

Partial Differential Equations: Origin of first order partial differential equations, Partial differential equations of the first order and degree one, Lagrange's solution, Partial differential equation of first order and degree greater than one and Solution of second order linear partial differential equations with constant coefficients.

Unit-V: 06

Statistics: Moments, Moment generating functions, Skewness, Kurtosis, Correlation and Regression analysis.

Text Books:

1. N.P. Bali and Dr. Manish Goyal, "Engineering Mathematics" University Science Press, Laxmi Publications, Pvt. Ltd.
2. CB Gupta, SR Singh and Mukesh Kumar, "Engineering Mathematics", McGraw Hill Education(India)Private Limited.
3. E. Kreyzig, "Advanced Engineering Mathematics", John-Wiley &Sons.

Reference Books:

1. B.S.Grewal, "Higher Engineering Mathematics", Khanna Publishers.
2. J.N. Kanpur, "Mathematical Statistics', S. Chand &company Ltd.
3. M.D. Raisnghania, "Advanced Differential Equations", S. Chand & company Ltd.
4. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomas(Cengage)Learning

NBCA-105
SOFT SKILLS AND PERSONALITY DEVELOPMENT

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3 1 0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

1. Understand personality and personality aspects.
2. be able to communicate professionally.
3. be able to put forward own view point and create a professional and profitable Pitch.
4. be able to communicate across organizational levels and cultures effectively.
5. be able to negotiate with the odds and bring in best of the results with specific success.
6. Understand the need for feedback and constant improvement.

Unit-I 08

Strategic Thinking and Listening: Constant Learning and Self Improvement: Being Proactive, Understanding Counter Argument, Optimizing with Experiences; Benefits of Strategic Thinking; Planning with Mind Mapping; Listening: Maintaining Eye Contact, Being Attentive, Keeping an open mind, Turning words into Pictures, Ensuring understanding, Giving Feedback, Reading between the lines (Nonverbal cues); Active Listening vs. Passive Listening.

Unit-II 08

Developing Speaking and Persuasive Writing Skills: Speaking: Modes of Speaking, Using Nonverbal communication, Time Management, Preparing draft, Pacing, Pronunciation, Practicing; Persuasive Writing: Building Argument, Understanding cultural context, Using recommendation, Using concrete evidence in support, Countering perspectives, using logical opening, body and close, Using typography and highlights.

Unit-III 08

Persuasive Presentation and Self-Assessment: Persuasive Presentation: Using ten-minute interactive argument on presentation slides, Attracting and persuading external Audience, Enacting change in strategy, Providing a course of action; Self-assessment: Self-evaluation (strength of argument, clarity in message, structure and use of verbal and nonverbal cues) at the end of presentation, Getting peer evaluation, Synthesizing observations, SOAR (strength, opportunity, aspirations and results) analysis.

Unit-IV 08

Reflection Report: Leadership Communication: Highlighting specific and attainable leadership goals and plan for achieving it; Using progress report as a strategic communicator: Accomplishments as mindful leader and strategic communicator, outlining critical communication experience (receiving meaningful feedback, reaching out audience, making a persuasive pitch etc.)

Unit-V 08

Developing Personality and Soft Skills: Motivation- Factors of motivation, Self-talk, Intrinsic & Extrinsic Motivators; Assertiveness and Negotiation; Personality Traits; Empathy, sympathy and altruism, Importance of empathising with others; Understanding stress and its impact, Stress management techniques; Entrepreneurship; Critical and Creative Thinking: Characteristics of a creative person.

Text Books:

1. Functional skills in Language and Literature, by R.P. Singh, Oxford Univ. Press, 2005, New Delhi.
2. The Nature of Narrative by Robert Scholes, James Phelan and Robert Kellogg, OUP, 2006, New Delhi.
3. Soft Skills for Everyone by Jeff Butterfield, Cengage Learning: 2023, New Delhi.
4. Spoken English- A manual of Speech and Phonetics by R.K. Bansal & J.B. Harrison Orient Blackswan, 2013, New Delhi.

Reference Books:

1. A Glossary of Literary Terms by M. H. Abrams, Cengage Learning, 2015, New Delhi.
2. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
3. Business Correspondence and Report Writing by Prof R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd. ,2001, New Delhi.
4. Word Power Made Easy by Norman Lewis, W.R. Goyal Pub. & Distributors, 2009, Delhi.
5. Developing Communication skills by Krishna Mohan, Meera Banerji Macmillan India Ltd. 1990, Delhi.

NBCA-106P

COMPUTER APPLICATION LAB

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Note: At least 3 practical needs to be conducted from each section.

Section 1: MS-Office

1. At least three applications of MS Word.
2. At least three applications of MS Excel
3. At least three applications of MS Power Point
4. At least three applications of MS Access

Section 2: Hardware

1. Disassembling of Computer system
2. Assembling of Computer system
3. Installation of operating systems (Windows, Linux, etc.)
4. Creating bootable pendrive
5. Familiarization with data recovery tools
6. Designing of posters/ flyers/ pamphlets etc using online portals like Canva.

NBCA-107P
PROGRAMMING IN C LAB

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0 0 3

1. WAP to print "Hello World".
2. WAP to calculate the area and circumference of a circle.
3. WAP that accepts the temperature in Centigrade and converts into Fahrenheit.
4. WAP that swaps values of two variables using a third variable.
5. WAP that checks whether the two numbers entered by the user are equal or not.
6. WAP to find the greatest of three numbers.
7. WAP that finds whether a given number is even or odd.
8. WAP that tells whether a given year is a leap year or not.
9. WAP that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
10. WAP to print the sum of all numbers up to a given number.
11. WAP to find the factorial of a given number.
12. WAP to print sum of even and odd numbers from 1 to N numbers.
13. WAP to print the Fibonacci series.
14. WAP to check whether the entered number is prime or not.
15. WAP to find the sum of digits of the entered number.
16. WAP to find the reverse of a number.
17. WAP to convert binary number into decimal number and vice versa.
18. WAP to add and multiply two matrices of order nxn.
19. WAP that finds the sum of diagonal elements of a mxn matrix.
20. WAP to implement a function that swaps two numbers using call by reference.

NBCA-108P
PROFESSIONAL COMMUNICATION LAB

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Note: At least 5 tasks needs to be conducted from each section.

Section 1: Soft Skills

1. Language Proficiency Test
2. Augmentative Skills- Outlining & Conveying
3. Reading Online Articles & Advertisement
4. Paper Presentation
5. Vocabulary Enhancement Exercises
6. Role Play- Dialogue and Conversation
7. Public Speaking Skills- 2 minutes pitch
8. Self-Assessment & Peer Feedback Script

Section 2: Personality Development

1. Personality Test
2. Office Behavioral Skills- Building Self-awareness & Adaptability in Workplace
3. Positive Thinking Exercises
4. Greeting/Introducing
5. Group/Panel Discussion
6. Presentation Skills-Drafting & Formatting Presentation Slides
7. Startup/Project Presentation
8. Interview etiquette- FAQs related to Job Interviews

NBCA - 201

DATA STRUCTURE

L T P

3 1 0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

1. Learn how to represent arrays, linked lists, stacks, queues in memory using the algorithms and their common applications.
2. Understanding the concept of recursion, application of recursion and its implementation and removal of recursion.
3. Learn the computational efficiency of the sorting and searching algorithms.
4. Learn implementation of Trees and Graphs, and various operations on these data structure.
5. Identify the alternative implementations of data structures with respect to its performance to solve a real world problem.

Unit–I 07

Introduction: Basic Terminology, Elementary Data Organization, Built in Data Types, Abstract Data Types. **Arrays:** Derivation of Index Formulae for 1D, 2D, 3D & nD Array, Application of arrays. **Linked lists:** Implementation of Singly Linked List and Doubly Linked List.

Unit–II 08

Stacks: Basic operations: Push & Pop, Array implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, and Evaluation of postfix expression. **Queues:** Basic operations: Create, Add, Delete, Circular queues, and Array implementation of queues in C.

Unit-III 09

Trees: Basic terminology, Binary Trees, Binary Tree Representation: Array and Pointer (Linked List) Representation, Binary Search Tree, Strictly Binary Tree, and Complete Binary Tree. Extended Binary Trees, Tree Traversal algorithms: In-order, Pre-order and Post-order, Constructing Binary Tree from given Tree Traversal and Insertion.

Unit–IV 08

Searching: Sequential search and Binary Search. **Sorting:** Insertion Sort, Selection, Bubble Sort, Quick Sort, and Radix Sort.

Unit–V 08

Graphs: Basic terminology, Graph Representations: Adjacency Matrices, Adjacency List. Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm.

Text Books:

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++", PHI

2. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education
3. Thareja, "Data Structure Using C" Oxford Higher Education

Reference Books:

1. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication
2. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education
3. Lipschutz, "Data Structures" Schaum"s Outline Series, TMH

NBCA-202

DATABASE MANAGEMENT SYSTEM

L T P
3 1 0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

1. Understand database concepts, structures and query language.
2. Understand the E R model and relational model.
3. Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
4. Understand concept of transaction processing and concurrency control.
5.

Unit-I 08

Introduction: An overview of database management system, advantage of database system, database system vs file system, database system concept and architecture, data model schema and instances, data independence, database language and interfaces, and overall database structure.

Unit-II 08

Data modeling using the entity relationship model: ER model concepts, notation for ER diagram, mapping constraints, keys, concepts of super key, candidate key, primary key, generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, and relationship of higher degree.

Unit-III 08

Relational data model and language: Relational data model concepts, integrity constraints, entity integrity, referential integrity, keys constraints, domain constraints, relational algebra, relational calculus, tuple calculus, and domain calculus. **Introduction to SQL Statements:** Data retrieval, DDL, DML, TCL, DCL, characteristics of SQL, advantage of SQL, SQL data type and literals, types of SQL commands, SQL operators and their procedure, tables, views and indexes, queries and sub queries, aggregate functions, joins, unions, intersection, minus, cursors, and triggers.

Unit-IV 08

Database design & normalization: Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, lossless join decompositions, and normalization using FD, MVD and JDs. **Transaction Processing Concept:** Transaction system, testing of serializability, serializability of schedules, conflict & view serializable schedule, recoverability, recovery from transaction failures, log based recovery, checkpoints, and deadlock handling.

Unit-V 08

Concurrency control techniques: Concurrency control, locking techniques for concurrency control, time stamping protocols for concurrency control, and validation based protocol.

Text Books:

1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill.

Reference Books:

2. Date C J, " An Introduction to Database Systems", Addision Wesley.
3. Elmasri, Navathe, " Fudamentals of Database Systems", Addision Wesley.

4. O"Neil, Databases, Elsevier Pub.
5. Leon &Leon, "Database Management Systems", Vikas Publishing House.
6. Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications.
7. Majumdar & Bhattacharya, "Database Management System", TMH.
8. Ramkrishnan, Gehrke, " Database Management System", McGraw Hill.

NBCA-203

OPERATING SYSTEM

L T P
3 1 0

Course Outcomes (COs):

1. After the completion of the course, students are expected to have the ability to:
2. Analyze various process scheduling Algorithms and their comparisons.
3. Understand the process synchronization problems.
4. Implement the concept of deadlock detection and avoidance.
5. Compare and contrast various Memory management schemes and Page replacement policies.
6. Understand the concept of File and Disk management.

Unit-I 08

Introduction: Operating system and its functions, classification of operating systems- batch, interactive, time sharing, real time system, multiprocessor systems, multiuser systems, multithreaded systems, operating system structure- layered structure, system components, and operating system services.

Unit-II 08

Process Management: Process Concept, Process Scheduling, CPU Scheduling Criteria and Scheduling Algorithms, Cooperating Processes, Threads, and Inter-process Communication.

Unit-III 08

Process Synchronization and Deadlocks: The Critical-Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Deadlock-System Model, Characterization, Deadlock Prevention, Avoidance and Detection and Recovery from Deadlock.

Unit-IV 08

Memory Management: Logical and Physical Address Space, Swapping, Contiguous Allocation, Paging, Virtual Memory, Demand Paging, Page Replacement Algorithms, Allocation of Frames and Thrashing.

Unit-V 08

File Management: File Systems, Secondary Storage Structure, File concept, Access methods and Directory implementation. **Disk Management:** Disk Structure, Disk scheduling, Disk management and Recovery.

Text Books:

1. Abraham Siberschatz and Peter Galvin "Operating System Concepts", Wiley.
2. Tannenbaum, "Operating System", TMH.
3. William Stallings, "Operating Systems: Internals and Design Principles ", 6th Edition, Pearson Education

Reference Books:

1. Milan Milankovic, "Operating Systems, Concept and Design", McGraw Hill.
2. Harvey M Deital, "Operating System", Addison Wesley.
3. D M Dhamdhere, "Operating Systems: A Concept based Approach", 2nd Edition, TMH.

NBCA-204
DISCRETE MATHEMATICL STRUCTURES

L T P
3 0 0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

1. Apply logical skills developed in this course, in various computer applications.
2. Apply the computing skills to formulate, solve and analyse interdisciplinary real-world problems for higher study and research.
3. Apply various algebraic structures in different branches of computer science
4. Apply Graph theoretical concepts to modal, analyse and solve real-world problems.

Unit-I

Set Theory: Introduction, Combination of sets, Multi sets, ordered pairs, Set identities. **Relations:** Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Order of relations. **Functions:** Definition, Classification of functions, Operations on functions, Recursively defined functions. **08**

Unit-II

Propositional Logic: Proposition, Logical connectives, Truth tables, Well formed formula, Tautology, Contradiction, Algebra of proposition, Normal forms, Modus ponens, Modus tollens, Validity. **Predicate Logic:** First order predicate, Well formed formula of predicate, Quantifiers, Inference theory of predicate logic. **Notion of Proof:** Proof by implication, converse, inverse, contra-positive, Negation and contradiction, Direct proof, Proof by using truth table, Proof by counter example. **08**

Unit-III

Combinatories: Mathematical induction, Basics of counting, Pigeonhole principle, Permutations, Combinations, Inclusion-exclusion. **Recurrence Relations & Generating function:** Recurrence relation of order n with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation, Generating function Closed form expression, Properties of G.F., Solution of recurrence relation using G.F. **08**

Unit-IV

Algebraic Structures: Binary composition and its properties, Definition of algebraic structure, Semi group, Monoid, Group, Abelain group, Properties of groups, Permutation group, Sub group, Cyclic group, Rings and Fields(definition and standard results), and Integers modulo n. **08**

Unit-V

Elements of coding theory: Introduction, Definitions, Error detecting & correcting code, Harmonic Code and distance, Theorems. Group (Linear) Codes, Decoding methods. Parity check and Generator matrix, Definition parity check Matrix decoding, Coset decoding. **Hamming's Codes:** Concept, implementation as error correcting code, SEC Code and SEC- DED. **08**

Text Books:

1. Liu and Mohapatra, " Elements of Discrete Mathematics", McGraw Hill
2. Y.N. Singh, "Discrete Mathematical Structures", Wiley India, New Delhi, 2010.

3. R.P. Grimaldi, Discrete and Combinatorial Mathematics, Addison Welsy,
4. S.K. Sarkar, "A Text Book of Discrete Mathematics", S.Chand & Company Ltd., 2012.

Reference Books

1. Kenneth H. Rosen, " Discerete Mathematics and its Applications", Mc Graw Hill, 2002.
2 J.P. Tremblay & R. Manohar, " Discrete Mathematical Structure with Applications to Computer Science" Mc Graw Hill, 1975.
3. V. Krishnamurthy, "Combinatories: Theory and Apllications", East-West Press.
4. Seymour Lipschutz, M.Lipson, "Discrete Mathematics" Tata Mc Graw Hill, 2005.
5. Kolman, Busby Ross, "Discrete Mathematical Structures", Prentice Hall Internatinal.

NBCA-205

DIGITAL ELECTRONICS AND COMPUTER ORGANIZATION

L T P
3 1 0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

1. Design various logic gates and simplify Boolean functions.
2. Design various flip flops, shift registers and determining outputs.
3. Analyze, design and implement combinational logic circuits.
4. Perform computer arithmetic operations.
5. Understand the Control unit, memory design and I/O organization of computer system.

Unit-I 08

Basics of Digital Electronics: Number System– Decimal, Binary, Octal, Hexa-Decimal Representation for their Conversion, Coding System and Arithmetic of Number System. Character Codes and its arithmetic, Error detecting and correcting codes. **Boolean algebra**: Definition, axioms, basic theorems, and properties. Boolean functions and their simplification: Canonical and standard forms, K- map method up to five variables, and don't care conditions.

Unit-II 08

Logic Gates: AND, OR, NOT, XOR, XNOR, NAND, NOR gates and their truth tables. Implementation of Boolean Functions using NAND and NOR gates. **Combinational Logic:** Combinational circuits, analysis and design procedures, adders, subtractor, Introduction to decoders, encoders, multiplexers and De-multiplexers.

Unit-III 08

Sequential logic: Sequential circuits, Latches, Flip flops: RS, clocked RS, JK, D and T flip-flops, Master slave flip-flop, edge and level triggering. Registers and Counters: Shift registers, Ripple counters, Johnson & Ring Counter. Introduction to Synchronous and Asynchronous Circuits.

Unit-IV 08

Basics of Computer Organization: Introduction, bus architecture, bus and memory transfer, processor organization, general register organization, stack organization, and addressing modes. **Arithmetic and logic unit:** Introduction, Fixed and floating point representation, IEEE standard for floating point representation, Multiplication: Signed operand multiplication, and Booth's algorithm.

Unit-V 08

Control Unit: Instruction types, formats, instruction cycles and sub-cycles, micro-operations, and execution of a complete instruction. **Memory:** Introduction, semiconductor RAM memories, ROM memories, and Cache memories. **Input / Output:** Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts, and standard communication interfaces.

Text Books:

1. M. Morris Mano, "Computer System Architecture", Pearson Education India.

2. W. Stallings, "Computer Organization", PHI.
3. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education India.

Reference Books:

1. DP Kothari and JS Dhillon, "Digital Circuit and Design", Pearson Education.
2. Vravice, Zaky & Hamacher, "Computer Organization", TMH Publication.
3. John P.Hayes, "Computer Organization", McGraw Hill.

NBCA-206P

DATA STRUCTURE LAB

L T P

0 0 3

1. To implement addition and multiplication of two 2D arrays.
2. To transpose a 2D array.
3. To implement stack using array.
4. To implement stack using linked list.
5. To implement queue using array.
6. To implement queue using linked list.
7. To implement circular queue using array.
8. To implement circular queue using linked list.
9. To implement binary tree using linked list.
10. To implement binary search tree using linked list.
11. To implement tree traversals using linked list.
12. To implement BFS using linked list.
13. To implement DFS using linked list.
14. To implement Linear Search.
15. To implement Binary Search.
16. To implement Bubble Sorting.
17. To implement Selection Sorting.
18. To implement Insertion Sorting.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

NBCA-207P
DBMS Lab

L T P
0 0 2

LIST OF PRACTICALS

Part I: Getting familiar with SQL (Maximum number of turns allotted: 3)

1) Creating tables.
2) Insertion, Deletion, Updation and Retrieval of data.
3) Arithmetic operations, Logical operations and Pattern matching.
4) Concept of Grouping (Group by clause, Having Clause).
5) Use Aggregate function in query.
6) Write commands for Joins, Union and Intersection.
7) Concept of Sub-query.
8) Concept of Data constraints (Unique Key, Primary Key, Foreign Key).
9) Creating Views and Indexes.
10) Creating Trigger.

Part II: Relational Database Implementation

Implement the following mini-project's database schemas and give an expression in SQL for each of the queries.

Project 1. Library Management System:

Create the following schema, enter at least 5 records in each table and answer the queries given below.

LibraryBooks (Accession number, Title, Author, Department, PurchaseDate, Price)
IssuedBooks (Accession number, Borrower)

a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
b) Delete the record of book titled "Database System Concepts".
c) Change the Department of the book titled "Discrete Mathematics" to "CSE".
d) List all books that belong to "CSE" department.
e) List all books that belong to "CSE" department and are written by author "Navathe".
f) List all computer (Department="CSE") that have been issued.
g) List all books which have a price less than 500 or purchased between "01/01/2015" and "01/01/2019".

Project 2. Student Management System:

Create the following schema, enter at least 5 records in each table and answer the queries given below.

Student (College roll number, Name of student, Date of birth, Address, Marks(rounded off to whole number) in percentage at 10 + 2, Phone number)
Paper Details (Paper code, Name of the Paper)
Academic_details (College roll number, Paper code, Attendance, Marks in home examination)

a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.

b) Design a query that will return the records (from the second table) along with the name of student from the first table, related to students who have more than 75% attendance and more than 60% marks in paper 2.
c) List all students who live in "Lucknow" and have marks greater than 60 in paper 1.
d) Find the total attendance and total marks obtained by each student.
e) List the name of student who has got the highest marks in paper 2.

Project 3. Customer Management System:

Create the following schema, enter at least 5 records in each table and answer the queries given below.

Customer (CustID, email, Name, Phone, ReferrerID)
Bicycle (BicycleID, DatePurchased, Color, CustID, ModelNo)
BicycleModel (ModelNo, Manufacturer, Style)
Service (StartDate, BicycleID, EndDate)

a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
b) List all the customers who have the bicycles manufactured by manufacturer "Honda".
c) List the bicycles purchased by the customers who have been referred by customer "C1".
d) List the manufacturer of red colored bicycles.
e) List the models of the bicycles given for service.

Project 4. Human Resource Management System:

Create the following tables, enter at least 5 records in each table and answer the queries given below.

EMPLOYEE (Person_Name, Street, City)
WORKS (Person_Name, Company_Name, Salary)
COMPANY (Company_Name, City)
MANAGES (Person_Name, Manager_Name)

a) Identify primary and foreign keys.
b) Alter table employee, add a column "email" of type varchar(20).
c) Find the name of all managers who work for both Samba Bank and NCB Bank.
d) Find the names, street address and cities of residence and salary of all employees who work for "Samba Bank" and earn more than $10,000.
e) Find the names of all employees who live in the same city as the company for which they work.
f) Find the highest salary, lowest salary and average salary paid by each company.
g) Find the sum of salary and number of employees in each company.
h) Find the name of the company that pays highest salary.

Project 5. Supplier Management System:

Create the following tables, enter at least 5 records in each table and answer the queries given below.

Suppliers (SNo, Sname, Status, SCity)
Parts (PNo, Pname, Colour, Weight, City)
Project (JNo, Jname, Jcity)
Shipment (Sno, Pno, Jno, Qunatity)

a) Identify primary and foreign keys.

b) Get supplier numbers for suppliers in Paris with status>20.
c) Get suppliers names for suppliers who do not supply part P2.
d) For each shipment get full shipment details, including total shipment weights.
e) Get all the shipments where the quantity is in the range 300 to 750 inclusive.
f) Get part nos. for parts that either weigh more than 16 pounds or are supplied by suppliers S2, or both.
g) Get the names of cities that store more than five red parts.
h) Get full details of parts supplied by a supplier in Delhi.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

NBCA-208P

OPERATING SYSTEM LAB

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0 0 3

1. WAP to implement first come first serve (FCFS) CPU Scheduling Algorithms in C.
2. WAP to implement shortest job first (SJF) CPU Scheduling Algorithms in C.
3. WAP to implement shortest remaining time First (SRTF) CPU Scheduling Algorithms in C.
4. WAP to implement PRIORITY CPU Scheduling Algorithms in C.
5. WAP to implement ROUND ROBIN Scheduling Algorithms in C.
6. WAP to implement BANKER'S Algorithms in C.
7. WAP to implement FIFO Page Replacement Algorithm in C.
8. WAP to implement LRU Page Replacement Algorithm in C.
9. WAP to implement OPTIMAL Page Replacement Algorithm in C.
10. Simulate Paging Technique of Memory Management.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY

UNIVERSITY OF LUCKNOW

Course Structure and Syllabus

For

BACHELOR OF COMPUTER APPLICATION (BCA)

2nd Year

as per

NEP-2020

(To be effective from the session 2024-2025)

BACHELOR OF COMPUTER APPLICATION (BCA)

YEAR: SECOND, SEMESTER-III

(To be effective from the session 2024-2025)

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam		
			L	T	P	CT	TA	Total	ESE		
1.	NBCA-301	Object Oriented Programming Using Java	3	1	0	20	10	30	70	100	4
2.	NBCA-302	Software Engineering	3	1	0	20	10	30	70	100	4
3.	NBCA-303	Computer Architecture	3	1	0	20	10	30	70	100	4
4.	NBCA-304	Python Programming	3	1	0	20	10	30	70	100	4
5.	NBCA-305	Accounting and Financial Management	3	0	0	20	10	30	70	100	3
Practical											
6.	NBCA-306P	Java Lab	0	0	3		20	20	30	50	2
7.	NBCA-307P	Python Programming Lab	0	0	3		20	20	30	50	2
8.	NBCA-308P	Industrial Training viva-voce	0	0	2		20	20	30	50	1
9.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	**15**	**4**	**8**					**650**	**24**

BACHELOR OF COMPUTER APPLICATION (BCA)

YEAR: SECOND, SEMESTER-IV

(To be effective from the session 2024-2025)

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam ESE		
			L	T	P	CT	TA	Total			
1.	NBCA-401	Advance Java Technology	3	1	0	20	10	30	70	100	4
2.	NBCA-402	Design and Analysis of Algorithm	3	1	0	20	10	30	70	100	4
3.	NBCA-403	Web Design Concepts	3	1	0	20	10	30	70	100	4
4.	NBCA-404	Computer Graphics	3	1	0	20	10	30	70	100	4
5.	NBCA-405	Managerial Economics	3	0	0	20	10	30	70	100	3
Practical											
6.	NBCA-406P	Advance Java Technology Lab	0	0	3		20	20	30	50	2
7.	NBCA-407P	Web Design Lab	0	0	3		20	20	30	50	2
8.	NBCA-408P	Computer Graphics Lab	0	0	2		20	20	30	50	1
9.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	**15**	**4**	**8**					**650**	**24**

Note:

1. After Examination of Semester-IV, the Industrial Project based Training (04 to 06 weeks) to be conducted during summer break, and will be assessed during V semester (BCA Degree Programme). The training may be carried out at some industrial unit or under the guidance of faculty member of the institution.
2. If the student leaves the programme after completing Semester-IV successfully, student will be awarded a **Diploma in Computer Application.**

NBCA-301

OBJECT ORIENTED PROGRAMMING USING JAVA

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Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand the fundamentals of object oriented programming.
- Understand java programming basics.
- Use inheritance, polymorphism, arrays, threads, packages, and exception handling.

Unit-I **08**

Object-Oriented Analysis: Introduction to Object Oriented Concepts, Object Oriented Analysis Modeling. **Java Basic:** JAVA environment, JAVA program structure, Tokens, JVM, Constant and Variables, Data Types, Declaration of variables, Scope of variables, Symbolic constants, Type Casting. **Operators**: Arithmetic, Relational, Logical, Increment and Decrement, Conditional, Bitwise.

Unit-II **08**

Object and Class Concept: Defining a Class, adding variables and Methods to classes, Creating Objects, Accessing Class Members, Constructors, use of this Keyword, Static Members, and Nesting of Methods. **Inheritance:** Definition, Single inheritance, Multilevel inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, use of super Keyword.

Unit-III **08**

Polymorphism: Definition, Types of Polymorphism, Methods Overloading, Overriding Methods, Final Variables and Methods, use of final Keyword, Finalize Methods. **Arrays:** One Dimensional and Two Dimensional, Strings, Vectors, Wrapper Classes.

Unit-IV **08**

Abstraction: Abstract class, Interface, Extending Interface, Implementing Interface, Accessing Interface Variable. **Access Modifiers:** Public, Private, Default and Protected. **Package:** System Packages, user defined Package, Encapsulation

Unit-V **08**

Exception Handling: Concepts of Exceptions, Types of Exception, Try and Catch keyword, Nested Try and Catch. **Threads:** Creating Threads, Extending Threads Class, Life Cycle of a Thread, Using Thread Methods, Thread Exceptions, and Synchronization.

Text Books:

1. E. Balagurusamy, "Programming in Java", TMH Publications.

Reference Books:

1. Peter Norton, "Peter Norton Guide to Java Programming", Techmedia Publications.
2. Naughton, Schildt, "The Complete Reference JAVA 2", TMH.

NBCA-302

SOFTWARE ENGINEERING

L	T	P
3	1	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand the basic concepts of software engineering.
- Understand the requirement analysis and importance of SRS documentation.
- Understand the design of software product.
- Understand various testing techniques and maintenance of software product.

Unit-I **08**

Introduction: Software components, software characteristics, software crisis, software engineering processes, similarity and differences from conventional engineering processes, and software quality attributes. SDLC Models: Water fall model, prototype model, spiral model, evolutionary development models, iterative enhancement models, and agile software development model.

Unit-II **08**

Software Requirement Specifications: Requirement engineering process, feasibility study, information modeling, data flow diagrams, entity relationship diagrams, decision tables, SRS document, and IEEE standards for SRS. SQA: Verification and validation, SQA plans, software quality frameworks, ISO 9000 models, and SEI-CMM model.

Unit-III **08**

Software Design: Basic concept, architectural design, low level design: modularization, design structure charts, pseudo codes, flow charts, coupling and cohesion measures, design strategies. Software Measurement and Metrics: Halestead's software science, function point (FP) based measures, and cyclomatic complexity measures: Control flow graphs.

Unit-IV **08**

Software Testing: Testing objectives, unit testing, integration testing, acceptance and regression test, testing for functionality and performance. Top-down and bottom-up testing strategies: test drivers and test stubs, structural testing (white box testing), functional testing (black box testing), test data suit preparation, alpha and beta testing of products, Static testing strategies.

Unit-V **08**

Software Maintenance and Software Project Management: Software as an evolutionary entity, need for maintenance, categories of maintenance, cost of maintenance, software re-engineering, reverse engineering, software configuration management activities, change control process, software version control, an overview of CASE tools, estimation of cost, efforts, schedule/duration, and constructive cost models (COCOMO).

Text Book:

1. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.

Reference Books:

1. R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
3. Pankaj Jalote, Software Engineering, Wiley
4. Carlo Ghezzi, M. Jarayeri, D. Manodrioli, Fundamentals of Software Engineering, PHI Publication.

NBCA-303

COMPUTER ARCHITECTURE

L	T	P
3	1	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand in depth about architecture of computer system.
- Analyse and understand the concepts of parallel processing.
- Understand the concepts of pipeline processing.

Unit-I **08**

Introduction: Functional units of digital computer system and their interconnections, introduction to Arithmetic and logic unit, basics of control unit, fundamentals of memory, input/output and peripheral devices introduction. Difference between computer organization and architecture.

Unit-II **08**

Architecture: Different components of a computer, Classification of computers (Flynn's and Feng's Classification), Introduction to RISC and CISC architecture, Comparison between Pipelining and Parallelism, Computer instruction types: formats, instruction cycles & sub-cycles, micro operations and execution of complete instruction.

Unit-III **08**

Basic Concepts of Parallel Processing: Concept of parallelism and Network Models (Mesh, Pyramid, Butterfly and Hypercube models), Performance metrics & measures and speed up performance laws, Parallel Random-Access Machine Models (PRAM models).

Unit-IV **08**

Pipeline Processing: Principle of pipelining, general structure of pipelines, classification of pipeline processors, general pipeline and reservation tables. Principle of Designing pipelined Processor: pipeline instruction execution, pre-fetched buffer, internal forwarding and register tagging, hazard detection & resolution. Pipeline Scheduling Theory.

Unit-V **08**

Program Partitioning & Scheduling: Grain size & latency, Grain packing, scheduling and static multiprocessor scheduling. Program Flow Mechanism: control flow vs data flow, demand driven mechanism and comparison of flow mechanism.

Text Book:

1. John P Hayes "Computer Architecture and organization" McGraw Hill
2. Dezso Sima,Terence Fountain and Peter Kacsuk " Advanced Computer Architecture" Pearson Education
3. Kai Hwang "Advanced Computer Architecture" TMH

Reference Books:

1. Linda Null, Julia Lobur- The Essentials of Computer Organization and Architecture, 2014, 4th Edition.
2. Rao, P.V.S. Prospective in Computer Architecture" Prentice Hall of India
3. William Stallings "Computer Organization and Architecture" Pearson
4. Carl Hamacher, ZvonkoVranesic and Safwat Zaky, "Computer Organization" Mcgraw Hill Fifth International Edition

NBCA-304

PYTHON PROGRAMMING

L	T	P
3	1	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand the basic concept of python.
- Understand the variable, data type, loop, and properties of python.
- Understand the concept of strings and its associated functions.
- Understand the object-oriented concept in python.
- Apply knowledge of python on file using pandas and numpy.

Unit-I **08**

Basics of Python: The programming cycle for python, python IDE, interacting with python programs, elements of python, variables, data types, type conversion. Expressions, assignment statement, arithmetic operators, operator precedence and Boolean expression.

Unit-II **08**

Conditional program execution: Conditional statement, looping, control statements: if, if else, nested if else, for loop, while loop, nested loop. **Lists:** Introduction, properties, accessing list, operations, working with functions and methods. **Tuple**: Introduction, properties, accessing tuple, operations, working with functions and methods. **Dictionaries**: Introduction, properties, accessing values in dictionaries, working with functions and methods.

Unit-III **08**

Strings and Functions: String manipulation: accessing strings, basic operations, string slices. Functions: definition, calling a function, types of functions, function arguments, anonymous functions, global and local variables.

Unit-IV **08**

OOP Concepts: Classes and objects, definition, creating classes, instance methods, new style class, attributes, inheritance, polymorphism, exception classes, custom exception, overloading, overriding and data hiding.

Unit-V **08**

File handling in Python: Opening and closing file, reading and writing files. Searching- Linear and Binary search, sorting-merge sorting, insertion sort, and selection sort.

Text Book:

1. Allen B. Downey, Think Python: How to think like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python- Revised and updated for Python 3.2", Network Theory Ltd, 2011.
3. John V Guttag, "Introduction to computation and programming using Python", Revised and expanded Edition, MIT Press, 2013.

Reference Books:

1. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt Ltd, 2016.
2. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd, 2015
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.

NBCA 305

ACCOUNTING AND FINANCIAL MANAGEMENT

L	T	P
3	0	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Understand the fundamentals and basic concepts of Financial Accounting.
- Apply various Accounting Principles and Standards used in preparation of financial statements.
- Understand preparation and presentation of financial statements.
- Acquire knowledge about various techniques used in Financial Statement Analysis.
- Demonstrate the awareness about the concepts, scope and objectives of Financial Management.

UNIT I **(8)**

Introduction to Accounting: Basic concepts, Meaning & Definition of Accounting, Objectives, Scope, Advantages, and Limitations of Accounting, Branches of Accounting, Users of Accounting Information, Accounting Process, Accounting equation, Generally Accepted Accounting Principles (GAAP) and Accounting Standards (AS), Introduction to International Financial Reporting Standards (IFRS): Need and significance. Ethical issues in Accounting.

UNIT II **(8)**

Basics of Accounting: Systems of Accounting: Double Entry System of Accounting, Introduction to Journal, Journalizing the transactions, Ledger & Posting, Trial Balance: Meaning, and methods, Capital and revenue items.

UNIT III **(8)**

Preparation of Final Accounts: Trading Account, Profit & Loss Account, Balance Sheet, with simple adjustment entries: Closing stock, Outstanding expenses, Prepaid Expenses, Depreciation, Accrued income, Unearned Income, Interest on Capital, Interest on Drawing, Interest on Loans, Bad Debts, Provision for Doubtful Debts, Provision for Discount on Debtors, Manager's Commission.

UNIT IV **(8)**

Financial Statement Analysis: Meaning, Objectives, and Techniques of Financial Statement Analysis. **Ratio Analysis:** Liquidity, Leverage, Profitability, and Activity Ratios, meaning and

significance. **Cash Flow Statement:** Meaning, Objectives, and Preparation of Cash Flow Statement - using Indirect Method, (simple numerical exercises).

UNIT V **(8)**

Introduction to Financial Management: Meaning, nature and approaches to Financial Management, Objectives: PMO vs. WMO, Financial Decisions: Financing, Investment, Dividend & Liquidity decisions, liquidity vs. profitability trade-off. Time Value of Money: Basic valuation concepts - Compounding and Discounting techniques. Sources of Finance: A brief overview of Short term and Long term sources.

Texts Books:

1. Narayanaswamy, R. (2014). Financial Accounting: A Managerial Perspective, Prentice Hall India, 6th Edition.
2. Tulsian's Financial Accounting: As per the latest curriculum on directives of NEP 2020, (2023), S. Chand Publishing.

Reference Books:

1. Ramchandran & Kakani, Financial Accounting for Management, TMH.
2. Bhattacharya, Ashish K., Essentials of Financial Accounting for Business Managers, 6th Edition, PHI.
3. Hanif & Mukherjee - Financial Accounting for Management (TMH, 2nd Edition).
4. Singh, Y. P., Accounting and Financial Management for I.T. Professionals, (2007) New Age International Publishers.
5. Khan & Jain, Financial Management: Text, Problems, and Cases, 8th Edition, (2018), McGraw Hill India.
6. Kishore, Ravi M., Financial Management, 8th Edition, (2020), Taxmann.
7. Vaishampayan J. V. Financial Management, NRBC.

NBCA-306P

JAVA LAB

L	T	P
0	0	3

Course Outcomes (COs):

At the end of this course students will be able to:

- Write programs in java language.
- Implement interface and package.
- Implement Method Overloading and Method Overriding. Handle exceptions in java.

LIST OF PRACTICALS

Note: - At least ten experiments are to be conducted. Perform practical using JAVA language.

1. Write a program in java which prints your name using command line arguments.

2. Write a program in java which enters three number using command line arguments and print sum and average of the number

3. Write a program to swap the value of 2 variables without using 3rd variable

4. Write a program to calculate the sum of digits of a given integer no.

5. Write a program to compute the sum of the first and last digit of a given number.

6. Write a program in java which enter the number using Data Input Stream and check whether the entered number is even or odd.

7. Write an application that reads a string and determines whether it is a palindrome.

8. Write a program to enter a sentence form keyboard and also find all the words in that sentence with starting character as vowel.

9. Write a Program in java which creates the array of size 5; find the sum and average of the five numbers.

10. Create a java program that has three version of add method which can add two, three, and four integers.

11. Program illustrating Classes and Objects.

12. Program illustrating Method Overloading and Method Overriding.

13. Program illustrating concept of Interface.

14. Program illustrating use of Final and Super keyword.

15. Program that illustrates the Creation of simple package.

16. Program that illustrates the Accessing of a package.

17. Program that illustrates the Handling of predefined exceptions.

18. Program that illustrates the Handling of user defined exceptions.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

NBCA-307P

PYTHON PROGRAMMING LAB

L	T	P
0	0	3

Course Outcomes (COs):

At the end of this course students will be able to:

- Understand the fundamentals of Python programming.
- Make programs in Python using list.
- Make programs Python using dictionary.
- Make programs Python using string.
- Make programs Python using tuple.

LIST OF PRACTICALS

Instruction: At least 6 sections are to be implemented.

Section 1: Basic python program

- Python program to print Hello world!
- Python program to add two numbers
- Python program to find the square root
- Python program to calculate the area of a triangle
- Python program to swap two variables

Section 2: Python program on conversion

- Python program to convert kilometres to miles
- Python program to convert Celsius to Fahrenheit
- Python program to convert decimal to binary, octal and hexadecimal
- Python program to find ASCII value of character
- Python program to implement type conversion

Section 3: Basic mathematical program

- Python program to check Armstrong number
- Python program to check if a number is odd or even
- Python program to check leap year
- Python program to find the largest among three numbers
- Python program to check prime number

Section 4: Python program on list

- Python program to check if a list is empty
- Python program to access index of a list using for loop

- Python program to slice list
- Python program to concatenate two lists
- Python program to remove duplicate element from a list

Section 5: Python program on dictionary

- Python program to merge two dictionaries
- Python program to iterate over dictionary using for loop
- Python program to sort a dictionary by value
- Python program to delete an element from a dictionary
- Python program to check if a key is already present in a dictionary

Section 6: Python program on string

- Python program to check if given strings is palindrome or not
- Python program to capitalize the first character of a string
- Python program to compute all the Permutation of the String
- Python program to create a countdown timer
- Python program to count the number of occurrences of a character in string

Section 7: Python program on tuple

- Python program to find the size of a tuple
- Python program for adding a tuple to list and vice-versa
- Python program to sort a list of tuples in increasing order by the last element in each tuple
- Python program to assign frequency to tuples
- Python program to check if any list element is present in tuple

Section 8: Python program on Classes and Objects

- Create a class my class and add some element in it.
- Create a python program to access all elements of a given class
- Create a python program to show OOPs concept
- Create a python program to delete an object in python
- Create a class named Person, use the init() function to assign values for name and age

Section 9 : Python program on files

- Create a python program to make a file
- Create a python program to open and close a given file.
- Create a python program to read and write in file
- Create a python program for copying, moving, and renaming files
- Create a python program for deleting files in python

Section 10: Section 8: Python program on patterns

- Program to print full pyramid using *
- Pascal's triangle pattern using numbers
- Numbered Diamond pattern
- Square pattern in python
- Simple Number triangle pattern

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

NBCA-401

ADVANCE JAVA TECHNOLOGY

L	T	P
3	1	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand Server Side Architecture of Web Applications.
- Connect to Database and do the CRUD Database operations using JDBC.
- Develop Web Application by using Servlets and JSP.
- Manage Session in the web application.

Unit-I **08**

Java Programming Language: Introduction to Java Programming, Operator, Data type, Variable, Arrays, Control Statements, Methods & Classes, Package and Interface, Polymorphism, Inheritance, Exception Handling, Multithread programming, Input / Output: exploring Java.io, Java Applet, String handling, Networking, Event handling.

Unit-II **08**

Introduction to AWT: AWT Controls, Graphics, Layout Manager and Menus, Images, Additional packages. Java Swing: Creating a Swing Applet and Application, Programming using Panes, Pluggable Look and feel, Labels, Text fields, Buttons, Toggle buttons, Checkboxes, Radio Buttons, View ports, Scroll Panes, Scroll Bars, Lists, Combo box, Progress Bar, Menus and Toolbars, Layered Panes, Tabbed Panes, Split Panes, Layouts, Windows, Dialog Boxes.

Unit-III **08**

JDBC: The connectivity Model, JDBC/ODBC Bridge, Understanding with MySql, JDBC Driver Setup, Create Connection, Write Statement, Create Login/Logout, Insert/Update/Delete. Java Servlets: Introduction to Servlets, Servlet life cycle, Servlet containers, Servlet Configurations and Parameters, Initialization parameters, Context parameters, Handling Form Data,GET and POST methods, HTML forms and servlets.

Unit-IV **08**

JavaServer Pages (JSP): Introduction to JSP, JSP life cycle, JSP expressions and declarations, Directives and Actions, Page directives, JSP actions and implicit objects, JSP Tag Libraries, Standard and Custom Tag Libraries, Expression Language (EL).

Unit-V **08**

Session Management: HttpSession and Cookies, Managing user sessions, Cookie handling. Enterprise JavaBeans (EJB): Introduction to EJB, Session beans, entity beans, and message-driven beans, EJB containers.

Text Book:

1. James Rumbaugh etal, "Object Oriented Modeling and Design", PHI
2. Balagurusamy E, "Programming in JAVA", Tata Mcgraw-hill Education Pvt. Ltd.
3. Herbert Schieldt, "The Complete Reference: Java" TMH

Reference Books:

1. Dustin R. Callway, "Inside Servlets", Addison Wesley.
2. Mark Wutica, "Java Enterprise Edition", QUE.
3. Steven Holzner, "Java2 Black book", Wiley Dreamtech Publication.
4. Liang, "Introduction to Java Programming, Comprehensive Version", Pearson Education.
5. Deitel and Deitel, "Java: How to Program" PHI Learning Private Limited, Delhi India.

NBCA-402

DESIGN AND ANALYSIS OF ALGORITHM

L	T	P
3	1	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Implementation of various sorting algorithm and their comparisons.
- Analyse the concept of Divide & Conquer and Greedy techniques.
- Implementation of Dynamic Programming concept in solving various problems.
- Understand the concepts such as NP-completeness and randomized algorithms.

Unit-I **08**

Introduction: Algorithms, analyzing algorithms, complexity of algorithms, growth of functions, performance measurements, sorting and order statistics - shell sort, quick sort, merge sort, heap sort, comparison of sorting algorithms, and sorting in linear time.

Unit-II **08**

Advanced Data Structures: Red-Black trees, B – trees, Binomial Heaps, Fibonacci Heaps.

Unit-III **08**

Design and Analysis Technique: Divide and Conquer Sorting, Greedy methods with examples such as Optimal Reliability Allocation, Knapsack, Single source shortest paths - Dijkstra's and Bellman Ford algorithms.

Unit-IV **08**

Dynamic Programming: Knapsack, all pair shortest paths – Warshal's and Floyd's algorithms, resource allocation problem. Backtracking, branch and bound, graph coloring, n-queen problem, Hamiltonian cycles, and sum of subsets.

Unit-V **08**

Selected Topics: Algebraic computation, fast Fourier transform, string matching, theory of NP completeness, approximation algorithms, and randomized algorithms.

Text Book:

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", Printice Hall of India.
2. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms", Galgotia Press.
3. Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms" Pearson

Reference Books:

1. Jon Kleinberg and Éva Tardos, "Algorithm Design", Pearson.
2. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis, and Internet Examples". Wiley.
3. Harry R. Lewis and Larry Denenberg, "Data Structures and Their Algorithms", Harper Collins.

NBCA-403

WEB DESIGN CONCEPTS

L	T	P
3	1	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand the knowledge of the internet and related internet concepts that are vital in understanding web application development.
- Analyse and apply the role of markup languages like HTML, DHTML, and XML in the workings of the web and web applications.
- Programming web pages with JavaScript.
- Design and implementation of build dynamic web pages using client side programming JavaScript and also develop the web application using servlet and JSP.

Unit-I **08**

Introduction: Introduction to web, protocols governing the web, web development strategies, web applications, web project, and web team.

Unit-II **08**

HTML: List, table, images, frames, forms, and CSS.

Unit-III **08**

XML: TAGS, DTD, XML schemes, presenting and using XML.

Unit -IV **08**

Java script: Introduction, documents, forms, statements, functions, objects, event and event handling, introduction to AJAX, VB Script, and CGI

Unit-V **08**

Server Site Programming: Introduction to active server pages (ASP), ASP.NET, java server pages (JSP), JSP application design, tomcat server, JSP objects, declaring variables and methods, debugging, and sharing data between JSP pages.

Text Books:

1. Xavier, C, "Web Technology and Design" , New Age International.

2. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication.

Reference Books:

1. Deitel, "Java for programmers", Pearson Education.

2. Ramesh Bangia, "Internet and Web Design", New Age International.

3. Jackson, "Web Technologies" Pearson Education.

4. Patel and Barik,"Introduction to Web Technology & Internet", Acme Learning.

NBCA-404

COMPUTER GRAPHICS

L	T	P
3	1	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Work with display systems.
- Execute various Scan Conversion algorithms in laboratory so as to draw Graphics primitives.
- Work with with 2D and 3D graphics.
- Develop creativity to create 2D objects.

Unit-I **08**

Introduction: Types of computer graphics, graphic displays- random scan displays, raster scan displays, frame buffer and video controller, points and lines, line drawing algorithms, circle generating algorithms, mid-point circle generating algorithm and parallel version of these algorithms.

Unit-II **08**

Transformations: Basic transformation, matrix representations and homogeneous coordinates, composite transformations, reflections and shearing. Windowing and clipping: Viewing pipeline, viewing transformations, 2-D clipping algorithms- line clipping algorithms such as Cohen Sutherland line clipping algorithm.

Unit-III **08**

Three Dimensional: 3-D geometric primitives, 3-D object representation, 3-D transformation, 3-D viewing, projections and 3-D clipping.

Unit-IV **08**

Curves and Surfaces: Quadric surfaces, spheres, ellipsoid, blobby objects, polygon meshes parametric and cubic curves, introductory concepts of spline, Bspline, Bezier curves and surfaces.

Unit-V **08**

Hidden Lines and Surfaces: Back face detection algorithm, depth buffer method, a- buffer method, scan line method, basic illumination models– ambient light, diffuse reflection, specular reflection and Phong model, combined approach, warn model, intensity attenuation, color consideration, transparency and shadows.

Text Book:

1. Donald Hearn and M Pauline Baker, "Computer Graphics C Version", Pearson.
2. Foley, Vandam, Feiner, Hughes, "Computer Graphics principle", Pearson.
3. Rogers, "Procedural Elements of Computer Graphics", McGraw Hill

Reference Books:

1. W.M.Newman, R.F.Sproull ,"Principles of interactive computer graphics",McGraw
2. Amrendra N Sinha and Arun D Udai," Computer Graphics", Tata MCGraw Hill.
3. M.C. Trivedi, NN Jani, "Computer Graphics & Animations", Jaico Publications.

NBCA 405

MANAGERIAL ECONOMICS

L	T	P
3	0	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Understand the importance of Managerial Economics in Business Decision-Making.
- Apply the concepts and tools of economic analysis in Business Decision-Making.
- Apply the principles of managerial economics in achievement of business objectives.
- Apply the knowledge of the mechanics of supply and demand to explain working of markets.
- Understand and analyze the macro environment affecting the business decision making.

UNIT I **(6)**

Managerial Economics: Meaning, Nature and Scope, relevance in business decisions, Fundamental principles: Opportunity Cost Principle, Marginality Principle, Incremental Principle, Equi-marginal Principle, Principle of Time perspective, Discounting Principle. Objectives of Firms.

UNIT II **(8)**

Demand Analysis: Demand Theory, The concept of Demand, Determinants of Demand. Demand Function, Demand Schedule, Demand curve, Law of Demand, Exceptions to the Law of Demand, Shift in demand. Elasticity of Demand and its uses in business decision making.

Demand Forecasting: Meaning, significance, and a brief overview of forecasting methods.

UNIT III **(8)**

Production Analysis: Concept of Production, Factors of Production, Production function, Laws of Production, Economies of Scale, Economies of Scope.

Cost Analysis: Cost Concept, Types of Costs, Cost Function and Cost Curves, Costs in short run and long run, LAC and Learning Curve.

UNIT IV **(12)**

Market Analysis: Price-output determination in different markets, Perfect competition, Monopoly, Price discrimination under monopoly, Monopolistic competition, Duopoly and Oligopoly markets. Pricing strategies and practices.

Profit Analysis: Nature and Management of Profit, Profit Theories, Function of Profits, Profit policies.

UNIT V **(6)**

Introduction to Macro Economics: National Income Aggregates. Concept of Inflation, InterSectoral Linkages: Macro Aggregates and Policy Interrelationships, Tools of Fiscal and Monetary Policies, Business cycle.

Texts Books:

1. Dwivedi, D. N. (2021), Managerial Economics, 9th edition, Vikas Publishing House.
2. Agarwal, M. K. (2011), Engineering & Managerial Economics, New Age International.

Reference Books:

1. Ahuja, H. L. (2022), Managerial Economics, 9e, S. Chand Publishing.
2. Thomas & Maurice (2015), Managerial Economics, Tata McGraw Hill.
3. Koutsoyiannis. A. (2013) Modern Micro Economics. Mc Millan.
4. Peterson H.C & Lewis (2003) Managerial economics, Tata McGraw Hill.

NBCA-406P

ADVANCE JAVA TECHNOLOGY LAB

L	T	P
0	0	3

Course Outcomes (COs):

At the end of this course students will be able to:

- Understand the concept of AWT.
- Write JDBC application.
- Make program for Applet.
- Make program for JSP.

LIST OF PRACTICALS

1). Write a Java program to create an Applet.

2). Write a Java program to create an Applet that reads Employee information using parameters and displays name of employee, designation, salary and tax.

3). Write a Java program that displays 4 buttons using AWT.

4). Write a Java program that displays text Field, Check Box and Radio Button using Swing.

5). Write a Java Program to create multiple frames, which create a Frame2 with a back button, such that when a user clicks back button, Frame 2 is closed, and we see the Frame1 only?

6). Write a Java Program to create a frame using swing in which create a push button with a label and image. When the button is clicked an image is displayed in the Frame?

7). Write a Java Program to execute select Query using JDBC.

8). Write a Java Program for basic Arithmetic Function Such as Addition, Subtraction, Multifaction and Division using JSP.

9). Write a servlet program to create a simple servlet and test it?

10). Write a Java program to create a bean that display employee name, salary, designation and company?

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

NBCA-407P

WEB DESIGN LAB

L	T	P
0	0	3

Course Outcomes (COs):

At the end of this course students will be able to:

- Create basic level forms using HTML tags to understand a web page.
- Extend the knowledge of HTML by combining CSS tags for updating the existing web page.
- Understand the use of XML for sharing and storing of data using Schema.
- Construct a dynamic web pages using Javascript also utilizing the knowledge of DTD.

LIST OF PRACTICALS

1. HTML program to create resume preparation using tables.

2. HTML program for home page creation using frames.

3. HTML program for form creation.

4. Create a web page to embed an image map in a web page using HTML.

5. Create a web page to fix the hot spots and to show all the related information when the hot spots are clicked using HTML.

6. Create a web page to get the coordinates from an image using java script.

7. Create a web page with all types of cascading style sheets.

8. Write HTML/Java scripts to display your CV in navigator, your institute website, Department website and tutorial website for specific subject.

9. Design HTML form for keeping student record and validate it using Java script.

10. Writing program in XML for creation of DTD, which specifies set of rules.

11. Create a style sheet in CSS/ XSL & display the document in internet explorer.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

NBCA-408P

COMPUTER GRAPHICS LAB

L	T	P
0	0	2

Course Outcomes (COs):

At the end of this course students will be able to:

- DDA algorithms for line and circle and Bresenham's algorithms for circle and ellipse drawing.
- Mid-Point Circle algorithm Mid-Point Ellipse algorithm using C.
- Understand the implementation of clipping, rotation, reflection, and shearing.
- Perform basic operations on images using animation software.

LIST OF PRACTICALS

Note: - At least ten experiments are to be conducted from the following list.

1. To implement DDA algorithms for line and circle.
2. To implement Bresenham's algorithms for line, circle and ellipse drawing
3. To implement Mid-Point Circle algorithm using C.
4. To implement Mid-Point Ellipse algorithm using C.
5. To perform 2D Transformations such as translation, rotation, scaling, reflection and sharing.
6. To implement Cohen–Sutherland 2D clipping and window–viewport mapping.
7. To implement Liang Barksy Line Clipping Algorithm.
8. To perform 3D Transformations such as translation, rotation and scaling.
9. To convert between colour models.
10. To perform animation using any Animation software
11. To perform basic operations on image using any image editing software
12. To draw different shapes such as hut, face, kite, fish etc.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.