

**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

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	Professional Communication	3	1	0	20	10	30	70	100	4
Practical											
6.	NBCA-106P	Computer Application Lab	0	0	3		20	20	30	50	2
7.	NBCA-107P	Programming in C Lab	0	0	3		20	20	30	50	2
8.	NBCA-108P	Professional Communication Lab	0	0	2		20	20	30	50	1
9.	NBCA-GP	General Proficiency	-	-	-		-	-	-	50	
10.	ABCA-101	Induction Program*	-	-	-		-	-	-		
Total			15	4	8					650	24

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

CERTIFICATE

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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
6.	NBCA-206	Human Values and Ethics	2	0	0				70	70*	0
Practical											
7.	NBCA-207P	Data Structure Lab	0	0	3		20	20	30	50	2
8.	NBCA-208P	DBMS Lab	0	0	2		20	20	30	50	1
9.	NBCA-209P	Operating System Lab	0	0	3		20	20	30	50	2
10.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	15	4	8					650	24

*Marks will not be added in Total (mandatory to Pass)

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
Practical											
6.	NBCA-306P	Java Lab	0	0	3		20	20	30	50	2
7.	NBCA-307P	Python Programming Lab	0	0	3		20	20	30	50	2
8.	NBCA-308P	Industrial Training viva-voce	0	0	2		20	20	30	50	1
9.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	15	4	8					650	24

DIPLOMA

BCA

(FOUR - SEMESTER PROGRAMME, TOTAL CREDITS=96)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY

UNIVERSITY OF LUCKNOW, LUCKNOW

YEAR: SECOND, SEMESTER-IV

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
			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
Practical											
6.	NBCA-406P	Advance Java Technology Lab	0	0	3		20	20	30	50	2
7.	NBCA-407P	Web Design Lab	0	0	3		20	20	30	50	2
8.	NBCA-408P	Computer Graphics Lab	0	0	2		20	20	30	50	1
9.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	15	4	8					650	24

Note:

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

DEGREE

BCA

(SIX - SEMESTER PROGRAMME, TOTAL CREDITS=144)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY
UNIVERSITY OF LUCKNOW, LUCKNOW

YEAR: THIRD, SEMESTER-V

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
			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
Practical											
5.	NBCA-505P	Computer Network Lab	0	0	3		20	20	30	50	2
6.	NBCA-506P	Industrial Training viva-voce	0	0	2		20	20	30	50	1
7.	NBCA-507P	Project Phase-I	0	0	6		50	50	100	150	4
8.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	12	2	15					650	24

Departmental Elective-I

NBCA-5041- Graph Theory

NBCA-5042- Software Testing and Audit

NBCA-5043- UNIX Operating System

NBCA-5044- 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											
	NBCA-605P	Machine Learning Lab	0	0	3		20	20	30	50	2
5.	NBCA-606P	Seminar	0	0	3		20	20	30	50	2
6.	NBCA-607P	Project Phase-II	0	0	9		50	50	100	150	6
7.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	12	2	15					650	24

Departmental Elective-II

NBCA-6041: Open Source Software

NBCA-6042: Mobile Computing

NBCA-6043: Cryptography

NBCA-6044: Optimization Techniques

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

DEGREE WITH RESEARCH

BCA

(EIGHT - SEMESTER PROGRAMME, TOTAL CREDITS=192)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY
UNIVERSITY OF LUCKNOW, LUCKNOW

YEAR: FOURTH, SEMESTER-VII

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
			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
Practical											
4.	NBCA-704P	Data Science Lab	0	0	3		20	20	30	50	2
5.	NBCA-705P	Dissertation	0	0	15		100	100	200	300	10
6.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	9	3	18					650	24

Departmental Elective-III

NBCA-7031: Internet of Things

NBCA-7032: Digital Image Processing

NBCA-7033: Advance DBMS

NBCA-7034: Soft Computing Techniques

DEGREE WITH RESEARCH

BCA

(EIGHT - SEMESTER PROGRAMME, TOTAL CREDITS=192)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY
UNIVERSITY OF LUCKNOW, LUCKNOW

YEAR: FOURTH, SEMESTER-VIII

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

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

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.

NBCA-101
FUNDAMENTALS OF COMPUTER AND ITS APPLICATIONS

L T P
3 1 0

Course Outcomes (COs):

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

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

Unit-I **08**

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

Unit-II **06**

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

Unit-III **08**

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

Unit-IV **08**

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

Unit-V **10**

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

Text Books:

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

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

Reference Books:

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

NBCA-102
PROGRAMMING IN C

L T P
3 1 0

Course Outcomes (COs)

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

1. Understand 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

NBCA-103
BASICS OF INFORMATION SYSTEM

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3 0 0

COURSE OUTCOMES (COs)

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

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

Unit-I

08

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.

Unit-II

08

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

Unit-III

08

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.

Unit-IV

08

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.

Unit-V

08

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.

Text Books:

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

Reference Books:

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

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

**NBCA-104
MATHEMATICS**

**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^{th} order with constant coefficients, Complementary function and Particular integral.

Unit-IV:

08

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

Unit-V:

06

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

Text Books:

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

Reference Books:

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

NBCA-105
PROFESSIONAL COMMUNICATION

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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. Develop industry oriented communication skills in reading, writing and speaking using powerful study skills required to succeed in an academic environment independently.
2. Apply the skills of Grammar, Paragraph Development, Business writing, and an array of additional strategies, the students will be prepared to experience rewards of success in employment and growth.
3. Refine their business writing skills while special emphasis is given to letters, email etiquette, proposal and report writing.
4. Understand the importance of grammar and punctuation to communicate concisely and correctly.

Unit-I

06

Basics of Communication: Theories of communication: Shannon-Weaver model, Constructionist model, Interactive or Convergence model, Axiology approaches; types, levels and flow of communication; communication as transaction of language; barriers and malfunctions in communication—perception vs. reality.

Unit-II

12

Functional Grammar: Articles, Pronouns, Verbs, Tenses, Subject-Verb Agreement, Inversion, Prepositions, and Question tags.

Unit-III

06

Vocabulary Development and Paragraph Development: Homophones, Indianisms, Indian coinages, idioms, idiomatic expressions, collocation, archaisms, style, cultural implications, writing process: pre-writing (mind mapping, brainstorming, free writing), writing first draft, post writing (evaluating-editing-evaluating); paragraph development: techniques and methods of paragraph development.

Unit-IV

10

Written Communication: Business writing strategies; business letter writing: sales, purchase, claim, adjustment; preparing technical proposal: elements of technical proposal, executive summary (problem statement and proposed solution); report writing: objective, characteristics, elements, types; building questionnaire; writing short reports: sports, events, incidents and messages etc.

Unit-V

06

Communication for Employment: Resume development; cover letter, accepting/rejecting job offer; communication and application through e-mail; etiquette for using professional networking web portals (LinkedIn); using online job portals and interview FAQs.

Text Books:

1. M. L. Tickoo, A. E. Subramanian & P. R. Subramaniam, “Intermediate Grammar, Usage and Composition’, Orient BlackSwan

2. Krishna Mohan and Meera Banerjee, “Developing Communication Skills”, Macmillan India Ltd.

Reference Books:

1. Eric Baber, “Fifty Ways to Improve Your Business English Using the Internet”, Orient BlackSwan
2. R. P. Singh, “Functional Skills in Language and Literature”, OUP
3. E. Suresh Kumar, B. Sandhya, J. Savithri and P. Sreehari, “Communication for Professional Success”, Orient BlackSwan

COMPUTER APPLICATION LAB

L T P
0 0 3

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

Section 1: MS-Office

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

Section 2: Hardware

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

NBCA-107P
PROGRAMMING IN C LAB

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 nxn.
19. WAP that finds the sum of diagonal elements of a mxn matrix.
20. WAP to implement a function that swaps two numbers using call by reference.

NBCA-108P
PROFESSIONAL COMMUNICATION LAB

L T P
0 0 2

1. Self Introduction
2. Speech Delivery—1 (Pure Vowels and Glide Vowels)
3. Speech Delivery—2 (Consonants)
4. Group Discussion—1
5. Group Discussion—2
6. Debate
7. Presentation using Technology
8. Interviews
9. Role Play
10. Technology in Oral Communication

NBCA - 201
DATA STRUCTURE

L T P
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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

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

NBCA-202
DATABASE MANAGEMENT SYSTEM

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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.

NBCA-203
OPERATING SYSTEM

L T P
3 1 0

Course Outcomes (COs):

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

Unit-I **08**

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

Unit-II **08**

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

Unit-III **08**

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

Unit-IV **08**

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

Unit-V **08**

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

Text Books:

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

Reference Books:

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

NBCA-204
DISCRETE MATHEMATICAL STRUCTURES

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3 0 0

COURSE OUTCOMES (COs)

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

1. 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 model, 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, Hamming 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.

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 International.

NBCA-205
DIGITAL ELECTRONICS AND COMPUTER ORGANIZATION

L T P
3 1 0

COURSE OUTCOMES (COs)

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

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

Unit-I

08

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

Unit-II

08

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

Unit-III

08

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

Unit-IV

08

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

Unit-V

08

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

Text Books:

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

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

Reference Books:

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

NBCA-206
HUMAN VALUES AND ETHICS

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COURSE OUTCOMES (COs)

1. This course would help to assess ideas about ethics, self-exploration and happiness through reflective enquiry.
2. It will aid in evaluating the prevailing problems in society due to differentiation and understanding the importance of human values in relationships.
3. The course would lead to knowledge of the ideas of globalization and the world as a nation, for a transformative world order.
4. It will help in analyzing ideas of leadership and creativity and using leadership qualities in day-to-day lives.
5. It will augment an understanding of cross-cultural ethics and help students learn the art of resolving ethical dilemmas in business.

Unit-I

08

Course Introduction

1. Understanding: Why humans are ethical, why they are not;
2. Understanding the need, basic guidelines, content and process for Value Education;
3. Self-Exploration—what is it? – It’s content and process;
4. ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration;
5. Right understanding of Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority;
6. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario;
7. Method to fulfil the above human aspirations: understanding and living in harmony at various levels

Unit-II

08

Understanding of Human Values and Ethics

1. Understanding the needs of Self (‘I’) and Body (‘Me’);
2. Understanding values in human-human relationship;
3. Meaning of Co-existence and Mutual Satisfaction;
4. Understanding Respect;
5. Understanding Comprehensive Human Goals;

Unit-III

08

Effects of Holistic Harmony on Professional Ethics

1. World as a Nation;
2. Definitiveness of Ethical Human Conduct;
3. Basis for Humanistic Education and Humanistic Universal Order;
4. Competence in professional ethics:
 - a) Ability to utilize the professional competence for augmenting universal human order;
 - b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems;
 - c) Ability to identify and develop appropriate technologies and management patterns for above production system;

5. Strategy for transition from the present state to Universal Human Order:
 - a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers;
 - b) At the level of society: as mutually enriching institutions and organizations;

Unit-IV

08

Effects of Holistic Personality for Success

1. Negotiation as a tool for success;
2. Leadership as an attribute of a successful Professional;
3. Managing Stress and Time;
4. Team Building--creating a harmonious environment with apathy to each other;
5. Understanding difference between evolution and revolution;

Unit-V

08

Managing Relationship for Success

6. Understanding and valuing Cross-Cultural Ethics;
7. Managing Relationships (Networking), Personal Effectiveness and Self Leadership;
8. Theory of Constraints;
9. A Decision Making Model: Ethics as making decisions and choices;
10. Conflicts and Ethical Dilemmas;
11. Entrepreneurship and Ethics: A sense of business Ethics;
12. Pragmatic Behavior of Business to its Colleagues/Competitors

Text Books:

1. Kazuo Ishiguro, 1989, *The Remains of the Day*, Faber and Faber
2. Sussan George, 1976, *How the Other Half Dies*. Penguin Press, Reprint 1991;
3. Amitabh Ghosh, 2008, *Sea of Poppies*. John Murray Publications.

Reference Books

1. B. L. Bajpai, 2004, *Indian Ethos and Modern Management*. New Royal Book Co., Lucknow. Reprinted 2008;
2. R. K. Narayan, 1958, *The Guide*, Viking Press.
3. P. L. Dhar, R. R. Gour, 1990, *Science and Humanism*, Commonwealth Publishers;
4. R. R. Gaur, R. Sangal and G. P. Bagaria, 2010, *A Foundation Course in Human Values and Professional Ethics*, Excel Books.

Relevant movies and documentaries:

1. Story of Stuff (Documentary);
2. The Remains of the Day (Movie);
3. Pursuit of Happyness (Movie);
4. Fences (Movie);

NBCA-207P
DATA STRUCTURE LAB

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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.

LIST OF PRACTICALS

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

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

Part II: Relational Database Implementation

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

Project 1. Library Management System:

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

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

IssuedBooks (Accession number, Borrower)

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

Project 2. Student Management System:

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

Student (College roll number, Name of student, Date of birth, Address, Marks(rounded off to whole number) in percentage at 10 + 2, Phone number)

Paper Details (Paper code, Name of the Paper)

Academic_details (College roll number, Paper code, Attendance, Marks in home examination)

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

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

Project 3. Customer Management System:

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

Customer (CustID, email, Name, Phone, ReferrerID)

Bicycle (BicycleID, DatePurchased, Color, CustID, ModelNo)

BicycleModel (ModelNo, Manufacturer, Style)

Service (StartDate, BicycleID, EndDate)

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

Project 4. Human Resource Management System:

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

EMPLOYEE (Person_Name, Street, City)

WORKS (Person_Name, Company_Name, Salary)

COMPANY (Company_Name, City)

MANAGES (Person_Name, Manager_Name)

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

Project 5. Supplier Management System:

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

Suppliers (SNo, Sname, Status, SCity)

Parts (PNo, Pname, Colour, Weight, City)

Project (JNo, Jname, Jcity)

Shipment (Sno, Pno, Jno, Qunatity)

- a) Identify primary and foreign keys.

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

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

NBCA-209P
OPERATING SYSTEM LAB

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0 0 3

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

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