

**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 of life.

## 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.

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# 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
			L	T	P	Sessional Exam			Exam ESE		
						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
<b>Practical</b>											
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*	-	-	-		-	-	-		
		<b>Total</b>	<b>15</b>	<b>4</b>	<b>8</b>					<b>650</b>	<b>24</b>

\*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

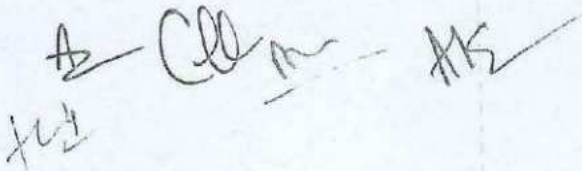
FACULTY OF ENGINEERING AND TECHNOLOGY  
UNIVERSITY OF LUCKNOW, LUCKNOW

YEAR: FIRST, SEMESTER-II

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
			L	T	P	Sessional Exam			Exam ESE		
						CT	TA	Total			
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
<b>Practical</b>											
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	
		<b>Total</b>	<b>15</b>	<b>4</b>	<b>8</b>					<b>650</b>	<b>24</b>

**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	
			L	T	P	Sessional Exam		Exam ESE			
						CT	TA				Total
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
<b>Practical</b>											
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	
		<b>Total</b>	<b>15</b>	<b>4</b>	<b>8</b>					<b>650</b>	<b>24</b>

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# 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
			L	T	P	Sessional Exam			Exam ESE		
						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
<b>Practical</b>											
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	
		<b>Total</b>	<b>15</b>	<b>4</b>	<b>8</b>					<b>650</b>	<b>24</b>

### 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**.

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# 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
			L	T	P	Sessional Exam			Exam ESE		
						CT	TA	Total			
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
<b>Practical</b>											
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	
		<b>Total</b>	<b>12</b>	<b>2</b>	<b>15</b>					<b>650</b>	<b>24</b>

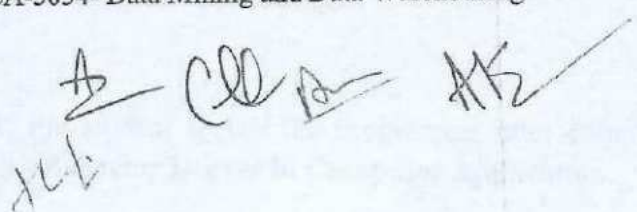
### Departmental Elective-I

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
			L	T	P	Sessional Exam			Exam ESE		
						CT	TA	Total			
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	
		<b>Total</b>	<b>12</b>	<b>2</b>	<b>15</b>					<b>650</b>	<b>24</b>

### 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.

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# 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
			L	T	P	Sessional Exam			Exam ESE		
						CT	TA	Total			
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
<b>Practical</b>											
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	
		<b>Total</b>	<b>9</b>	<b>3</b>	<b>18</b>					<b>650</b>	<b>24</b>

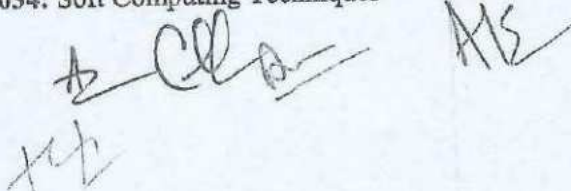
### Departmental Elective-III

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	
		<b>Total</b>					<b>650</b>	<b>24</b>

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

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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.

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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

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NBCA-102  
PROGRAMMING IN C

LTP  
310

**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. Kernighan Brian 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

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NBCA-103  
BASICS OF INFORMATION SYSTEM

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**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.

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

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NBCA-104  
MATHEMATICS

L T P  
3 1 0

**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  $n^{\text{th}}$  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

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*Handwritten initials: 'JCB'.*

NBCA-105  
SOFT SKILLS AND PERSONALITY DEVELOPMENT

LTP  
310

**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.

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**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.

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COMPUTER APPLICATION LAB

**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.

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NBCA-107P  
PROGRAMMING IN C LAB

L T P  
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  $n \times n$ .
19. WAP that finds the sum of diagonal elements of a  $m \times n$  matrix.
20. WAP to implement a function that swaps two numbers using call by reference.

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**NBCA-108P  
PROFESSIONAL COMMUNICATION LAB**

**LTP  
002**

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

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**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

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2. R. Kruse et al, "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 et al, "Data Structures and Program Design in C", Pearson Education
3. Lipschutz, "Data Structures" Schaum's Outline Series, TMH

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NBCA-202  
DATABASE MANAGEMENT SYSTEM

LTP  
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", Addison Wesley.
3. Elmasri, Navathe, "Fundamentals of Database Systems", Addison 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.

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**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.

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NBCA-204  
DISCRETE MATHEMATICAL STRUCTURES

LTP  
300

**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**

08

**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.

**Unit-II**

08

**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.

**Unit-III**

08

**Combinatorics:** 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.

**Unit-IV**

08

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

**Unit-V**

08

**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.

**Text Books:**

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

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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, "Discrete 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, "Combinatorics: Theory and Applications", 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.

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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:**

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

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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.

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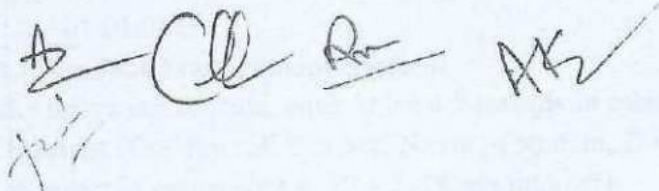
NBCA-206P  
DATA STRUCTURE LAB

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.

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## 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.

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- 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.

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 A signature that looks like "CLO" with a flourish, another signature that looks like "AK", and some initials "nt" below.

- 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.

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*14*

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.

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**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**UNIVERSITY OF LUCKNOW**

**Course Structure and Syllabus**

**For**

**BACHELOR OF COMPUTER APPLICATION**  
**(BCA)**

**2<sup>nd</sup> Year**

**as per**

**NEP-2020**

**(To be effective from the session 2024-2025)**

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# 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
			L	T	P	Sessional Exam			Exam ESE		
						CT	TA	Total			
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
<b>Practical</b>											
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	
		<b>Total</b>	<b>15</b>	<b>4</b>	<b>8</b>					<b>650</b>	<b>24</b>

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# 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
			L	T	P	Sessional Exam			Exam ESE		
						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
<b>Practical</b>											
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	
		<b>Total</b>	<b>15</b>	<b>4</b>	<b>8</b>					<b>650</b>	<b>24</b>

**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.**

## 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.

## SOFTWARE ENGINEERING

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**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: Halstead'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.

## COMPUTER ARCHITECTURE

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**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, Zvonko Vranesic and Safwat Zaky, "Computer Organization" Mcgraw Hill Fifth International Edition

## PYTHON PROGRAMMING

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**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“, 2<sup>nd</sup> 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.

## ACCOUNTING AND FINANCIAL MANAGEMENT

L	T	P
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**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

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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.

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**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.

## PYTHON PROGRAMMING LAB

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**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

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**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.

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## ADVANCE JAVA TECHNOLOGY

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**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 et al, "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.

## DESIGN AND ANALYSIS OF ALGORITHM

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**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. Cormen, 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.

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## WEB DESIGN CONCEPTS

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**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.

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## COMPUTER GRAPHICS

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**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

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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.

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**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.

Arjun

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Rathale

MS

Ami

Arjun

Jayya

Arjun

Arjun

Arjun

Arjun

**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.

*(Handwritten signatures and initials)*

**NBCA-407P**  
**WEB DESIGN LAB**

**L T P**  
**0 0 3**

**Course Outcomes (COs):**

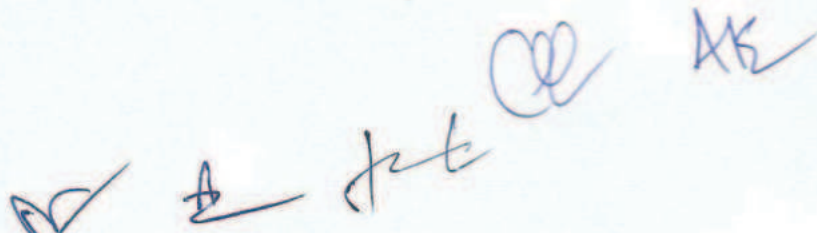
At the end of this course students will be able to:

- 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.



## 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 Barsky 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.

Handwritten signatures and initials: A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, AA, AB, AC, AD, AE, AF, AG, AH, AI, AJ, AK, AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU, AV, AW, AX, AY, AZ, BA, BB, BC, BD, BE, BF, BG, BH, BI, BJ, BK, BL, BM, BN, BO, BP, BQ, BR, BS, BT, BU, BV, BW, BX, BY, BZ, CA, CB, CC, CD, CE, CF, CG, CH, CI, CJ, CK, CL, CM, CN, CO, CP, CQ, CR, CS, CT, CU, CV, CW, CX, CY, CZ, DA, DB, DC, DD, DE, DF, DG, DH, DI, DJ, DK, DL, DM, DN, DO, DP, DQ, DR, DS, DT, DU, DV, DW, DX, DY, DZ, EA, EB, EC, ED, EE, EF, EG, EH, EI, EJ, EK, EL, EM, EN, EO, EP, EQ, ER, ES, ET, EU, EV, EW, EX, EY, EZ, FA, FB, FC, FD, FE, FF, FG, FH, FI, FJ, FK, FL, FM, FN, FO, FP, FQ, FR, FS, FT, FU, FV, FW, FX, FY, FZ, GA, GB, GC, GD, GE, GF, GG, GH, GI, GJ, GK, GL, GM, GN, GO, GP, GQ, GR, GS, GT, GU, GV, GW, GX, GY, GZ, HA, HB, HC, HD, HE, HF, HG, HH, HI, HJ, HK, HL, HM, HN, HO, HP, HQ, HR, HS, HT, HU, HV, HW, HX, HY, HZ, IA, IB, IC, ID, IE, IF, IG, IH, II, IJ, IK, IL, IM, IN, IO, IP, IQ, IR, IS, IT, IU, IV, IW, IX, IY, IZ, JA, JB, JC, JD, JE, JF, JG, JH, JI, JJ, JK, JL, JM, JN, JO, JP, JQ, JR, JS, JT, JU, JV, JW, JX, JY, JZ, KA, KB, KC, KD, KE, KF, KG, KH, KI, KJ, KK, KL, KM, KN, KO, KP, KQ, KR, KS, KT, KU, KV, KW, KX, KY, KZ, LA, LB, LC, LD, LE, LF, LG, LH, LI, LJ, LK, LL, LM, LN, LO, LP, LQ, LR, LS, LT, LU, LV, LW, LX, LY, LZ, MA, MB, MC, MD, ME, MF, MG, MH, MI, MJ, MK, ML, MM, MN, MO, MP, MQ, MR, MS, MT, MU, MV, MW, MX, MY, MZ, NA, NB, NC, ND, NE, NF, NG, NH, NI, NJ, NK, NL, NM, NN, NO, NP, NQ, NR, NS, NT, NU, NV, NW, NX, NY, NZ, OA, OB, OC, OD, OE, OF, OG, OH, OI, OJ, OK, OL, OM, ON, OO, OP, OQ, OR, OS, OT, OU, OV, OW, OX, OY, OZ, PA, PB, PC, PD, PE, PF, PG, PH, PI, PJ, PK, PL, PM, PN, PO, PP, PQ, PR, PS, PT, PU, PV, PW, PX, PY, PZ, QA, QB, QC, QD, QE, QF, QG, QH, QI, QJ, QK, QL, QM, QN, QO, QP, QQ, QR, QS, QT, QU, QV, QW, QX, QY, QZ, RA, RB, RC, RD, RE, RF, RG, RH, RI, RJ, RK, RL, RM, RN, RO, RP, RQ, RR, RS, RT, RU, RV, RW, RX, RY, RZ, SA, SB, SC, SD, SE, SF, SG, SH, SI, SJ, SK, SL, SM, SN, SO, SP, SQ, SR, SS, ST, SU, SV, SW, SX, SY, SZ, TA, TB, TC, TD, TE, TF, TG, TH, TI, TJ, TK, TL, TM, TN, TO, TP, TQ, TR, TS, TT, TU, TV, TW, TX, TY, TZ, UA, UB, UC, UD, UE, UF, UG, UH, UI, UJ, UK, UL, UM, UN, UO, UP, UQ, UR, US, UT, UY, UZ, VA, VB, VC, VD, VE, VF, VG, VH, VI, VJ, VK, VL, VM, VN, VO, VP, VQ, VR, VS, VT, VU, VV, VW, VX, VY, VZ, WA, WB, WC, WD, WE, WF, WG, WH, WI, WJ, WK, WL, WM, WN, WO, WP, WQ, WR, WS, WT, WU, WV, WW, WX, WY, WZ, XA, XB, XC, XD, XE, XF, XG, XH, XI, XJ, XK, XL, XM, XN, XO, XP, XQ, XR, XS, XT, XU, XV, XW, XX, XY, XZ, YA, YB, YC, YD, YE, YF, YG, YH, YI, YJ, YK, YL, YM, YN, YO, YP, YQ, YR, YS, YT, YU, YV, YW, YX, YY, YZ, ZA, ZB, ZC, ZD, ZE, ZF, ZG, ZH, ZI, ZJ, ZK, ZL, ZM, ZN, ZO, ZP, ZQ, ZR, ZS, ZT, ZU, ZV, ZW, ZX, ZY, ZZ.

# UNIVERSITY OF LUCKNOW

## STUDY AND EVALUATION SCHEME

### BACHELOR OF COMPUTER APPLICATION

#### YEAR: THIRD, SEMESTER –V

Sl. No	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
			L	T	P	Sessional Exam			Exam. ESE		
						CT	TA	Total			
1	BCA-501	Data Communication and Computer Network	3	1	0	20	10	30	70	100	4
2	BCA-502	Design and Analysis of Algorithm	3	1	0	20	10	30	70	100	4
3	BCA-503	Web design Concept	3	0	0	20	10	30	70	100	3
4	BCA-504	UNIX and Shell Programming	3	1	0	20	10	30	70	100	4
5	BCA-505X	Elective-I	3	0	0	20	10	30	70	100	3
<b>PRACTICALS</b>											
6	BCA-506P	UNIX Lab	0	0	2	10	10	20	30	50	1
7	BCA-507P	Web Design lab	0	0	3	10	10	20	30	50	2
8	BCA-508P	Viva-Voce on Summer Training	0	0	2	10	10	20	30	50	1
9	BCA-GP	General Proficiency	-	-	-	-	-	-	-	50	-
		Total	15	3	7					700	22

#### Elective-I

1. BCA-5051 Data Mining and Ware Housing
2. BCA-5052 Software Testing Methodology
3. BCA-5053 Open Source Software
4. BCA-5054 Information System: Analysis, Design & Implementation

# UNIVERSITY OF LUCKNOW

## STUDY AND EVALUATION SCHEME

### BACHELOR OF COMPUTER APPLICATION

#### YEAR: THIRD, SEMESTER –VI

Sl. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
			L	T	P	Sessional Exam		Exam. ESE			
						CT	TA		Total		
1	BCA-601	E-Commerce	3	1	0	20	10	30	70	100	4
2	BCA-602	Cyber Law and Internet Security	3	1	0	20	10	30	70	100	4
3	BCA-603	Mobile Computing	3	0	0	20	10	30	70	100	3
4	BCA-604X	Elective-II	3	1	0	20	10	30	70	100	4
<b>PRACTICAL/PROJECT</b>											
5	BCA-605P	Advanced Technology ( Dot Net) Lab	0	0	3	10	10	20	30	50	2
6	BCA-Pro	Project	0	0	6	-	50	50	150	200	5
7	BCA-GP	General Proficiency	-	-	-	-	-	-	-	50	-
		Total	12	3	9					700	22

#### Elective-II

- |             |                         |
|-------------|-------------------------|
| 1. BCA-6041 | Optimization Techniques |
| 2. BCA-6042 | Microprocessor          |
| 3. BCA-6043 | Data Compression        |
| 4. BCA-6044 | Cryptography            |

**BCA-501**  
**Data Communication and Computer Network**

**L T P**  
**3 1 0**

**Unit-1** **08**

**Introduction Concepts:** Goals and applications of networks, network structure and architecture, the OSI reference model, services, network topology design, delay analysis, back bone design, local access network design, physical layer transmission media, switching methods, ISDN, and terminal handling.

**Unit-2** **12**

**Medium Access Sub Layer:** Medium access sub layer - channel allocations, LAN protocols - aloha protocols - overview of IEEE standards - FDDI.

**Data Link Layer:** Elementary data link protocols, sliding window protocols, and error handling.

**Unit-3** **12**

**Network Layer:** Point - to point Networks, routing, congestion control Internetworking -TCP /IP, IP packet, IP address, and IPv6.

**Transport Layer:** Transport layer - design issues, and connection management.

**Unit-4** **08**

**Session Layer:** Design issues and remote procedure call.

**Presentation Layer:** Design issues.

**Application Layer:** File transfer, access and management, electronic mail, virtual terminals, other application. Example networks - internet and public networks.

**Text Books:**

1. Forouzen, “Data Communication and Networking”, TMH.
2. A.S. Tanenbaum, “Computer Networks”, Pearson Education.
3. W. Stallings, “Data and Computer Communication”, Macmillan Press.

**Reference Books:**

1. Anuranjan Misra, “Computer Networks”, Acme Learning
2. G. Shanmugarathinam, “Essential of TCP/ IP”, Firewall Media.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open Source Approach”, Mc Graw Hill Publisher.

**BCA-502**  
**Design and Analysis of Algorithm**

**L T P**  
**3 1 0**

**Unit-1**

**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-2**

**12**

**Advanced Data Structures:** Red-Black trees, B – trees, Binomial Heaps, Fibonacci Heaps. 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-3**

**12**

**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-4**

**08**

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

**Text Books:**

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 Education.

**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.

**BCA–503**  
**Web Design Concept**

**L T P**  
**3 0 0**

**Unit-1**

**12**

**Introduction:** Introduction and web development strategies, history of web and internet, protocols governing web, introduction to client-server computing, web applications, web project, and web team.

**Unit-2**

**08**

**Web Page Designing:** HTML: List, table, images, frames, forms, CSS, document type definition, object Models, presenting and using XML, **XML Processors:** DOM and SAX, and dynamic HTML.

**Unit-3**

**10**

**Java script:** Introduction, documents, forms, statements, functions, objects, introduction to AJAX, and VB script.

**Unit-4**

**10**

**Server Site Programming:** Introduction to active server pages (ASP), introduction to Java Server Page (JSP), JSP application design, JSP objects, conditional processing, declaring variables and methods, sharing data between JSP pages.

**Text Books:**

1. Burdman, Jessica, “Collaborative Web Development” Addison Wesley.
2. Xavier, “Web Technology and Design”, New Age International.
3. Ivan Bayross, “HTML, DHTML, Java Script, Perl & CGI”, BPB Publication.

**Reference Books:**

1. Ramesh Bangia, “Internet and Web Design”, New Age International.
2. Deitel, “Java for programmers”, Pearson Education.
3. Uttam k. Roy, “Web Technologies”, Oxford.

**BCA-504**  
**UNIX and Shell Programming**

**L T P**  
**3 1 0**

**Unit-1** **08**

**UNIX Architecture:** The UNIX operating system, LINUX and gnu. The UNIX architecture, features of UNIX, POSIX and single UNIX specification, internal and external commands, command structure, man browsing and manual pages on-line.

**The file system:** The parent – child relationship, the home variable, pwd, cd, mkdir, absolute pathname, and relative pathname.

**Unit-2** **10**

**Basic File Attributes:** Listing directory contents, the UNIX file system, ls -l, -d option, file ownership, file permissions, chmod, directory permissions, changing file ownership, file attributes.

**The Process:** Process basics, process status, system processes (-e or -a), mechanism of process creation, process states and zombies, and running jobs in background.

**Unit-3** **10**

**Simple Filters:** pr, head, tail, cut, paste, sort, uniq, tr.

**Filters using regular expressions – grep and sed:** grep, Basic Regular Expressions (BRE), Extended Regular Expressions (ERE) and egrep, the stream editor, and line addressing using multiple instructions (-E and -F) context addressing.

**Unit-4** **12**

**The Shell:** The shell's interpretive cycle, shell offerings, pattern matching, escaping and quoting, redirection, pipes, tee, command substitution, shell variables, and essential shell programming.

**Text Books:**

1. Sumitabha Das, "UNIX – Concepts and Applications", Tata McGraw Hill.
2. Behrouz A. Forouzan, Richard F. Gilberg, "Unix and shell Programming", Thomson Learning.
3. Neil Matthew and Richard Stones, "Beginning Linux Programming", Wrox.

**Reference Books:**

1. Kernighan and Pike, "Unix programming environment", Pearson Education.
2. Rosen, Host, Klee, Farber, Rosinski, "The Complete Reference Unix", TMH.
3. Yashavant P. Kanetkar, "Unix Shell Programming", BPB Publications.

**BCA-5051**  
**Data Mining and Data Warehousing**

**L T P**  
**3 0 0**

**Unit-1** **08**

**Introduction:** Data mining-definition & functionalities, data processing, form of data pre-processing, data cleaning: missing values, noisy data, binning, clustering, regression, inconsistent data, data integration and transformation, and data reduction.

**Unit-2** **12**

**Concept Description:** Association rule mining, mining single-dimensional Boolean association rules from transactional databases, Apriori Algorithm, **Classification and Predictions:** Decision tree, Bayesian Classification, and K-nearest neighbour classifiers.

**Unit-3** **08**

**Data Warehousing:** Overview, definition, delivery process, difference between database system and data warehouse, multi-dimensional data model, data cubes, stars, snowflakes, fact constellations, concept hierarchy, process architecture, 3 tier architecture, and data marting.

**Unit-4** **12**

**OLAP:** Aggregation, historical information, query facility, OLAP function and tools. OLAP servers, ROLAP, MOLAP, HOLAP, data mining interface, security, backup and recovery.

**Text Books:**

1. M. H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education.
2. Jiawei Han, Micheline Kamber, "Data Mining Concepts & Techniques", Elsevier.
3. Ian H. Witten, "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann

**Reference Books:**

1. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World: A Practical Guide for Building Decision Support Systems", Pearson Education.
2. Mallach, "Data Warehousing System", McGraw –Hill.
3. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining, & OLAP", Tata McGraw-Hill Education.

**BCA-5052**  
**Software Testing Methodology**

**L T P**  
**3 0 0**

**Unit-1** **10**

**Introduction:** Principles of software testing, error, fault, failure, incident, error and fault taxonomies, test cases, limitations of testing, code inspections, desk checking, group walkthroughs and peer reviews and overview of graph theory for testers.

**Unit-2** **10**

**Functional Testing:** Boundary value analysis, equivalence class testing, decision table-based testing, cause effect graphing technique.

**Structural Testing:** Path testing, DD-paths, cyclomatic complexity, graph metrics, data flow testing and slice-based testing.

**Unit-3** **08**

**Testing Activities:** Unit testing, levels of testing, integration testing, system testing, debugging, regression testing and extreme testing.

**Unit-4** **12**

**Object Oriented Testing:** Issues in object-oriented testing, class testing, GUI testing, object-oriented integration and system testing. Testing internet applications: overview and challenges and strategies of testing internet applications.

**Text Books:**

1. Paul Ammann and Jeff Offutt, "Introduction to Software Testing", Cambridge University Press, Cambridge, UK.
2. Mauro Pezze, Michal Young, "Software Testing and Analysis: Process, Principles and Techniques", Wiley India.
3. Yogesh Singh, "Software Testing", Cambridge University Press, New York.

**Reference Books:**

1. William Perry, "Effective Methods for Software Testing", John Wiley & Sons, New York.
2. Cem Kaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Van Nostrand Reinhold, New York.
3. Boris Beizer, "Software Testing Techniques", Van Nostrand Reinhold, New York.

**BCA-5053**  
**Open Source Software**

**L T P**  
**3 0 0**

**Unit-1** **08**

**Introduction-** Introduction to open sources, need of open sources, advantages of open sources and application of open sources.

**Unit-2** **12**

**Open Source Operating Systems: LINUX-** Introduction, general overview, kernel mode and user mode, process, advanced concepts, scheduling, personalities, cloning and signals.

**Unit-3** **08**

**Open Source Database: MySQL-** Introduction - setting up account-starting, terminating and writing your own SQI programs, record selection technology, working with strings - date and time, sorting query results.

**Unit-4** **12**

**Open Source Programming Languages: PHP-** Introduction - programming in web environment, variables, constants, datatypes, operators, statements, functions, arrays and OOP - string manipulation and regular expression.

**Perl:** Perl backgrounder, Perl overview, Perl parsing rules, variables and data -statements and control structures, subroutines, packages, and modules- working with files and data manipulation.

**Text Books:**

1. Martin C. Brown, "Perl: The Complete Reference", Tata McGraw-Hill Publishing Company Limited, Indian Reprint
2. Vikram Vaswani, "MYSQL: The Complete Reference", Tata McGraw -Hill Publishing Company Limited, Indian Reprint.
3. Paul Kavanagh, "Open Source Software: Implementation and Management", Elsevier.

**Reference Books:**

1. Rasmus Lerdorf and Levin Tatroe, "Programming PHP", O'Reilly.
2. Wesley J. Chun, "Core Python Programming", Prentice Hall.
3. Steven Holzner, "PHP: The Complete Reference", Tata McGraw-Hill Publishing Company Limited, Indian Reprint.

**BCA-5054**  
**Information System: Analysis and Design & Implementation**

**L T P**  
**3 0 0**

**Unit-1** **12**

**Basic Concept of Systems:** The system: definition and concepts, elements of a system: input, output processor, control, feedback, environment, boundaries and interface, characteristics of a system, types of systems -physical and abstract system, open and closed systems, man-made systems, information and its categories.

**Information systems:** TPS, OAS, MIS, DSS, ESS; System analyst: role and need of system analyst and system analyst as an agent of change.

**Unit-2** **08**

**System Development Life Cycle:** Introduction to SDLC. Various phases: study, analysis, design, development, testing, implementation, and maintenance.

**System documentation:** Types of documentation and their importance.

**Unit-3** **10**

**Tools for System Analysis:** Data flow diagram (DFD), logical and physical DFDs, developing DFD, system flowcharts and structured charts, structured English, decision trees and decision tables.

**System design module specifications:** Module coupling and cohesion, top-down and bottom-up design, logical and physical design and structured design.

**Unit-4** **10**

**System Implementation and Maintenance:** Need of system testing, types of system testing, quality assurance; system conversion, conversion methods, procedures and controls, system evaluation and performance.

**Text Books:**

1. Perry Edwards, "System Analysis & design", Mc Graw Hill Publication.
2. Jeffrey A. Hofer Joey F. George Joseph S. Valacich, "Modern System Analysis and Design", Addison Weseley.
3. Shouhong Wang, "Information Systems Analysis and Design", Universal-Publisher Boca Raton.

**Reference Books:**

1. Elias m. Awad, "System Analysis and Design", Galgotia Publications Pvt. Ltd.
2. Henry C. Lucas, "Analysis, Design and Implementation of Information Systems", McGraw-Hill Education.
3. Whitten, Bentaly and Barlow, "System Analysis and Design Methods", Galgotia Publication.

1. Execute the following list of basic commands in UNIX:
  - (i) pwd (ii) mkdir (iii) cd
2. Execute the following list of basic commands in UNIX:
  - (i) who (ii) echo (iii) cat
2. Execute the following list of basic commands in UNIX:
  - (i) rm (ii) mv (iii) wc (iv) cp
4. Execute the basic file attributes with all possible options:
  - (i) ls (ii) chmod
5. Execute basic commands using vi editor:
  - a. input mode commands
  - b. saving text and quitting
6. Execute basic commands using vi editor
  - a. navigation
  - b. editing text
  - c. searching pattern
7. Execute the following filters using regular expressions with all possible options:
  - (i) grep (ii) sed
8. Write a shell script to display current date and calendar.

**BCA-507P**  
**Web Design Lab**

**L T P**  
**0 0 3**

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 get the coordinates from an image using java script.
6. Create a web page with all types of cascading style sheets.
7. Write HTML/Java scripts to display your CV in navigator, your institute website, Department website and tutorial website for specific subject.
8. Design HTML form for keeping student record and validate it using Java script.
9. Writing program in XML for creation of DTD, which specifies set of rules.
10. 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.

**BCA-601**  
**E-Commerce**

**L T P**  
**3 1 0**

**Unit-1** **12**

**Introduction:** What is E-commerce, forces behind E-commerce industry framework, brief history of ecommerce, inter organizational E-commerce intra organizational E-commerce, and consumer to business electronic commerce, architectural framework.

**Unit-2** **08**

**Mobile Commerce:** Introduction to mobile commerce, mobile computing application, wireless application protocols, WAP technology, mobile information devices, web security introduction to web security, firewalls & transaction security, client server network, emerging client server security threats, firewalls and network security.

**Unit-3** **08**

**Encryption:** World wide web & security, encryption, transaction security, secret key encryption, public key encryption, virtual private network (VPN) and implementation management issues.

**Unit-4** **12**

**Electronic Payments:** Overview of electronics payments, digital token-based electronics payment system, smart cards, credit card I debit card-based EPS, emerging financial instruments, and online banking.

**Text Books:**

1. Greenstein and Feinman, "E-Commerce", TMH.
2. Ravi Kalakota, Andrew Whinston, "Frontiers of Electronic Commerce", Addison Wesley.
3. Pete Lohsin , John Vacca "Electronic Commerce", New Age.

**Reference Books:**

1. Denieal Amor, "The E-Business Revolution", Addison Wesley.
2. Diwan, Sharma, "E-Commerce", Excel.
3. Bajaj & Nag, "E-Commerce: The Cutting Edge of Business", TMH.

**BCA-602**  
**Cyber Law and Internet Security**

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**Unit-1** **12**

**Cyber Space Jurisdiction:** Jurisdiction issues under IT Act, 2000, traditional principals of jurisdiction, extra-terrestrial jurisdiction and case laws on cyber space jurisdiction.

**E-commerce and Laws in India:** Digital / Electronic signature in Indian laws, E-commerce; issues and provisions in Indian law, and E-Governance.

**Unit-2** **08**

**Intellectual Property Rights, Domain Names and Trademark Dispute:** Concept of trademarks in internet era, cybersquatting, reverse hijacking, jurisdiction in trademark disputes, copyright in the digital medium, and copyright in computer programs

**Unit-3** **10**

**Developing Secure Information Systems:** Information security governance & risk management, security architecture & design security issues in hardware, data storage & downloadable devices, physical security of IT assets, access control, CCTV and intrusion detection systems and backup security measures.

**Unit-4** **10**

**Security Policies:** Development of policies, WWW policies, email security policies, policy review process-corporate policies-sample security policies, publishing and notification requirement of the policies.

**Text Books:**

1. Prashant Mali, "Cyber Law & Cyber Crimes", Snow White publications, Mumbai.
2. Dr. Surya Prakash Tripathi, Ritendra Goyal and Praveen Kumar Shukla, "Introduction to Information Security and Cyber Law", Willey Dreamtech Press.
3. Sarika Gupta & Gaurav Gupta, "Information Security and Cyber Laws", Khanna Publishing House.

**Reference Books:**

1. Farooq Ahmad "Cyber Law in India", Pioneer Publications.
2. Vakul Sharma, "Information Technology Law and Practice", Universal Law Publishing Co. Pvt. Ltd.
3. Suresh T. Vishwanathan, "The Indian Cyber Law", Bharat Law House New Delhi.

**BCA-603**  
**Mobile Computing**

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**3 0 0**

**Unit-1** **10**

**Introduction:** Issues in mobile computing, characteristics of mobile computing, structure of mobile computing and overview of wireless telephony: cellular concept.

**Unit-2** **10**

**Evaluation of Mobile System and Wireless Network:** GSM, CDMA, FDMA, TDMA; **Wireless networking:** Wireless LAN overview, Bluetooth, wireless multiple access protocols, TCP over wireless, wireless applications, data broadcasting, mobile IP and WAP.

**Unit-3** **08**

**Data management issues:** Management issues, hoarding techniques, data replication for mobile computers, adaptive clustering for mobile wireless networks and file system.

**Unit-4** **12**

**Mobile Agents and Routing algorithms:** Mobile agent, security and fault tolerance, transaction processing in mobile computing environment, Mobile Adhoc Networks (MANETs), Routing protocols, Global State Routing (GSR), Destination Sequenced Distance Vector routing (DSDV) and Dynamic Source Routing (DSR) and Ad Hoc On-demand Distance Vector routing (AODV).

**Text Books:**

1. Jochen Schiller, "Mobile Communications", Addison-Wesley.
2. Raj Kamal, "Mobile Computing", Oxford University Press.
3. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing, Technology Applications and Service Creation", Mc Graw Hill.

**Reference Books:**

1. Charles Perkins, "Mobile IP", Addison Wesley.
2. Charles Perkins, "Ad hoc Networks", Addison Wesley.
3. Upadhyaya, "Mobile Computing", Springer.

**BCA-6041**  
**Optimization Techniques**

**L T P**  
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**Unit-1** **10**

**Linear programming:** Central problem of linear programming various definitions included statements of basic theorem and also their properties, simplex methods, primal and dual simplex method, transport problem, tic-tac problem, and its solution. Assignment problem and its solution. Graphical method formulation and linear programming problem.

**Unit-2** **10**

**Queuing Theory:** Characteristics of queuing system, classification of queuing model single channel queuing theory and generalization of steady state m/m/1 queuing models (model-I, model-II).

**Unit-3** **08**

**Replacement Theory:** Replacement of item that deteriorates replacement of items that fail. Group replacement and individual replacement.

**Unit-4** **12**

**Inventory Theory:** Cost involved in inventory problem- single item deterministic model economics long size model without shortage and with shorter having production rate infinite and finite. **Job Sequencing:** Introduction, solution of sequencing problem, and Johnson's algorithm for n jobs through two machines.

**Text Books:**

1. S S Rao, "Engineering Optimization – Theory and Applications", New Age International (P) Ltd.
2. A.M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education.
3. Gupta V.G., "Optimization Theory Techniques of Operations Research", Oxford Book Company.

**Reference Books:**

1. Abidi Mongi A. "Optimization Techniques in Computer vision", Springer.
2. Falk Heiko, "Source Code Optimization Techniques for Data Flow Dominated Embedded Software", Springer Verlag New York.
3. Evtushenko Yuriy G. "Numerical Optimization Techniques", Springer Verlag New York.
4. Prakash Om, "Information Theory and Optimization Techniques in Scientific Research", VDM Verlag.

**BCA-6042**  
**Microprocessor**

**L T P**  
**3 1 0**

**Unit-1** **08**

**Microprocessors:** Introduction, Advances in semiconductor technology, Organization of microprocessor-based system, and 8085 microprocessor.

**Unit-2** **10**

**The 8085 MPU architecture:** 8085 bus organization, demultiplexing the bus AD7-AD0, generating control signals. ALU, timing and control unit, instruction register and decoder, register array, decoding and executing an instruction.

**Unit-3** **10**

**8085 Machine:** Machine cycles and bus timings opcode fetch machine cycle, memory read machine cycle, memory k machine cycle, IO read machine cycle, IO write machine cycle and execution time of the instruction cycle.

**Unit-4** **12**

**Counters and time delays:** Time delay using single register and register pair, Stack and subroutines, Call and return instructions, Advanced subroutine concept. Assembly language program Hexadecimal counter, Sum of odd and even numbers, Hex to BCD conversion and Interrupts.

**Text Books:**

1. Gaonkar, Ramesh S., “Microprocessor Architecture, Programming, and Applications with the 8085”, Pen Ram International Publishing.
2. Ray, A.K. & Burchandi, “Advanced Microprocessors and Peripherals: Architecture Programming and Interfacing”, Tata McGraw Hill.
3. B. Ram, “Fundamentals of microprocessor and microcontroller”, Dhanpat Rai Publishing Co Pvt Ltd.

**Reference Books:**

1. Hall D.V, “Microprocessor and Interfacing”, Tata McGraw Hill.
2. B.P. Singh & Renu Singh, “Microprocessors and Microcontrollers”, New Age International.
3. Deniel Tabak, “Advance Microprocessor”, TMH.
4. Triebel & Singh, “The 8088 and 8086 Microprocessors”, Pearson Education.

**BCA-6043**  
**Data Compression**

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**Unit-1** **10**

**Compression Techniques:** Loss less compression, lossy compression, measures of performance, modeling and coding, mathematical preliminaries for lossless compression: A brief introduction to information theory, models: Physical models, probability models, Markov models, composite source model, uniquely decodable codes and prefix codes.

**Unit-2** **10**

**Huffman coding algorithm:** Minimum variance Huffman codes, adaptive Huffman coding, update procedure, encoding procedure, decoding procedure, applications of Huffman coding: loss less image compression, text compression and audio compression.

**Unit-3** **12**

**Coding a sequence:** Generating a binary code, Comparison of Binary and Huffman coding, Applications, Bi-level image compression-The JBIG standard, JBIG2, Image compression, Introduction of Dictionary Techniques, **Static Dictionary:** Diagram Coding, and Adaptive Dictionary.

**Unit-4** **08**

**Distortion criteria, Models, Scalar Quantization:** The Quantization problem, uniform quantizer, adaptive quantization and non-uniform quantization.

**Text Books:**

1. Khalid Sayood, "Introduction to Data Compression", Morgan Kaufmann Publishers.
2. Peter D. Johnson Jr., Greg A. Harris, D.C. Hankerson, "Introduction to Information Theory and Data Compression", CRC.
3. David Salomon, "Data Compression: The Complete Reference 4th Edition", Springer.

**Reference Books:**

1. Drozdek, "Elements of Data Compression", Cengage Learning.
2. Timothy C., "Text Compression", Bell Prentice Hall.
3. Nitin Chikani, "The Complete Format of Data Compression & Decompression", Lambert.

**BCA-6044**  
**Cryptography**

**L T P**  
**3 1 0**

**Unit-1** **10**

**Introduction to Security:** Introduction to security: Attacks, services & mechanisms, security. Conventional encryption model, classical encryption techniques, steganography, modern techniques: simplified DES, block cipher principles, DES standard, DES strength, differential & linear cryptanalysis, block cipher design principles and block cipher modes of operation.

**Unit-2** **08**

**Conventional Encryption Algorithms:** Conventional Encryption Algorithms: Triples DES, blowfish, International data encryption algorithm, RC5, placement of encryption function and key distribution.

**Unit-3** **10**

**Public Key Encryption:** Public Key Encryption: public, key cryptography: principles of public, key cryptosystems, RSA algorithm, key management, Fermat's & Euler's theorem, primality test and the Chinese remainder theorem.

**Unit-4** **12**

**Message Authentication & Hash Functions:** Message Authentication & Hash Functions: Authentication requirements, authentication functions, message authentication codes, hash function, md5 message digest algorithm, secure hash algorithm (SHA), and digital signatures.

**Text Books:**

1. William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall, New Jersey.
2. Atul Kahate, "Cryptography and Network Security", TMH.
3. Douglas R. Stinson, "Cryptography: Theory and Practice", CRC press.

**Reference Books:**

1. William Stallings, "Network Security Essentials: Applications and Standards", Prentice Hall.
2. Johannes A. Buchmann, "Introduction to cryptography", Springer, Verlag.
3. Wenbo Mao, "Modern Cryptography: Theory and Practice", Prentice Hall PTR.
4. Simon Rubinstein Salzedo, "Cryptography", Springer.

**BCA-605P**  
**Advanced Technology (Dot Net) Lab**

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**0 0 3**

1. Familiarization with IDE.
2. Programming Console applications using VB.NET covering all the aspects of VB.NET fundamentals
3. Object oriented programming using VB.NET covering objects, Inheritance, Polymorphism, Constructors, Static Classes, and Interfaces.
4. Programme to illustrate Exception Handling concepts.
5. Programme to illustrate use of Collections.
6. Programme to perform File I/O Operations.
7. Programming Windows applications using VB.NET covering all major controls and components, Menus, MDI, Event Handling.
8. Creating windows installer.
9. Programme to interact with Database from a Windows Desktop Application.
10. Programming to build web applications using web controls, maintaining state.

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