SCHOOL OF COMPUTER APPLICATIONS

Vision

To achieve high quality in technical education that provides the skills and attitude to adapt to the global needs of the Information Technology sector, through academic and research excellence.

Mission

The objective is to enhance students' problem-solving abilities and enrich the teaching-learning process through innovative pedagogical techniques, while simultaneously strengthening the knowledge base of both faculty and students by fostering academic excellence and relevant research skills. Additionally, it aims to instill strong moral and ethical values in software engineers and computer application professionals, ensuring their positive contribution to society.

Program Educational Objectives (PEOs)

PEO1: Build Strong Foundations in Computing: Equip students with fundamental knowledge of computer science, programming, and mathematics to address real-world computational challenges.

PEO2: Develop Technical and Professional Skills: Foster proficiency in modern tools, technologies, and software development methodologies, along with strong communication, teamwork, and leadership abilities.

PEO3: Promote Lifelong Learning and Adaptability: Prepare students for continuous learning to keep pace with advancements in technology and emerging trends in the global IT landscape.

PEO4: Instill Ethical and Societal Responsibility: Ensure that graduates adhere to ethical principles and design solutions that prioritize sustainability, inclusivity, and societal well-being

PEO5: Enhance Problem-Solving and Analytical Abilities: Develop critical thinking and analytical skills to design efficient algorithms, manage data, and solve complex interdisciplinary problems effectively.

Program Outcomes (POs)

The following outcomes represent the skills, knowledge, and attitudes that graduates of the Bachelor of Computer Applications (BCA) program are expected to achieve:

PO1. Foundational Knowledge and Technical Proficiency: Apply fundamental principles of computer science, programming, and mathematics to solve computational problems. Demonstrate proficiency in using modern tools, techniques, and technologies, including programming languages, development frameworks, and software applications.

PO2. Problem-Solving and Analytical Thinking: Analyze complex problems, identify computational requirements, and design efficient solutions and Develop algorithms and implement them in software solutions with attention to performance and scalability.

PO3. Professional Skills and Employability: Exhibit strong communication, teamwork, and project management skills to succeed in a professional environment and stay abreast of emerging technologies and trends to ensure lifelong learning and adaptability in the tech industry.

PO4. Database and Web Applications Development: Design, develop, and manage databases using relational and non-relational systems to ensure data integrity and accessibility and create dynamic and responsive web applications using modern front-end and back-end technologies.

PO5. Software Development and Testing: Apply software engineering principles to design, develop, and deploy high-quality software systems and use systematic approaches to software testing and debugging to ensure robust and error-free applications.

PO6. Cyber security and Ethics: Understand and implement best practices in cyber security to protect systems, data, and networks and adhere to ethical principles, ensuring privacy, confidentiality, and integrity in computing practices.

PO7. Artificial Intelligence and Data Analysis: Apply concepts of artificial intelligence, machine learning, and data analytics to extract meaningful insights from data and build intelligent systems that address real-world challenges across industries.

PO8. Entrepreneurial and Innovative Thinking: Foster innovation through the development of new software solutions, applications, or business models and demonstrate entrepreneurial skills to launch and manage technology-driven ventures.

PO9. Interdisciplinary Integration: Integrate knowledge from diverse domains, including business, science, and the arts, to design versatile solutions and collaborate effectively across disciplines to create impactful projects.

PO10. Leadership and Global Perspective: Demonstrate leadership qualities by effectively managing technology projects and understanding global trends in technology and adapting solutions to meet the demands of an interconnected world.

IMS UNISON UNIVERSITY

Nurturing Knowledge. Empowering Minds.

SCHOOL OF COMPUTER APPLICATIONS

Bachelor of Computer Applications (BCA)
(Three-Year, Semester Based, Full Time Program)

PROGRAM STRUCTURE: DISTRIBUTION OF CREDITS

Category of courses	**Ist Sem**	**2nd Sem**	**3rd Sem**	**4th Sem**	**5th Sem**	**6th Sem**	**Credits**	**Course**
Major	03	13	16	12	09	09	62	21
Minor	11	09	04	0	06	12	42	12
Multidisciplinary Courses (MDC)	06	0	03	0	0	0	09	04
Ability Enhancement Courses (AEC)	03	03	0	02	0	0	08	03
Skill Enhancement Courses (SEC)	0	0	02	05	02	0	09	04
Value added Courses (VAC)	0	0	0	05	03	0	08	03
Internship	0	0	0	0	0	0	0	0
Project/Dissertation	0	0	0	0	03	03	06	02
Total Credits	**23**	**25**	**25**	**24**	**23**	**24**	**144**	
Teaching Hours	**30**	**30**	**30**	**30**	**30**	**30**	**180**	

SEMESTER I

Sr No	Course Code	Course Name	Periods			Credits	Category
			L	T	P		
1	BCA 101	Basic Statistics	2	0	0	2	MDC
2	BCA 102	Digital Electronics	4	0	0	4	Minor
3	BCA 103	Computer Fundamentals	4	0	0	4	Minor
4	BCA 104	Basic Mathematics	3	0	0	3	MDC
5	BCA 105	English Language -I	3	0	0	3	AEC
6	BCA 101P	Basic Statistics Lab	0	0	2	1	MDC
7	BCA 102P	Digital Electronics Lab	0	0	6	3	Major
8	BCA 103P	Computer Fundamentals Lab	0	0	6	3	Minor
		Total Credits	**16**	**0**	**14**	**23**	
		Total Contact Hours	**30**				

SEMESTER II

Sr No	Course Code	Course Name	Periods			Credits	Category
			L	T	P		
1	BCA 106	Programming with C	3	0	0	3	Major
2	BCA 107	Data Structures using C	3	0	0	3	Major
3	BCA 108	Operating Systems with Linux	4	0	0	4	Minor
4	BCA 109	Discrete Mathematics	3	0	0	3	Major
5	BCA 110	Computer Architecture	4	0	0	4	Minor
6	BCA 111	English Language -II	3	0	0	3	AEC
7	BCA 106P	Programming with C Lab	0	0	4	2	Major
8	BCA 107P	Data Structures using C Lab	0	0	4	2	Major
9	BCA 108P	Operating Systems with Linux Lab	0	0	2	1	Minor
		Total Credits	**20**	**0**	**10**	**25**	
		Total Contact Hours	**30**				

SEMESTER-III

Sr No	Course Code	Course Name	Periods			Credits	Category
			L	T	P		
1	BCA 201	Relational Data Base Management Systems	4	0	0	4	Major
2	BCA 202	Programming with Java	4	0	0	4	Major
3	BCA 203	Computer Based Numerical Methods	3	0	0	3	MDC
4	BCA 204	Software Engineering	4	0	0	4	Major
5	BCA 205	Data Communication and Networking	4	0	0	4	Minor
6	BCA 201P	Relational Data Base Management Systems Lab	0	0	4	2	Major
7	BCA 202P	Programming with Java Lab	0	0	4	2	Major
8	BCA 206P	Soft Skills -I	1	0	2	2	SEC
		Total Credits	**20**	**0**	**10**	**25**	
		Total Contact Hours	**30**				

SEMESTER-IV

Sr No	Course Code	Course Name	Periods			Credits	Category
			L	T	P		
1	BCA 207	Web Technologies	4	0	0	4	Major
2	BCA 208	Computer Graphics	3	0	0	3	SEC
3	BCA 209	Python Programming	4	0	0	4	Major
4	BCA 210	E-Commerce	3	0	0	3	VAC
5	BCA 211	Indian Mathematics	2	0	0	2	VAC
6	BCA 212	English Language -III	2	0	0	2	AEC
7	BCA 207P	Web Technologies Lab	0	0	4	2	Major
8	BCA 208P	Computer Graphics Lab	0	0	4	2	SEC
9	BCA 209P	Python Programming Lab	0	0	4	2	Major
		Total Credits	**18**	**0**	**12**	**24**	
		Total Contact Hours	**30**				

SEMESTER-V

Sr No	Course Code	Course Name	Periods			Credits	Category
			L	T	P		
1	BCA 301	Artificial Intelligence	3	0	0	3	Major
2	BCA 302	Fundamentals of Accounting	2	0	0	2	Minor
3	BCA 303	Generative AI	3	0	0	3	VAC
4	BCA 304	Soft Skills- II	2	0	0	2	SEC
5	-	Elective –I (Advanced Programming)	2	0	4	4	Major
6	-	Elective -II	3	1	0	4	Minor
7	BCA 301P	Artificial Intelligence Lab	0	0	4	2	Major
8	BCA 305P	Project-I	0	0	6	3	Dissertation
		Total Credits	**15**	**1**	**14**	**23**	
		Total Contact Hours	**30**				

SEMESTER-VI

Sr No	Course Code	Course Name	Periods			Credits	Category
			L	T	P		
1	BCA 306	Data Warehouse and Data Mining	4	0	0	4	Minor
2	BCA 307	Data Analysis with R	4	0	0	4	Major
3	-	Elective-I (Advanced Programming)	2	0	4	4	Major
4	-	Elective -III (Same as of Elective II Group)	3	1	0	4	Minor
5	-	Elective -III (Same as of Elective II Group)	3	1	0	4	Minor
6	BCA 307P	Data Analysis with R Lab	0	0	2	1	Major
7	BCA 308P	Project-II	0	0	6	3	Dissertation
		Total Credits	**16**	**2**	**12**	**24**	
		Total Contact Hours	**30**				

LIST OF ELECTIVES

Group I (Advanced Programming)						
Sr No	**Course Code**	**Course Name**	**Periods**			**Credits**
			L	**T**	**P**	
1	BCA-AP101	Dot Net Technology	2	0	4	4
2	BCA-AP102	Advanced Java Programming	2	0	4	4
3	BCA-AP103	Mobile Programming	2	0	4	4
4	BCA-AP104	Advanced Web Technology with PHP	2	0	4	4

Group II (Cloud Technology & Information Security)						
Sr No	**Course Code**	**Course Name**	**Periods**			**Credits**
			L	**T**	**P**	
1	BCA-CI101	Network Security and Cryptography	3	1	0	4
2	BCA-CI102	Virtualization and Cloud Computing	3	1	0	4
3	BCA-CI103	Wireless Communications and VOIP Security	3	1	0	4
4	BCA-CI104	Ethical Hacking and Cyber Law	3	1	0	4

Group III (Business Analytics)						
Sr No	**Course Code**	**Course Name**	**Periods**			**Credits**
			L	**T**	**P**	
1	BCA-BA101	Machine Learning	3	1	0	4
2	BCA-BA102	Business Intelligence	3	1	0	4
3	BCA-BA103	Low Code No Code	3	1	0	4
4	BCA-BA104	Software Testing	3	1	0	4

Notes:

1. A student shall select a course for Elective-I only from the List of Elective Group-I (Advanced Programming) and for Elective-II and Elective-III from Group-II (Cloud Technology and Information Security) and Group-III (Business Analytics). A student selecting one group say X in Semester V for Elective-II then Elective-III can only be selected from same group X in Semester VI.

2. A student shall do his/her project in the elective area chosen. The topic of the Project must be finalized before Semester IV End Term Examination in consultation with the faculty members.

SEMESTER I

Course: BASIC STATISTICS			**Semester: I**
Course Code : BCA 101	**L T P**	**2 0 0**	**Credits: 2**

OBJECTIVE	This course acquaints students with various statistical methods and cultivates statistical thinking among students by giving hands-on experience in data analysis platforms like MS-Excel.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Distinguish types of studies and their limitations and strengths, 2. Describe a data set including both categorical and quantitative variables to support or refute a statement, 3. Perform statistical inference in several circumstances and interpret the results in an applied context, 4. Use mathematical tools, including calculus and linear algebra, to study mathematical statistics and in the description and development of statistical procedures, **5.** Use a statistical software package for computations with data.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Introduction to Statistics, Classification and Presentation of Data** Definition of statistics, Importance and scope of statistics in business decisions, Limitations, Difference between samples and populations, Methods of data collection: primary and secondary data, Tabulation of data, Frequency distributions, Constructing a frequency distribution, Graphing frequency distribution: histograms, frequency polygons. Measurement and scaling concepts.	10
	2	**Measures of Central Tendency** Concept of central tendency, Mean, Median, Mode.	5

	3	**Measures of Dispersion** Concept of dispersion, Range, Inter-Quartile Range, Average Deviation, Mean Deviation, Median deviation, Standard Deviation.	6
	4	**Simple Regression and Correlation** Introduction, Types of relationships between two (or more) variables, Scatter diagrams, Karl Pearson's coefficient of correlation. Lab exercises on MS Excel & SPSS.	5
	5	**Fundamentals of Probability and Distribution** Introduction, Concepts of Probability, Definition, concepts of combination and permutation, Rules of Probability.	4
		Total Hours	**30**
TEXT BOOK	1. Bruce, P., Bruce, A., & Gedeck, P; Practical statistics for data scientists: 50 essential concepts using R and Python; O'Reilly Media 2. Urdan, T. C. Statistics in plain English; Routledge.		
REFERENCE BOOK/ SUGGESTED READING	3. Ken, Black; Business Statistics For Contemporary Decision Making; Wiley. 4. Aczel, Amir. D, Sounderpandian, J, Saravanan, P; Complete Business Statistics; McGraw Hill Education. 5. Carver, R. H., Nash, J. G.; Doing Data Analysis with SPSS; Cengage learning,		

Course: DIGITAL ELECTRONICS			**Semester: I**
Course Code: BCA 102	**L T P**	**4 0 0**	**Credits: 4**

OBJECTIVE	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits and prepare students to perform the analysis and design of various digital electronic circuits.
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. To understand and examine the structure of various number systems and their application in digital design. 2. Have a thorough understanding of the fundamental concepts and techniques used in digital electronics. 3. The ability to understand, analyze, and design various combinational and sequential circuits. 4. Ability to identify basic requirements for a design application Registers and Counters. 5. The ability to identify and understand the working of various Memories.

COURSE DETAILS	Unit No	Topic	Hours
	1	**Number Systems** Binary number system, Octal and Hexa-decimal number system, Conversion of number system, r's and (r-1)'s complement, Arithmetic operations on binary numbers	10
	2	**Logic Gates Boolean Algebra Simplification** AND, OR, NOT GATES and their truth tables, NOR, NAND and XOR gates, AND, OR, Inversion, Basic Boolean law's, Demorgan's theorem. K - Map, Sum of product and Product of sum forms.	12
	3	**Combinational Circuits and Sequential Circuits** Multiplexers, Demultiplexers, Decoders and encoders, Half adder, Full adder, Half subtractor, Full subtractor, Sequential circuits classification, Types of flip flop: R-S, D, J-K, T, Master slave.	14
	4	**Registers and Counters** Types of registers: shift registers, universal shift register with parallel load, Counter: synchronous counter, ripple counter.	14
	5	**Memory** Auxiliary memory, Associative memory, Cache memory, Virtual memory.	10
		Total Hours	60
TEXT BOOK	1. Mano, M.M.; Digital Logic and Computer Design; Pearson Education. 2. Floyd, T. L. Digital fundamentals. Pearson		
REFERENCE BOOK/ SUGGESTED READING	3. Taub, H. and Schilling, D. L.; Digital Integrated Electronics; McGraw-Hill. 4. Givone, D.P.; Digital Principles and Design; McGraw-Hill. 5. Bartee, T. C.; Digital Computer Fundamentals; McGraw-Hill. 6. Malvino, A. P., Brown, J. A.; Digital Computer Electronics; McGraw-Hill.		

Course: COMPUTER FUNDAMENTALS			**Semester: I**
Course Code: BCA 103	**L T P**	**4 0 0**	**Credits: 4**

OBJECTIVE	To introduce students to the fundamentals of computing devices and essential computer literacy, focusing on hardware, software, internet, and networking concepts that support lifelong learning and real-world applications.
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Converse basic computer terminology and evolution. 2. Formulate opinions about the impact of computers on society and understand the basics peripherals of computers. 3. Understand the application of computer languages and software. 4. Possess knowledge of basic computer languages and software. 5. Demonstrate understanding of the Internet and its key applications.

COURSE DETAILS	Unit No	Topic	Hours
	1	**Computer Evolution** Characteristics of computers, Evolution of computers, Generation of computers, Classification of computers, Computer system, Applications of computers, Introduction to developing a program, Algorithm, Flowchart, Pseudo code (P-Code).	**15**
	2	**Input-Output Devices** Memory hierarchy, Random Access Memory (RAM), Types of RAM, Read Only Memory (ROM), Types of ROM. Classification of secondary storage devices, Magnetic tape, Magnetic disk, Optical disk, Magneto optical disk, Keyboard, Pointing devices, Speech recognition, Digital camera, Scanners, Optical scanners, Classification of output, Hard copy output devices, Printers, Plotters, Computer Output Microfilm (COM), Soft copy output devices, Monitors, Audio output, Projectors, Terminals.	**10**
	3	**Computer Languages and Software's** Computer programming languages: machine language, assembly language, and high-level language; 4 GL: merits and demerits, Software and its need; Types of software: System software, Application software, Operating System, Utility Program, Assembler, Compiler and interpreter. Introduction, Evolution of operating system, Types of operating system, Functions of an operating system, Modern operating systems.	**15**
	4	**MS-Office** Basic introduction and use of MS-Word, features of MS Word, formatting tools, mail merge applications, MS-Excel, features of MS Excel, use of basic functions, MS-Power Point, animation and transition.	**14**
	5	**Internet** The evolution of Internet, Network concepts, Uses of the Internet, applications of Internet: e-mail, WWW, FTP, TELNET, USENET NEWS.	**06**
		Total Hours	**60**
TEXT BOOK	1. Sinha, P. K and Sinha, P.; Computer Fundamentals; BPB Publications. 2. Balagurusamy, E.; Fundamentals of Computers; McGraw-Hill.		
REFERENCE BOOK/ SUGGESTED READING	3. Williams, B. and Sawyer, S.; Using Information Technology; McGraw-Hill. 4. Curtain, D. and Sen, K. and Foley, K.; Information Technology; McGraw-Hill 5. Norton's, P; Computing Fundamentals; McGraw-Hill 6. Goel, R. Computer Fundamentals. Pearson India.		

Course: BASIC MATHEMATICS			Semester: I
Course Code : BCA 104	L T P	3 0 0	Credits: 3

OBJECTIVE	To acquire the knowledge of fundamentals of mathematics to make them ready to apply these mathematical concepts and application to solve different problems		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Familiar with Determinant and Matrices and their application. 2. Familiar with logarithms and concepts of permutation and combination and its applications. 3. Formulate and understand the concepts of Limit and Continuity. 4. Formulate the concepts of basic Differentiability and its applications. 5. Demonstrate a working knowledge of Definite and Indefinite Integrals.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Matrices:** Definition, Minors, Cofactors, Properties of Determinants MATRICES: Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices, Adjoint, Inverse, Cramer's Rule	**9**
	2	**Logarithm and Combinatorics:** Definition of logarithms, properties, basic laws of logarithms, definition of permutation, properties of permutation, application, combination, Combination, properties and applications.	**9**
	3	**Limits and Continuity:** Limit at a Point, Properties of Limit, Computation of Limits of Various Types of Functions, Continuity at a Point, Continuity Over an Interval, Intermediate Value Theorem, Type of Discontinuities.	**9**
	4	**Differentiation:** Derivatives, Derivatives of Sum, Differences, Product & Quotients, Chain Rule, Derivatives of Composite Functions, Logarithmic Differentiation.	**9**
	5	**Integration:** Integral as Limit of Sum, Fundamental Theorem of Calculus (without proof), Indefinite Integrals, Methods of Integration: Substitution, By Parts	**9**
		Total Hours	**45**
TEXT BOOK	1. B.S. Grewal, "Elementary Engineering Mathematics", BPP publication. 2. Shanti Narayan, "Integral Calculus", S. Chand & Company		

REFERENCE BOOK/ SUGGESTED READING	3. H. K. Dass, "Advanced Engineering Mathematics", S. Chand & Comp 4. J.P. Chauhan "BCA Mathematics Volume -1", Krishna Publications 5. Jain, R. K., & Iyengar, S. R. K. Advanced engineering mathematics . Narosa Publishing House

Course: ENGLISH LANGUAGE -I			**Semester: I**
Course Code : BCA 105	**L T P**	**3 0 0**	**Credits: 3**

OBJECTIVE	To develop students' effective communication skills—both written and spoken—with a focus on business contexts, and to build essential soft skills for success in the corporate environment.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Demonstrate skills related to the corporate world. 2. Learn the basics of formal communication. 3. Develops other essential skills required for the smooth functioning of any organization. 4. Create and effectively deliver oral presentations. 5. Demonstrate an understanding of the global perspectives of business.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Fundamentals of Communication:** Features of Indian/ colloquial English – Correction of sentences – structures of sentences – Tenses – identifying clichés and removing ambiguity – Idiomatic/phrasal distortions. Informal conversation Vs Formal expression, Types of Verbal Communication. Identifying barriers to effective communication and effective ways to overcome the barriers	**9**
	2	**Business Communication/ Correspondence** Business Correspondence – Principles, Features, Types, Formats and layout of Business Letter. Types of Business Correspondence – Letters of Enquiry, Quotation, Order, Instructions, Sales, Credit, Complaint, Adjustment, Collection, etc. Some more types of Business Correspondence-- Notice, Agenda, Minutes, Memorandum. Job Application letters -- Covering letter, Resume, Bio-data and C.V.	**9**

	3	**Business Proposal and Business Report** Business Proposal – Introduction, purpose, features, types, format, importance, process of preparation. Writing Business Proposals. Business Report -- Features, Types, Style, Format, Relevance. Writing Business Reports.	**9**
	4	**Soft Skills** Kinesics, Para language, Proxemics. Presentation skills - Features, Types, Structure, Aids and Importance. Group Discussion skills - Features and Importance.	**9**
	5	**Effective Presentation Skills** a. Management presentations – types of presentations – video conferencing – participation in meetings – chairing sessions. b. Formal and informal interviews- ambience and polemics – interviewing in different settings and for different purposes e.g. eliciting and giving information, recruiting, performance appraisal.	**9**
		Total Hours	**45**
TEXT BOOK	1. Chaturvedi, Courtland L., Bovee J.V, Thill, Mukesh; Business Communication Today, Pearson 2. Raymond V. Lesikav, John D. Pettit Jr.: Business Communication; Theory and Application, All India Traveller Bookseller, New Delhi		
REFERENCE BOOK/ SUGGESTED READING	1. Rentz, Flatley and Lentz. Lesikar's Business Communication Connecting in a Digital World. New York. McGraw-Hill Irwin. 2. Basic Communication Skills for Technology, Andre J. Rutherford: Pearson Education Asia 3. Edmund H Weiss: Writing Remedies: Practical Exercises for Technical Writing. Universities Press, Hyderabad 4. Ronald E. Duleck and John S. Fielden.; *Principles of Business Communication*. Macmillan. 5. Herta A Murphy and Herbert W. Hildebrandt.; Effective Business Communication; McGraw-Hill, Inc. 6. Shirley Taylor and Chandra, V.; *Communication for Business*; Pearson Education		

Course: BASIC STATISTICS LAB			Semester:I
Course Code: BCA 101P	L T P	0 0 2	Credits: 1

OBJECTIVE	To develop practical skills and confidence of statistical methods using MS Excel.

Suggested List of Practicals

1. Calculate mean, median, mode and display results in proper format.
2. Calculate the product and sum of two vectors.
3. Calculate Range, quartile deviation, standard deviation and coefficient of variation for grouped data.
4. Partition values-quartiles for grouped and ungrouped data and display formatted results.
5. Data Base Creation (including vector, matrix, data frames).
6. Graphical representation (Bar, Pie, Line, Histogram, Scatter).
7. Descriptive Statistics
8. Implement Correlation.

Course: DIGITAL ELECTRONICS LAB			Semester: I
Course Code : BCA 102P	L T P	0 0 6	Credits: 3

OBJECTIVE	To impart practical knowledge about electronics and its applications in computers.

Suggested List of Practicals

1. Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates, Realization of OR, AND, NOT and XOR functions using universal gates.
2. Half Adder / Full Adder.
3. Half Subtractor / Full Subtractor.
4. Parallel Adder / Subtractor: Perform adder and subtractor operation using IC7483 chip.
5. 4-Bit Binary-to-Gray and Gray-to-Binary Code Converter: Realization using XOR gates.
6. 4-Bit and 8-Bit Comparator: Implementation using IC7485magnitude comparator chips.
7. Multiplexer: Truth-table verification.
8. Demultiplexer: Truth-table verification.
9. LED Display: Use of BCD to 7 Segment decoder / driver chip to drive LED display.
10. Encoder: Truth table verification and realization.
11. Decoder: Truth Table verification and realization.
12. Flip Flops: Truth-table verification of JK Master Slave FF, T-type and D-type FF using IC7476 chip.

13. Asynchronous Counter: Realization of 4-bit up counter and Mod-N counter using IC7490 and IC7493 chip.
14. Synchronous Counter: Realization of 4-bit up/down counter and Mod-N counter using IC74192 and IC74193 chip.
15. Shift Register: Study of shift right (SIPO, SISO, PIPO, PISO) and Shift left operations using IC7495 chip

Course: COMPUTER FUNDAMENTALS LAB			**Semester: I**
Course Code : BCA 102P	**L T P**	**0 0 6**	**Credits: 3**

OBJECTIVE	To impart practical knowledge about MS-Office software's like MS-Word, MS-Excel, MS-PowerPoint and working

Suggested List of Practicals

MS-Word

1. Starting Word, Excel and PowerPoint
2. Elaboration of MS Word IDE and its uses
3. Basic formatting tools and application of MS word
4. Items Covered in This Lab
5. Use Nested Folders
6. Open a Document
7. Save a Document
8. Understand Show/Hide Format
9. Use Basic Keyboard Functions
10. Starting Word, Excel and PowerPoint
11. Use Nested Folders
12. Open a Document
13. Save a Document
14. Understand Show/Hide Format
15. Use Basic Keyboard Functions
16. Practice Basic Text Entry
17. Create a Simple Bulleted List
18. Use the Zoom function.

MS Excel:

19. Create a grade report card.
20. create employee's salary sheet
21. Use of Mathematical function.
22. Use of statistical function
23. Use of most frequently used financial functions
24. Use most frequently used Text function.
25. Use of conditional functions.
26. Use of special function like Vlookup and Hlookup

MS PowerPoint:
27. Creating power point presentation. 28. Applying animation and transition feature

SEMESTER II

Course: PROGRAMMING WITH C			**Semester: II**
Course Code: BCA 106	**L T P**	**3 0 0**	**Credits: 3**

OBJECTIVE	To impart knowledge about basic concepts of procedure-oriented programming with a focus on designing applications using C.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Develop a C program to understand the fundamentals of programming. 2. Control the sequence of the program and give logical outputs. 3. Implement various data structures like Array, Structure, and functions in your C program. 4. Apply code reusability with functions and pointers. 5. Understand the basics of file handling mechanisms.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Introduction to 'C' Programming Language** History of 'C' Programming, Types of Programming Languages. Introduction to C and structure of 'C' Program, some simple C programs, Desirable program characteristics. C Fundamentals- C character Set, Identifiers and keywords, data types, constants, variables and arrays, Declarations, expressions, statements, Symbolic constants.	**9**
	2	**Introductions to Control Structures** Control structures: Conditional and loop, break, continue, goto, and exit, Concept of header files, Introduction to C preprocessor, Definition of preprocessor, Macro substitution directives, File inclusion directives.	**7**
	3	**Introduction to Arrays, Functions and Structures** Control Statements- Preliminaries, Branching, Looping, Nested control statements, switch statement, break statement, The continue statement. Arrays: Defining an array, processing an array, passing arrays to functions, Multidimensional arrays, Arrays and strings. Functions: A brief overview, defining a function, accessing a function, function prototypes, passing arguments to a function, recursion. Storage classes.	**10**

	4	**Introduction to Pointers and Strings** Pointers- Fundamentals, Pointer declarations, Passing pointers to the functions, pointers and one-dimensional array, dynamic memory allocation, Operations on pointers, arrays of pointers. Pointer to Pointer, call by value, call by reference, pointer to function.	**10**
	5	**Structure and File Handling** Structure &Union: Declaration & Initialization of Structure & Union, Array of Structure, passing structure to a function, union and array as member of union, concept of memory saving and union. Data files- Opening and closing a data file, creating a data file, processing a data file, unformatted data files. Command line argument in 'C'.	**9**
		Total Hours	**45**
TEXT BOOK	1. Balagurusamy, E.; Programming in Ansi C; McGraw-Hill. 2. Kernighan, B. W., & Ritchie, D. M. *The C programming language* . Prentice Hall		
REFERENCE BOOK/ SUGGESTED READING	1. Ritchie, D. and Kernighan, B. W.; The C Programming Language; PHI. 2. Dromey, R.G.; How to solve it by Computer; Pearson Education. 3. Forouzan, B. A, Gilberg, R. F., Geetha, B.G, Singharavel, G: Computer Science: A Structured Programming Approach Using C; Cengage Learning. 4. Kanetkar, Y; Letus C; BPB Publication.		

Course: DATA STRUCTURE USING C			**Semester: II**
Course Code: BCA 107	**L T P**	**3 0 0**	**Credits: 3**

OBJECTIVE	To impart appropriate knowledge of data structures and algorithms for solving real world problems, implement various kinds of searching and sorting techniques and implement data structures such as stacks, queues, Search trees, and hash tables to solve various computing problems.		
LEARNING OUTCOMES	**Upon completion of the course students should be able to:** 1. Understand basic data structures such as arrays, strings, and linked lists. 2. Study linear data structures such as stacks and queues and understand their differences. 3. Describe the hash function and concepts of collision and its resolution methods. 4. Understand the concept of memory management. 5. Study tree, heap and graphs along with their basic operations.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Introduction to Data Structure:** Definition, Classification of data structures (Linear and Non-Linear), Operations on data structures, Complexity: time and space complexity. String Processing: Strings, Storing strings.	**8**

	2	**Arrays and Sorting:** Definition, Representation of linear arrays in memory (Both Single- and Two-Dimensional arrays), Algorithm for insertion and deletion in one dimensional array, advantages and disadvantages of arrays, Sparse matrices, Linear search and binary search. Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort	**10**
	3	**Linked Lists:** Linked list, Representation of linked lists in memory, Operations on linked list (Insertion, Deletion, Display), Circular linked linear lists (Insertion, Deletion, Display), Doubly linked linear list (Insertion, Deletion, Display), Applications of linked linear lists.	**9**
	4	**Stacks and Queues:** Concepts, Operations, Sequential and linked implementation, Application of stacks, Towers of Hanoi, Infix, Prefix and Postfix expressions, and Evaluation of postfix expression using stacks. Concepts, Operations, Sequential and linked implementation, Linear queue (FIFO), Circular queues, Dequeue (Introductory concepts), Application of queues.	**9**
	5	**Trees and Graph:** Binary trees, Complete binary trees, Binary search trees, Searching and inserting in binary search Trees, deletion in a binary search tree; Traversals on a binary tree (in-order, post-order, pre-order), Application of trees (brief overview). Basic terminology, Representations of graphs, Graph search methods: DFS and BFS	**9**
		Total Hours	**45**
TEXT BOOK	1. Lipschutz,; Data Structures; McGraw-Hill. 2. Srinivasan, M. *Data Structures Using C*. McGraw-Hill Education		
REFERENCE BOOK/ SUGGESTED READING	3. Tremblay, J.P. and Sorenson, P.G.; An Introduction to Data Structures with Applications; McGraw-Hill. 4. Bhasin, H. Data Structures with Python. BPB Publications. 5. Sahni,S.; Data Structures, Algorithms and Applications in C++;Sillicon Press. 6. Langsam, Y; Augentein, M. J. and Tenenboum, A. M.; Data Structures using C and C++; Pearson.		

Course: OPERATING SYSTEMS WITH LINUX			**Semester: II**
Course Code: BCA 108	**L T P**	**4 0 0**	**Credits: 4**

OBJECTIVE	This course acquaints students with basic concepts of Operating System, its functions and services and providing hands on experience using Linux operating system and shell programming.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Explain the structure and functions of operating systems along with their components, types and working. 2. Analyze the performance of different scheduling algorithms along with the policies for concurrency and deadlock management. 3. Elaborate the system calls for Memory Management and Device Management. 4. Elaborate the system calls for process management and file management. 5. Make use of appropriate Linux commands for memory management, file management and directory management.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Introduction** Operating systems, Simple Batch Systems, Multi-programmed Batch systems, Time-Sharing systems, Personal – Computer systems, Parallel systems, Distributed systems, Real- Time systems.	**10**
	2	**Processes and Threads** Process Concept, Process Scheduling, Operation on Processes, CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Process Synchronization: Background, The Critical–Section Problem, Semaphores, Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks	**15**
	3	**Memory and Device Management** Basic memory management, Swapping, Virtual Memory, Page replacement algorithms, Implementation Issues, Segmentation. Input or Output Devices, Storage Devices, Buffering, Secondary Storage Structure: Disk Structure, Disk Scheduling, Disk Management, Swap- Space Management, Disk Reliability.	**15**
	4	**File Systems** Introduction, A Simple File system, Access Control Verification, Logical File System, Physical File system, File system Interface; File Concept, Access Methods, Directory Structure, Protection, Allocation Methods, Free- Space Management.	**08**
	5	**Linux** History of Linux, Linux Operating System Layers, The Linux Shell (different kinds of shell), Process: (parent and child processes), Memory management, Files and Directories (File Structure and directory structure), Shell Programming.	**08**
		Total Hours	**60**

TEXT BOOK	1. Silberschatz, A., Galvin, P. B., & Gagne, G. Operating System Concepts with Linux . Wiley. 2. Evi Nemeth, G. Snyder, T. Hein, & B. Whaley. Linux Administration: A Beginner's Guide. McGraw-Hill Education
REFERENCE BOOK/ SUGGESTED READING	3. Deitel H. M, Dietel, P. J and Choffens, T. R; Operating Systems, Pearson. 4. Madnick, S. E., Donovan J., Operating Systems; McGraw Hill. 5. Harris, A. J; Operating Systems; McGraw Hill. 6. Stones and Matthew; Beginning Linux Programming; Wrox. 7. Kanetkar; Unix Shell Programming; BPB publications.

Course: DISCRETE MATHEMATICS			**Semester: II**
Course Code: BCA 109	**L T P**	**3 0 0**	**Credits: 3**

OBJECTIVE	To impart knowledge basic concepts of mathematical logic for analyzing propositions and proving theorems. Use sets for solving applied problems and use the properties of set operations algebraically. Work with relations and investigate their properties.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Understand and apply discrete structures to model relationships between discrete objects. 2. Demonstrate mathematical reasoning to read, construct, and comprehend proofs. 3. Apply knowledge of algebraic structures, such as groups. 4. Develop and analyze algorithms for problem-solving, including correctness and efficiency. 5. Use Boolean algebra to explain fundamental computer operations.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Sets and Relations, Sets, Type of Sets, Operations on Sets :** Type and composition of relations, Pictorial representation of relations, Equivalence relations, Partial ordering relations, Function types, Composition of function, Recursively defined functions, Hasse diagram	**10**
	2	**Mathematical Induction:** Piano's axioms, Mathematical induction, Simple recurrence relation with constant coefficients, Linear recurrence relation without constant coefficients.	**9**
	3	**Algebraic Structures:** Properties, Semi group, Monoid group, Abelian group,	**9**

		Properties of groups, Subgroups.	
	4	**Propositional Logic:** Proposition, First order logic, Basic logical operations, Tautologies, Contradictions, Algebra of proposition, Normal forms.	**10**
	5	**Boolean Algebra:** Definition, Stone representation for finite Boolean algebra, Boolean function, Free Boolean Algebra, Relationship with statement logic.	**7**
		Total Hours	**45**
TEXT BOOK	1. Fortney, J. P. *Discrete mathematics for computer science: An example-based introduction*. Chapman & Hall/CRC. 2. Kumar, B. V. S., & Dutta, H. *Discrete mathematical structures: A succinct foundation*. CRC Press.		
REFERENCE BOOK/ SUGGESTED READING	3. Busby, R.; Kolman, B. and Ross, S. C; Discrete Mathematical Structures; Pearson 4. Sen, M. and Malik, D.S.; Discrete Mathematical Structures: Theory and Application; Cengage. 5. Johnson baugh, R.; Discrete Mathematics; Pearson. 6. Liu, C. L., Mohapatra, D. P.; Elements of Discrete Mathematics: A Computer Oriented Approach; McGraw-Hill.		

Course: COMPUTER ARCHITECTURE			**Semester: II**
Course Code: BCA 110	**L T P**	**4 0 0**	**Credits: 4**

OBJECTIVE	To impart knowledge about the basic concepts of Computer Architecture and various types of file systems, and memory management.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Study of the basic structure and operation of a digital computer system. 2. Understand basic Computer architecture and Assembly Language. 3. Understand the architecture and functionality of central processing unit. 4. Analysis of the design of arithmetic & logic unit and understanding of the fixed point and floating-point arithmetic operations. 5. Understanding the hierarchical memory system, cache memories and virtual memory		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Register Transfer and Micro Operations:** Register Transfer Language, Register Transfer, Bus and memory transfer, Three-state bus buffer, Memory transfer, Arithmetic micro-operations, Binary incrementer, Logic	**12**

		micro-operations, Hardware Implementation, Shift micro-operations, Hardware implementation.	
	2	**Basic Computer Organization :** Instruction codes stored in programmed organization, Computer registers, Common bus system, Computer instructions, Instruction cycle, Register reference instructions, Memory reference instructions.	**15**
	3	**Central Processing Unit Organization:** Introduction, General register organization, Control word, Stack organization, Register stack, Memory stack, Reverse polish notation, Instruction formats.	**11**
	4	**Computer Arithmetic and Input-Output Organization:** Addition and subtraction, Addition and subtraction with signed-magnitude data, peripheral devices, Input-output interface, Asynchronous data transfer, modes of transfer, Direct memory access, DMA controller.	**10**
	5	**Memory Organization:** Memory hierarchy, Main memory, RAM and ROM chips, Memory address map, Memory interfacing with CPU, Auxiliary memory, Magnetic disk, Magnetic tapes, Associative memory, Hardware Organization of CAM, Cache memory, Cache organization, Locality of reference, Hit-miss ratio of cache, Virtual memory, Page replacement algorithms, Memory management hardware.	**12**
		Total Hours	**60**
TEXT BOOK	1. Morris M. M.; Computer System Architecture; Pearson Education 2. Stallings, W.; Computer Organization and Architecture Designing for Performance; Pearson Education.		
REFERENCE BOOK/ SUGGESTED READING	3. Hayes, J. P.; Computer Architecture and Organization; McGraw-Hill 4. Hamacher, C., Vranesic, Z. and Zaky S.; Computer Organization; McGraw-Hill. 5. Hennessy, J. L., & Patterson, D. A. Computer architecture: A quantitative approach . Morgan Kaufmann. 6. Comer, D. Essentials of computer architecture . Pearson		

Course: ENGLISH LANGUAGE-II			**Semester: II**
Course Code : BCA 111	**L T P**	**3 0 0**	**Credits: 3**

OBJECTIVE	The objective of the course is to develop among students a vast understanding of communication and its different dimensions.

<table>
<tr><td>COURSE OUTCOMES</td><td colspan="3">Upon completion of the course students should be able to:

1. Understand the foundational concepts of personality development and personal grooming to enhance individual confidence and professional image.
2. Demonstrate proper grooming, dressing, and presentation skills appropriate for formal and professional settings.
3. Apply structured communication techniques and professional etiquette to effectively participate in interviews and group discussions.
4. Exhibit appropriate body language and behavioral responses in various professional settings, including individual, group, and virtual environments.
5. Utilize effective verbal and non-verbal communication strategies in personal, academic, and workplace interactions.</td></tr>
<tr><td rowspan="6">COURSE DETAILS</td><td>Unit No</td><td>Topic</td><td>Hours</td></tr>
<tr><td>1.</td><td>Personality and Personal Grooming: Understanding Personality, Definition and Meaning of Personality, Types of Personality, Components of Personality, Determinants of Personality, Assessment of Personality Grooming Self, Dress for success Make up & skincare, Hair care & styles for formal look, Art of accessorizing, Oral Hygiene.</td><td>11</td></tr>
<tr><td>2.</td><td>Interview Preparation and Group Discussion: Meaning and Types of Interviews [Face to Face, Telephonic, Video], Interview procedure [Opening, Listening, Closure], Preparation for Interview Resume Writing, LinkedIn Etiquette, Meaning and methods of Group Discussion, Procedure of Group Discussion, Group Discussion simulation, Group discussion common error.</td><td>12</td></tr>
<tr><td>3.</td><td>Body Language and Behaviour :Concept of human behavior, Individual and group behavior, Developing Self-Awareness, Behavior and body language, Dimensions of body language: Proxemics, Haptics Oculesics Paralanguage Kinesics, Sign Language Chromatics, Chronemics Olfactics, Cultural differences in Body Language, Business Etiquette & Body language, Body Language in the Post Corona Era, Virtual Meeting Etiquette, Social Media Etiquette.</td><td>12</td></tr>
<tr><td>4.</td><td>Art of Good Communication: Communication Process, Verbal and Non-verbal communication, 7 Cs of effective communication, Barriers to communication, Paralinguistics Pitch, Tone Volume Vocabulary Word stress Pause, Types of communication Assertive, Aggressive Passive, Listening Skills, Questioning Skills, Art of Small Talk, Email Writing.</td><td>10</td></tr>
<tr><td></td><td>Total hours</td><td>45</td></tr>
<tr><td>TEXT BOOK</td><td colspan="3">1. Cloninger, S.C., “Theories of Personality: Understanding Person”, Pearson, New York.</td></tr>
<tr><td>REFERENCE BOOK/ SUGGESTED READING</td><td colspan="3">2. Luthans F, “Organizational Behaviour”, McGraw Hill, New York.
3. Barron, R.A. & Brian D, “Social Psychology”, Prentice Hall of India.
4. Adler R.B., Rodman G. & Hutchinson C.C., “Understanding Human Communication”, Oxford University Press: New York.</td></tr>
</table>

Course: PROGRAMMING WITH C LAB			Semester: II
Course Code : BCA 106P	L T P	0 0 4	Credits: 2

OBJECTIVE	To develop practical skills and confidence in procedure-oriented programming using C

Suggested List of Practicals

Writing a program in C for:

1. Writing a program in C to find the largest of three integers.
2. Writing a program in C to check whether the given string is palindrome or not.
3. Writing a program in C to find whether the given integer is a prime number and an Armstrong number.
4. Writing a program in C for Pascal triangle.
5. Writing a program in C to find sum and average of n integer using linear array.
6. Writing a program in C to perform addition, multiplication, and transpose on matrices.
7. Writing a program in C to find Fibonacci series of iterative methods using user-defined functions.
8. Writing a program in C to find factorial of n by recursion using user-defined functions.
9. Writing a program in C to perform following operations by using user defined functions:
   a. Concatenation
   b. Reverse
   c. String-matching
10. Writing a program in C to find sum of n terms of series: n – n*2/2! + n*3/3! - n*4/4! + ...
11. Writing a program in C to interchange two values using
    a. Call by value.
    b. Call by reference.
12. Writing a program in C to display the mark sheet of a student using structure.
13. Writing a program in C to perform following operations on data files: Read from data file and writing to data file.
14. Writing a program in C to copy the content of one file to another file using command line arguments.
15. Writing a program in C to reverse a given number.
16. Writing a program in C to find gross salary.
17. Writing a program in C to find that entered year is leap year or not.
18. Writing a program in C to find whether given no is even or odd.
19. Writing a program in C to shift input data by two bits to the left.
20. Writing a program in C to perform linear sort on an array of integers.
21. Writing a program in C for reading an employee's file containing {emp_number, name, salary, address}. Create an output file containing the names of those employees along with their salary and address whose salary is > 20,000..

Course: DATA STRUCTURE USING C LAB			Semester: II
Course Code: BCA 107P	L T P	0 0 4	Credits: 2

OBJECTIVE	To impart practical knowledge about the use of data structures in computer science.

Suggested List of Practicals

Writing a program in C/C++ for

1. Matrix Operations-Add, Multiply, Rank, Determinant.
2. Stack and Queue operations using Arrays and linklist.
3. Self-referential structures and single linked list operations.
4. Implementing Stack and Queues using linked lists.
5. Implementing Polish Notations using Stacks.
6. Circular and double linked list operations.
7. Implementing priority queue and Dequeue lists.
8. Evaluating polynomial operations using Linked lists.
9. Implementing set related operations and Hashing.
10. Linear search, binary search, and bubble sort techniques.
11. Insertion sort, selection sort and merge sort techniques.
12. Quick sort, counting sort and shell sort techniques.
13. Binary tree traversals (preorder, in order, postorder).
14. Storing sparse matrix as a linked list.
15. Creating a Binary Search tree.
16. Illustrating application of recursion.
17. Graph representation with matrix and adjacency lists.
18. Creating a Hash Table that allows insertion, deletion and searching for an element.

Course: OPERATING SYSTEMS WITH LINUX LAB			**Semester: II**
Course Code: BCA 108P	**L T P**	**0 0 2**	**Credits: 1**

OBJECTIVE	To impart practical knowledge about the use of Linux operating systems

Suggested List of Practicals

1. Study of Basic commands for Linux.
2. Study of Advance commands and filters of Linux.
3. Write a shell script to generate a mark sheet for a student. Take 3 subjects, calculate and display total
   Marks, percentage and Class obtained by the student.
4. Write a shell script to find factorial of given number n.
5. Write a shell script which will accept a number b and display first n prime numbers as output.
6. Write a shell script which will generate Fibonacci numbers like: 1, 1, 2, 3, 5, 13,…
7. Shell script Program to search whether element is present is in the list or not.
8. Display calendar of current month and display today's date and time.
9. Display usernames those are currently logged in the system
10. Shell script program to check whether given file is a directory or not.
11. Write a shell script to display all executable files, directories and zero sized files from current Directory.
12. Shell script program to copy contents of one file to another.
13. Create directory, write contents on that and Copy to a suitable location in your home directory.
14. Use a pipeline and command substitution to set the length of a line in file to a variable
15. Write a shell script to check entered string is palindrome or not.
16. Shell programming using filters (including grep, egrep, fgrep).
17. Write a shell script program to display the process attributes.
18. Write a shell script to change the priority of processes.
19. Write a program to create a child process and allow the parent to display "parent" and the child to display "child" on the screen.
20. Write a program to retrieve a process from background.
21. Write a shell script program to check variable attributes of file and processes.
22. Write a shell script program to check and list attributes of processes.
23. Shell Script program to implement read, write, and execute permissions.

SEMESTER III

Course: RELATIONAL DATA BASE MANAGEMENT SYSTEMS			Semester: III
Course Code: BCA 201	L T P	4 0 0	Credits: 4

OBJECTIVE	The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS.

COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Describe the fundamental elements of relational database management systems. 2. Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL. 3. Design ER-models to represent simple database application scenarios. 4. Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data. 5. Improve the database design by normalization.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Introduction:** Elements of database system, DBMS and it's architecture, advantages of DBMS, data independence, types of database users, role of database administrator	**10**
	2	**DBMS Architecture:** Brief overview of hierarchical and network model, relation model (Relations, properties of relational model, keys and entity integrity & referential integrity rules), CODD's rules for referential Model. Entity relationship Model: Entity sets, Relationship sets, Design Issue, Mapping constraints, E-R diagram, weak entity sets, specialization & generalization.	**14**
	3	**DBMS Designing Principles:** Normalization concepts and update anomalies, Functional dependencies, Normal forms (1NF, 2NF, 3NF, BCNF).	**10**
	4	**DBMS Language SQL** : SQL fundamentals - Integrity – Triggers - Security – Advanced SQL features – Embedded SQL–Dynamic SQL- Missing Information– Views – Introduction to Distributed Databases and Client/Server Databases.	**14**

	5	**DBMS Backup and Recovery:** Centralized system, Client-Server systems (Transaction server, Data server), Parallel system (Speedup & Scale up), Parallel database architecture (Shared memory, Shared Disk, Shared Nothing), Distributed System (Structures, Tradeoffs), Backup and Recovery, Security and Privacy.	**12**
		Total Hours	**60**
TEXT BOOK	1. Silberschatz, A., Korth, H. F., & Sudarshan, S. *Database system concepts* . McGraw-Hill. 2. Grippa, V., &Kuzmichev, S. *Learning MySQL: Get a handle on your data* . O'Reilly Media.		
REFERENCE BOOK/ SUGGESTED READING	3. Bipin Desai, An Introduction to Database System, Galgotia Publication 4. Date C J, "An Introduction to Database System", Addison Wesley 5. Ivan,Bayross; SQL/ PL SQL Programming Language of Oracle; BPB Publication. 6. Garcia-Molina, H., Ullman, J. D., & Widom, J. Database systems: The complete book . Pearson. 7. Ramakrishnan, R., & Gehrke, J. Database management systems . McGraw-Hill.		

Course: PROGRAMMING WITH JAVA			**Semester: II I**
Course Code: BCA 202	**L T P**	**4 0 0**	**Credits: 4**
OBJECTIVE	Introduce object-oriented programming concepts and apply them to problem-solving and GUI design using applets and Swing controls.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Demonstrate an understanding of Java fundamentals, including data types, operators, expressions, and the Java Virtual Machine, to write basic Java programs. 2. Apply conditional statements and looping constructs in Java to control program flow and develop decision-based applications. 3. Implement object-oriented programming concepts such as classes, objects, inheritance, method overloading, and arrays to design structured and reusable code. 4. Develop multithreaded applications, manage Java packages, and apply exception handling techniques to ensure smooth program execution. 5. Create Java applets and implement file input/output operations using byte and character streams for interactive and data-driven applications.		

COURSE DETAILS	Unit No	Topic	Hours
	1	**Introduction to Java programming:** Introduction to Java programming–Java Buzzword, The Java Virtual Machine, Variables and data types, Operators and Expressions- Introduction, Arithmetic Operators, Relational Operators Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Type Conversion and Associativity.	12
	2	**Decision Making and Branching:** Decision Making and Branching- Introduction, Decision Making with if Statement, Simple if Statement, The if…else Statement, Nesting of if ...Else Statements, The else if Ladder, The Switch Statement, The ?: Operator. Decision Making and Looping – Introduction, while Statement, do Statement, for Statement, Jumps in Loops Labeled Loops	12
	3	**Classes, Objects and Methods –** Introduction, Defining a Class, Adding Variables, Adding Methods, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods, Inheritance- Types of inheritance single, multiple, multi-level, hierarchical, Interfaces, Extending a Class Overriding Methods, Final Variables and Methods, Finalizer methods, Abstract Methods and Classes, Visibility Control. Arrays, Strings and Vectors - Arrays, One-dimensional Arrays, Creating an Array, Two-Dimensional Arrays, Creating an Array, Two – dimensional Arrays, Strings, Vectors, Wrapper Classes.	12
	4	**Multithreaded Programming**: Introduction, Creating Threads, Extending the Thread Class, Stopping and Blocking a thread, Life Cycle of a thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the 'Runnable' Interface. Packages - Using a Package, Adding a Class to a Package, Exceptions Handling - Introduction, Types of Exception Handling Code, Multiple Catch Statements, Using Finally Statement,	12

	5	**Applet Programming**: Introduction, How Applets Differ from Applications, Applet Life Cycle, Creating Applet Tag, Adding Applet to HTML File, running the Applet, Input/Output Files in JAVA:- Introduction, Concept of Streams, Stream Classes, Byte Stream Classes, Character Stream Classes, Using Streams, Using the File Class	12
		Total Hours	60
TEXT BOOK	1. Cay, S. H. Core Java for the Impatient . Addison-Wesley. 2. Bloch, J. Effective Java . Addison-Wesley.		
REFERENCE BOOK/ SUGGESTED READING	3. J. Nino and F. A. Hosch; An Introduction to programming and OO design using Java, John Wiley &sons 4. Y. Daniel Liang; Introduction to Java programming, Pearson Education. 5. P. Radha Krishna; Object Oriented Programming through Java, University Press. 6. S. Malhotra, S. Chudhary; Programming in Java, 2nd edition, Oxford Univ. Press. 7. R. A. Johnson; Java Programming and Object-oriented Application Development, Cengage Learning		

Course: COMPUTER BASED NUMERICAL METHODS			Semester: III
Course Code: BCA 203	L T P	3 0 0	Credits: 3

OBJECTIVE	To develop a practical understanding of numerical methods for fundamental problems in numerical analysis, implement these methods using a computer, and analyze, trace, and predict associated errors.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Students will be able to represent numbers in computers, perform floating-point arithmetic, and evaluate different types of numerical errors. 2. Students will be able to solve nonlinear equations using iterative methods like bisection, false position, Newton-Raphson, and secant methods. 3. Students will be able to solve systems of linear equations using direct (Gauss Elimination) and iterative (Gauss-Seidel) methods and analyze matrix conditioning. 4. Students will be able to construct interpolating polynomials using Lagrange and Newton's methods and estimate unknown values. 5. Students will be able to apply Trapezoidal and Simpson's rules to approximate definite integrals and compare the accuracy of these methods		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Computer Arithmetic and Errors:** Number System, Conversion of Numbers, Representation of numbers, Floating point representation, Arithmetic operations with Normalized Floating-point Numbers, consequences of normalization, pitfalls in computing. Approximation and Errors Significant digits, Types of errors, absolute and relative error.	08
	2	**Roots of Nonlinear Equations:** Introduction, Methods of Solution, Iterative Methods, Bisection method, False position method, Newton-Raphson method, Secant method	10
	3	**Solution of Simultaneous Algebraic Equations:** Gauss elimination method, Pivoting, ill-conditioned systems, Gauss-Seidel iterative method.	10
	4	**Polynomial Interpolation:** Introduction, Polynomial Forms, Linear interpolation, Lagrange interpolation, Newton interpolation.	10
	5	**Numerical Integration :** Trapezoidal Rule, Simpson's 1/3 rule, Simpson's 3/8 rule.	07
		Total Hours	45
TEXT BOOK	1. Shastri, S. S. .*Numerical Methods* . Prentice Hall India 2. Grewal, B. S. *Numerical Methods in Engineering and Science*. Khanna Publishers.		

REFERENCE BOOK/ SUGGESTED READING	3. Stoor, Bullrich, Computer Oriented Numericals Methods, Springer-Verlag. 4. Krishnamurthy, E.V., Sen, S.K., Computer Based Numerical Algorihms, East West Press. 5. Jain, M.K., Iyengar, S.R.K., Jain R.K., Numerical Methods : Problems and Solutions, New Age Int.(P) Ltd., New Delhi. 6. Jain, M.K., Iyengar, S.R.K., Jain R.J., Numerical Method 7. Rajaraman V., Computer Oriented Numerical Methods, 3rd Edition, Prentice Hall India, New Delhi, 1998.

Course: SOFTWARE ENGINEERING			**Semester: III**
Course Code: BCA 204	**L T P**	**4 0 0**	**Credits: 3**

OBJECTIVE	To understand the process of decomposing problems into Analysis, Design, Implementation, Testing, and Maintenance phases, and explore the use of various software process models based on specific industry needs.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Explain the fundamental concepts of software engineering including the evolving role of software, its characteristics, layered technology, process models, and software development frameworks. 2. Analyze user requirements using systematic requirement engineering processes and modeling techniques, and develop Software Requirement Specifications (SRS) with appropriate structure and components. 3. Apply project management principles such as estimation, scheduling, and risk management to effectively plan and manage software development projects. 4. Utilize software engineering tools and principles, including data flow diagrams, decision tables, and modular design techniques like coupling and cohesion, to design structured software systems. 5. Apply appropriate software testing strategies and techniques, including black-box and white-box testing, validation, and system testing to ensure software quality and reliability.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Introduction:** The Evolving Role of Software, Software characteristics, Software Engineering as a Layered Technology, Software Process Framework and Umbrella Activities, Process Models.	**12**
	2	**Requirement Analysis:** Software Requirement Analysis, Initiating Requirement Engineering Process, Requirement Analysis and Modelling Techniques, Flow Oriented Modelling, Need for SRS, Characteristics and Components of SRS.	**12**

	3	**Software Project Management:** Estimation in Project Planning Process, Project Scheduling. Risk Management: Software Risks, Risk Identification, Risk Projection and Risk Refinement.	**12**
	4	**Software Engineering Principles &Tools:** Tools of Design (Data Flow Diagrams, Data Dictionary, Decision Tree, Decision Tables), Modularization (Coupling).	**12**
	5	**Testing Strategies & Tactics:** Software Testing Fundamentals, Test Strategies for Conventional Software, Validation Testing, System testing, Black-Box Testing, White-Box Testing and their type, Basis Path Testing.	**12**
		Total Hours	**60**
TEXT BOOK	1. Pressman, R. S. *Software engineering: A practitioner's approach* . McGraw-Hill Education. 2. Fowler, M. *Refactoring: Improving the design of existing code* . Addison-Wesley.		
REFERENCE BOOK/ SUGGESTED READING	3. Rajib Mall, "Fundamentals of Software Engineering". PHI. 4. Pankaj Jalote. "An Integrated Approach to Software Engineering", Narosa 5. Brooks, F. P. The mythical man-month: Essays on software engineering. Addison-Wesley. 6. McConnell, S. Code complete: A practical handbook of software construction (2nd ed.). Microsoft Press. 7. Martin, R. C.Clean code: A handbook of agile software craftsmanship. Prentice Hall.		

Course: DATA COMMUNICATION AND NETWORKING			**Semester: III**
Course Code: BCA 205	**L T P**	**4 0 0**	**Credits: 4**

OBJECTIVE	To enable students to understand and analyze the core concepts of computer networking, including networking models, transmission mediums, technologies, protocols, switching techniques, and the functions of OSI model layers.
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Remember the fundamentals of Networking. 2. Understand Networking Models. 3. Evaluate various Transmission Mediums. 4. Analyze Technologies and Protocols and switching techniques. 5. Analyse the functions of Network Layers of OSI Models

COURSE DETAILS	Unit No	Topic	Hours
	1	**Network definition:** Network topologies; network classifications; network protocol; layered network architecture; overview of OSI reference model; overview of TCP/IP protocol suite.	12
	2	**Data Communication Fundamentals and Techniques:** Analog and digital signal; data-rate limits; digital to digital line encoding schemes; pulse code modulation; digital to analog modulation-multiplexing techniques- FDM, TDM; transmission media.	12
	3	**Error detection techniques:** Data-link control- framing and flow control; error recovery protocols-stop and wait ARQ, go-back-n ARQ; Multiple Access Protocol.	12
	4	**Networks Switching Techniques and Access mechanisms:** Circuit switching; packet switching-connectionless datagram switching, connection-oriented virtual circuit switching.	12
	5	**Networks Layer Functions and Protocols:** Routing algorithms; Distance vector routing and link state routing, protocol of Internet- IP protocol (IP4)	12
		Total Hours	60
TEXT BOOK	1. Forouzan, B. A. *Data Communications and Networking*. McGraw-Hill Education. 2. Stallings, W. *Data and Computer Communications* . Pearson.		
REFERENCE BOOK/ SUGGESTED READING	3. Kurose, J. F., & Ross, K. W. Computer networking: A top-down approach. Pearson. 4. Tanenbaum, A. S. Computer networks. Pearson 5. James F. Kurose, Keith W. Ross, "Computer Networking", Pearson Education. 6. Michael A. Gallo, William M. Hancock, "Computer Communications and Networking Technologies", CENGAGE Learning 7. Grigorik, I. High-performance browser networking. O'Reilly Media.		

Course: RELATIONAL DATA BASE MANAGEMENT SYSTEMS LAB			Semester: III
Course Code: BCA 201P	L T P	0 0 4	Credits: 2
OBJECTIVE	Create, Maintain and Query MySQL Database and by Using MySQL to model real world data.		

Suggested List of Practicals

1. Analyze the organization and identify the entities, attributes and relationships in it.
2. Identify the primary keys for all the entities. Identify the other keys like candidate keys, partial keys, if any.
3. Relate the entities appropriately. Apply cardinalities for each relationship.
4. Identify strong entities and weak entities (if any).
5. Represent all the entities (Strong, Weak) in tabular fashion. Represent relationships in a tabular fashion.
6. Apply the First, Second and Third Normalization levels on the database designed for the organization.
7. Installation of Mysql and practicing DDL commands
8. Installation of MySql. Creating databases, how to create tables, altering the database, dropping.
9. tables and databases if not required. Try truncate, rename commands etc.
10. Practicing DML commands on the Database created for the example organization.
11. DML commands are used to for managing data within schema objects. Some examples: SELECT, INSERT, UPDATE, DELETE
12. Practice queries (along with sub queries) involving ANY, ALL, IN, Exists, NOT EXISTS, UNION, INTERSECT, Constraints etc.
13. Practice queries using Aggregate functions (COUNT, SUM, AVG, and MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.

Course: PROGRAMMING WITH JAVA LAB			Semester: III
Course Code: BCA 202P	L T P	0 0 4	Credits: 2

OBJECTIVE	To apply Object-Oriented Programming (OOP) concepts using Java and develop Graphical User Interface (GUI) applications that simulate real-world scenarios effectively.

Suggested List of Practicals

1. Program on strings.
2. Programs to practice loops.
3. Program to demonstrate all math class functions.
4. Program on files.
5. Program to demonstrate method over-riding and overloading.
6. Programs on Inheritances.
7. Program to create a Date object using the Calendar class.
8. Program to add some hours to the current time.
9. Multi-threaded programming.
10. Programs to demonstrate the use of container classes of JAVA.
11. Programs to demonstrate Database Programming.
12. Programs to queries MySQL database through JAVA.
13. Creating and using Packages.
14. Creating GUI applications using Java Swing.
15. Creating Applications that uses GUI concepts as well as Database Programming Concepts.
16. Create Clone of popular real-life Windows application using Swing and JDBC.

Course: SOFT SKILLS-I			Semester: III
Course Code: BCA 206P	L T P	1 0 2	Credits: 2

OBJECTIVE	To familiarize students with soft skills like Communication Skills, People Skills, and personality traits to enhance their interactions, job performance and career prospects.
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Apply the conceptual understanding of communication into everyday practice. 2. Understand the importance of teamwork and group discussion skills. 3. Make use of techniques for self-awareness and self-development. 4. Develop insights on how to cope with work stress and students will develop time management skills. 5. Apply business etiquette skills on professional front and will bring a change in organizational culture

COURSE DETAILS	Unit No	Topic	Hours
	1	**Communication Skills:** Basics of Communication Skills— Verbal Communication, Nonverbal Communication- Kinesics, Paralanguage and Proxemics. Presentation Skills - Multimedia Presentation: Understanding the Basics, Features, Structure, Aids and Importance, Presentation and Interaction. Public Speaking- Art of Public Speaking, the Rhetoric of making a Public Speech, Exploring Rhetorical Elements through various Videos.	5
	2	**Interpersonal Communication:** Building Relationships - Understanding Group Dynamics, Conflicts and their Resolution, Social Network, Media and Extending our Identities. Role of Personality and its various Attributes - Emotional Quotient, Attitude, Perception, Motivation, Socialization, Self- Esteem, Impact of Behavior, and Self-Awareness. Stress Management and Accepting Criticism in determining Efficacy of Interpersonal Communication	6
	3	**Professional Skills:** Creativity, Critical Thinking and Problem Solving. Leadership Skills- Develop Leadership Qualities. Collaboration and Team Work - Work Effectively in a Team, understand Personal as well as Professional Goals of the members of the Group. Decision Making- Creative, Rational and Intuitive Decision Making. Negotiation - Ways of Effective Negotiation. Mentoring and Conflict Management–Reasons of Conflicts in Human Relations, Approaches to Conflict Resolution, Importance and Manner of Mentoring. Conducting Meetings - Call and Organize meetings, Conducting meetings, Agenda and Minutes of the meeting. Time Management and Effective Planning - Importance of Time, Preparing Time Line, Allocation of time, Prioritizing Work, Multi-Tasking. Stress Management - Kinds of Stress, Reason/s of Stress, Techniques to cope with Stress.	5
	4	**Business Etiquette:** Professional Grooming- How to carry yourself; Dressing- Selection of Proper Attire as per the Situation, and Conduct- To Project One's Self in the Right Frame and Spirit. Work-Life Balance and Punctuality.	7
	5	**Social Etiquette-** Meeting People, Greetings, Introductions, Office Parties, Dining Etiquette, Cultural Courtesy. Professional Etiquette - Phone Etiquette - Tone and Pitch of the Voice, Voice Mail, Correspondence Etiquette, Netiquettes	7
		Total Hours	30

TEXT BOOK	1. Nitin Bhatnagar; *Effective Communication and Soft Skills*; Pearson Education India
REFERENCE BOOK/ SUGGESTED READING	1. Daniel Coleman; *Emotional Intelligence*; Bantam Book, 2. Butterfield Jeff; *Soft Skills for Everyone*; Cengage Learning,

SEMESTER IV

Course: WEB TECHNOLOGIES			**Semester: IV**
Course Code: BCA 207	**L T P**	**4 0 0**	**Credits: 4**

OBJECTIVE	To introduce the fundamentals of Internet, and the principles of web design languages and develop modern interactive web applications using PHP, XML and MySQL.		
COURSE OUTCOME	**Upon completion of the course students should be able to:** 1. Understand best technologies for solving web client/server problems. 2. Analyze and design real time web applications. 3. Use Java script for dynamic effects and to validate form input entry. 4. Analyze to Use appropriate client-side and Server-side application technology. 5. Able to develop web applications using PHP with database connectivity.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Introduction to HTML:** Basics of HTML, formatting, and fonts, commenting code, hyperlink, lists, tables, images, forms, Meta tags, Character entities, frames and frame sets, Overview and features of HTML5.	10
	2	**Style Sheets:** Need for CSS, Introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3	12
	3	**Introduction to JavaScript:** JavaScript Variables and Data Types, Declaring Variables, Data Types, Statements and Operators, Control Structures, Conditional Statements, Loop Statements, Object-Based Programming, Functions, Executing Deferred Scripts, Objects, Message box in JavaScript, Dialog Boxes, Alert Boxes, Confirm Boxes, Prompt Boxes, JavaScript with HTML, Events, Event Handlers, Forms, Forms Array.	14

	4	**PHP:** Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP.	12
	5	**PHP Database Connectivity:** Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP my admin and database bugs.	12
		Total Hours	60
TEXT BOOK	1. Robbins, J. N. *Learning web design: A beginner's guide to HTML, CSS, JavaScript, and web graphics*. O'Reilly Media. 2. Duckett, J. *HTML and CSS: Design and build websites*. Wiley.		
REFERENCE BOOK/ SUGGESTED READING	3. Jeremy Keith p; HTML5 for Web Designers; A Book Apart Jeffrey Zeldmann. 4. Cameron Adams; The Art and Science of CSS: Create Inspirational, Standards-Based Web Designs 5. Lynn Beighley & Michael Morrison; Headfirst PHP & MySQL; O'Reilly Media, Inc. 6. Frain, B. Responsive web design with HTML5 and CSS . Packt Publishing. 7. Duckett, J. PHP & MySQL: Server-side web development. Wiley.		

Course: COMPUTER GRAPHICS			**Semester: IV**
Course Code: BCA 208	**L T P**	**3 0 0**	**Credits: 3**

OBJECTIVE	To introduce students to the fundamental concepts and theories of computer graphics, including essential drawing algorithms, polygon filling, clipping, 2D transformations, curves, and an introduction to 3D transformations.
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Understand the basics of computer graphics, different graphics systems and applications of computer graphics. 2. Understand various algorithms for scan conversion and filling of basic objects and their comparative analysis. 3. Understand the use of geometric transformations on graphics objects and their applications in composite form. 4. Understand how to Extract scene with different clipping methods and its transformation to graphics display device. 5. Explore projections techniques for display of 3D scene on 2D screen.

COURSE DETAILS	Unit No	Topic	Hours
	1	**Introduction:** Basic elements of Computer graphics, Applications of Computer Graphics. Graphics Hardware, Video Display Devices, Architecture of Raster and Random scan display devices, Input devices, Hard-copy devices, Graphics software.	10
	2	**Fundamental Techniques in Graphics:** Line Drawing Algorithms: DDA Algorithm, Bresenham's Line algorithm, Circle Generating Algorithms: Midpoint Circle Algorithm. Filled-Area Primitives: Scan-line polygon fill algorithm, boundary Fill Algorithm, Flood- Fill algorithm.	10
	3	**Two- Dimensional Geometric Transformations:** Basic Transformations: Translation, Rotation, Scaling. Matrix representations and Homogeneous Coordinates, Composite Transformations. Other Transformations: Reflection, Shearing.	10
	4	**Two-Dimensional Viewing:** The Viewing Pipeline, clipping operations: Point clipping, Line Clipping: Cohen Sutherland line clipping, Polygon Clipping: Sutherland Hedgeman Polygon Clipping	10
	5	**Three-Dimensional Concepts and 3-D Transformations:** 3-D display methods: Parallel projection, Perspective projection. Basic Transformations- Translation, Rotation, Scaling.	05
		Total Hours	45
TEXT BOOK	1. Hughes, J. F., van Dam, A., McGuire, M., Sklar, D. F., Foley, J. D., Feiner, S. K., & Akeley, K. *Computer graphics: Principles and practice* . Addison-Wesley. 2. Shirley, P., Feiner, S. K., & Arvo, J. *Fundamentals of computer graphics*. CRC Press.		
REFERENCE BOOK/ SUGGESTED READING	3. Akenine-Möller, T., Haines, E., & Hoffman, N. Real-time rendering . CRC Press. 4. Pharr, M., Jakob, W., & Humphreys, G. Physically based rendering: From theory to implementation. Morgan Kaufmann. 5. Lehn Karsten; Introduction to Computer Graphics; Springer. 6. Steve Marschner Peter Shirley, A K Peters; Fundamentals of Computer Graphics; A K Peters/Crc Pres. 7. S. Bhattacharya; Computer Graphics; Oxford Press		

Course: PYTHON PROGRAMMING			Semester: IV
Course Code: BCA 209	L T P	4 0 0	Credits: 4

OBJECTIVE		The course is designed to provide Basic knowledge of Python, Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language.	
COURSE OUTCOMES		**Upon completion of the course students should be able to:** 1. Remember the basic principles of Python programming language. 2. Implement object-oriented concepts in Python. 3. Analyze Functional Programming Paradigm with Python. 4. Use the concepts of classes and object to develop an applications 5. Create tools for web scrapping.	
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Introduction and Overview:** Overview of Python Programming: Structure of a Python Program, Elements of Python, Python Interpreter, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings.	12
	2	**Operators and Statements:** Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator). Creating Python Programs: Input and Output Statements.	12
	3	**Decision making and Branching:** Control statements (Branching, Looping, Conditional Statement, Difference between break, continue and pass, default arguments. Defining Functions.	12
	4	**Classes and Objects:** An introduction to object-oriented programming in Python. objects, operator overloading, overriding, special methods. Inheritance, polymorphism and composition.	12
	5	**Iterators and Generators:** Iteration protocol, Iterable objects, generators and generator expressions. Use of generators, assertions. Testing and debugging of a python project, Web Scrapping in Python.	12
		Total Hours	60
TEXT BOOK	1. Sweigart, A. *Automate the boring stuff with Python: Practical programming for total beginners* . No Starch Press. 2. Lutz, M. . *Learning Python* . O'Reilly Media		

REFERENCE BOOK/ SUGGESTED READING	3. Zelle, J. M. Python programming: An introduction to computer science . Franklin, Beedle & Associates. 4. Alvarado, F., & Patwardhan, A. Learn Python the Hard Way . Addison-Wesley. 5. Barry, P. Head-First Python: A Brain-Friendly Guide . O'Reilly Media 6. Allen Downey, Jeffrey Elkner, Chris Meyers, how to think like a computer scientist: learning with Python. (online) 7. Brown C. M.; Python: The Complete Reference; Tata McGrahill.

Course: E-COMMERCE			**Semester: IV**
Course Code: BCA 210	**L T P**	**3 0 0**	**Credits: 3**

OBJECTIVE	This course introduces information systems for business and management. It is designed to familiarize students with organizational and managerial foundations of systems, the technical foundation for understanding information systems.
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Understand the basic concepts and technologies used in the field of Information Systems, specifically E-Commerce eco system. 2. Have knowledge of the different types of management information systems and methods of e-commerce. 3. Understand the processes of developing and implementing information systems. 4. Be aware of the ethical, social, and security issues of internet security system 5. Understand the different applications of Internet for E-Commerce.

COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Electronic Commerce Environment and Opportunities:** Background, The Electronic Commerce Environment, Electronic Marketplace Technologies. Modes of Electronic Commerce: Electronic Data Interchange, Migration to Open EDI, Electronic Commerce with www/Internet, Commerce Net Advocacy, web Commerce Going Forward.	**9**
	2	**Approaches to Safe Electronic Commerce:** Secure Transport Protocols, Secure Transactions, Secure Electronic Payment Protocol (SEPP), Secure Electronic Transaction (SET), Certificates for authentication Security on web Servers and Enterprise Networks. Electronic Cash and Electronic Payment Schemes: Internet Monetary Payment & Security Requirements. Payment and Purchase Order Process, On-line Electronic cash.	**9**
	3	**Internet/Intranet Security Issues and Solutions:** The need for Computer Security, Specific Intruder Approaches, Security Strategies, Security Tools, Encryption, Enterprise Networking and Access to the Internet, Antivirus Programs, Security Teams.	**9**

	4	**Master Card/Visa Secure Electronic Transaction:** Introduction, Business Requirements, Concepts, payment Processing. E-Mail and Secure Email Technologies for Electronic Commerce: Introduction, The Means of Distribution, A model for Message Handling, E-mail working, Multipurpose Internet Mail Extensions, Message Object Security Services, Comparisons of Security Methods, MIME and Related Facilities for EDI over the Internet.	**9**
	5	**Internet Resources for Commerce:** Introduction, Technologies for web Servers, Internet Tools Relevant to Commerce, Internet Applications for Commerce, Internet Charges, Internet Access and Architecture, Searching the Internet. Advertising on Internet: Issues and Technologies. Introduction, Advertising on the Web, Marketing creating web site, Electronic Publishing Issues, Approaches and Technologies: EP and web based EP.	**9**
		Total Hours	**45**
TEXT BOOK	1. Laudon. K.C, Traver C. G.; E-Commerce 2021- 2022 Business, Technology, and Society; Pearson 2. Chaffey, D.*Digital marketing: Strategy, implementation, and practice* . Pearson.		
REFERENCE BOOK/ SUGGESTED READING	3. Larsson, T.E-commerce evolved: The essential playbook to build, grow & scale a successful e-commerce business. Tanner Larsson 4. Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, E-Commerce Fundamentals and Applications;John Wiley. 5. DanielMinoli, Emma Minoli;Web Commerce Technology Handbook; McGraw-Hill 6. Henry Chan and Raymond Lee and Tharam Dillon and Elizabeth Chang; E-Commerce, Fundamentals and Applications; John Wiley 7. Galgotia; Frontiers of Electronic Commerce;TMH		

Course: INDIAN MATHEMATICS			Semester: IV
Course Code: BCA 211	L T P	2 0 0	Credits: 2

OBJECTIVE	To provide students with an understanding of the historical development and contributions of Indian mathematicians. The course aims to develop an appreciation for indigenous methods in arithmetic, algebra, geometry, and astronomy, and their influence on modern mathematics.		
COURSE OUTCOMES	**Upon successful completion of this course, students will be able to:** 1. Understand the origin and evolution of mathematical concepts in ancient India. 2. Analyze the mathematical techniques used in Vedic and classical periods. 3. Recognize contributions of key Indian mathematicians like Aryabhata, Brahmagupta, and Bhaskaracharya. 4. Apply traditional Indian mathematical techniques to solve problems. 5. Compare Indian mathematical methods with their modern counterparts.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	Numbers, fractions and geometry in the Vedas. Decimal nomenclature of numbers in the Vedas. Zero and Infinity. Simple constructions from Sulba-sutras.	6
	2	The development of the decimal place value system which resulted in a simplification of all arithmetical operations. Linguistic representation of numbers	6
	3	Important texts of Indian mathematics. Brief introduction to the development of algebra, trigonometry and calculus	6
	4	How Indian mathematics continued to flourish in the 18/19/20th centuries. Kerala School. Ramanujan.	6
	5	Contribution of Indian Mathematicians Bhaskaracharya, Madhava, Kerala School of Mathematics.	6
		Total Hours	30
TEXT BOOK	1. Sarma, K.V. – A History of Indian Astronomy. Motilal Banarsidass. 2. Plofker, Kim – Mathematics in India: From Vedic Period to Modern Times. Princeton University Press.		
REFERENCE BOOK/ SUGGESTED READING	1. Datta, Bibhutibhusan and Singh, Avadhesh Narayan – History of Hindu Mathematics. Asia Publishing House. 2. Joseph, George Gheverghese – The Crest of the Peacock: Non-EuropeanRoots of Mathematics. Princeton University Press. 3. Bag, A.K. – Mathematics in Ancient and Medieval India. Chaukhambha Orientalia.		

Course: ENGLISH LANGUAGE -III			Semester: IV
Course Code: BCA 212	L T P	2 0 0	Credits: 2

OBJECTIVE	To develop students' proficiency in speaking and writing with a professional outlook, enabling effective communication in academic and workplace settings.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Demonstrate a clear understanding of English grammar and foundational writing skills applicable to academic and professional communication. 2. Develop effective verbal and non-verbal communication strategies for confident articulation in professional and social contexts. 3. Identify and analyze personal strengths and areas for improvement to enhance overall communication and self-presentation skills. 4. Apply structured writing techniques to create academic documents, including research articles, project reports, and dissertations. 5. Integrate critical thinking and language skills to produce coherent, purpose-driven communication across diverse academic and professional scenarios.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Professional Communications - Fundamentals** Tenses and sentence-structures: A recapitulation, Verbal and non-verbal communication, Decoding body language and facial expressions, Syntax formation using all principles of communication.	8
	2	**Effective Speaking** :Speech writing and delivery, Aided and unaided presentations, Impromptu speaking	7
	3	**Personality Embellishment** Self-assessment using SWOC, improving emotional quotient, leadership development, chronemic efficacy, and coping with stress	8
	4	**Business Writing Skills:** Business correspondences v/s general writings, Principles, kinds and orders of Paragraph-writing, Drafting business proposal; elements of research writing and report formation	7
		Total Hours	30
TEXT BOOK	1. Bovee, Courtland and Thrill, John; *Business Communication Essentials - A Skills-based Approach to Vital Business* ;Prentice Hall		
REFERENCE BOOK/ SUGGESTED READING	1. Butterfied, Jeff; *Soft Skills for Everyone*; Cengage		

Course: WEB TECHNOLOGIES LAB			Semester: IV
Course Code: BCA 207P	L T P	0 0 4	Credits: 2

OBJECTIVE	To develop dynamic and user-friendly web applications using HTML, CSS, PHP, and MySQL, with a focus on integrating frontend design and backend functionality for real-time data management.

Suggested List of Practicals

1. Calculate Hypotenuse of triangle using dynamic initialization of variables
2. Develop a PHP application to print the students list using classes and objects.
3. Develop a PHP application to implement inheritance concepts Single Inheritance, Multilevel Inheritance, Multiple Inheritance.
4. Develop a console application to implement operator overloading concept in PHP Unary Operator Overloading, Binary Operator Overloading
5. Develop a PHP application to implement multithreading.
6. Develop a PHP console application to implement the following concepts: Delegates, Events
7. Design a window-based application using PHP.
8. Design windows-based messenger application.
9. Learn HTML fundamentals.
10. Create Webpages with HTML, CSS.
11. Practice JavaScript.
12. Develop Web Application for capturing data with input validation.
13. Create dynamic Webpages.
14. Create a real life website.

Course: COMPUTER GRAPHICS LAB			Semester: IV
Course Code: BCA 208P	L T P	0 0 4	Credits: 2

OBJECTIVE	Apply the fundamental concepts and theory of computer graphics by computer programs using any computer language preferably C++

Suggested List of Practicals

1. To Study various in build graphics functions in C library.
2. Write a program to draw a line using DDA algorithm.
3. Write a program to draw a line using Bresenham's algorithm.
4. Write a program to draw a circle using midpoint algorithm.
5. Write a program to draw a circle using Bresenham's algorithm.
6. Write a program to draw a rectangle using line drawing algorithm.
7. Write a program to perform 2D Transformation on a line.
8. Write a program to perform shear transformation on a rectangle.
9. Write a program to rotate a circle (alternatively inside and outside) around the circumference of another circle.
10. Write a program to draw a car using in build graphics function and translate it from bottom left corner to right bottom corner of screen.
11. Write a program to draw balloons using in build graphics function and translate it from bottom left corner to right top corner of screen.
12. Write a program to draw a cube using in build library function and perform 3D transformations.
    a. Translations in x, y, z directions
    b. Rotation by angle 450 about z axis, rotation by 600 about y-axis in succession.
    c. Scaling in x-direction by a factor of 2, scaling in y- direction by a factor of 3.
13. Write a program to implement line clipping (Cohen Sutherland algorithm). 13. Write a program for making Bezier curves.
14. Write a program to study various in build functions for 2D drawing in MAYA software.
15. Write a program to show animation of a ball moving in a helical path.
16. Write a program to show animation of solar system.

Course: PYTHON PROGRAMMING LAB			Semester: IV
Course Code: BCA 209P	L T P	0 0 4	Credits: 2

OBJECTIVE	To apply Python programming concepts through hands-on lab sessions and develop skills for data visualization and web application development.

Suggested List of Practicals

1. Write a program to demonstrate different number data types in Python.
2. Write a program to perform different Arithmetic Operations on numbers in Python.
3. Write a programs to perform different String Operations.
4. Write programs to showcase the python time library.
5. Write a program to demonstrate working with lists in python.
6. Write a program to demonstrate working with tuples in python.
7. Write a program to demonstrate working with dictionaries in python.
8. Write programs to demonstrate the uses of functions.
9. Demonstrate the use of *args, **kwargs in python.
10. Write Programs to showcase use of lambda functions.
11. Write a python program to define a Unit and import a specific function in that module to another program.
12. Write Programs for file operations in python.
13. Write programs to demonstrated the working of generator.
14. Implement programs to showcase the uses of Iterators.
15. Demonstrate OOPs Capabilities of python language.
16. Demonstrate Exception Handling features of Python.
17. Write testing cases for python programs.
18. Learn basics of web scrapping in python.
19. Create a working web scrapper in python.

SEMESTER V

Course: ARTIFICIAL INTELLIGENCE			Semester: V
Course Code: BCA 301	L T P	3 0 0	Credits: 3

OBJECTIVE	To enable the students to understand the basic principles of Artificial Intelligence and its various applications.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Understand the basics of Artificial Intelligence and gain knowledge of the learning process and its models. 2. Understand different types of search techniques. 3. Understand different knowledge representation schemes. 4. Understand the AI applications in the design of expert systems. 5. Understand basic concepts of machine learning, ANN, SVM and fuzzy logic		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1.	**Introduction:** Introduction to Artificial Intelligence, Background and Applications, AI techniques, Tic Tac-Toe problem, Problem Characteristics.	**8**
	2.	**Problem Solving and Searching Techniques:** Problem Characteristics, Production Systems, Water Jug Problem, Control Strategies, Breadth First Search, Depth First Search, Hill climbing and its Variations, Heuristics Search Techniques: Best First Search. 8-Puzzle Problem	**12**
	3.	**Knowledge Representation:** Definition of Knowledge, Knowledge Based Systems, Representation of Knowledge. Introduction to First Order Predicate Logic, Conversion to clausal form, Unification, Resolution Principle	**10**
	4.	**Expert Systems:** Introduction to Expert Systems, Characteristic Features of Expert Systems, Applications of Expert Systems, Components and Working of Expert Systems	**5**
	5.	**Introduction to Machine Learning Techniques:** Fuzzy Logic, Fuzzy Set, Membership Function, Union, intersection and complement of a fuzzy set, Introduction to Artificial Neural Network, Introduction to Support Vector Machine.	**10**
		Total Hours	45
TEXTBOOKS:	1. Sutton, R. S., & Barto, A. G. *Reinforcement Learning: An Introduction*. MIT Press. 2. Russell, S., & Norvig, P. *Artificial Intelligence: A Modern Approach* . Pearson		
REFERENCE BOOK/ SUGGESTED READING	3. Rich & Knight, Artificial Intelligence – Tata McGraw Hill. 4. W.F. Clocksin and Mellish, Programming in PROLOG, Narosa Publishing House. 5. DAN.W. Patterson, Introduction to A.I and Expert Systems – PHI, 6. Murphy, K. P. Machine Learning: A Probabilistic Perspective. MIT Press 7. Moroney, L. AI and Machine Learning for Coders: A Programmer's Guide to Artificial Intelligence. O'Reilly Media.		

Course: FUNDAMENTALS OF ACCOUNTING			Semester: V
Course Code: BCA 302	L T P	2 0 0	Credits: 2

OBJECTIVE	To familiarize students with the mechanics of preparation of financial statements, understanding corporate financial statements, their analysis and interpretation.
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Define bookkeeping and accounting. 2. Understand the accounting process. 3. Describe the main elements of financial accounting information, assets, liabilities, revenue and expenses, along with subsidiary books. 4. Understand the preparation of financial statements, Trading Account, Profit & Loss Account and Balance Sheet 5. Explain various Indian accounting standards, IFRS and preparation of depreciation accounting.

	Unit No	Topic	Hours
COURSE DETAILS	1.	**Introduction to Accounting :**Introduction to Basic Financial Accounting. Accounting as an Information System. Importance, Scope, and Limitations. Users of Accounting Information. Generally Accepted Accounting Principles.	**05**
	2.	**Basics of Accounting:** The Accounting Equation. Nature of Accounts and Rules of Debit and Credit. Recording Transactions in General Journal. Recording Transactions in Three Column Cash Book. An Overview of Subsidiary books – Purchase Book, Purchase Returns Book, Sales Book, and Sales Returns Book. Opening and Closing Entries. Preparation of Ledger Accounts	**08**
	3.	**Preparation of Financial Statements:** Preparation of Financial Statements: Preparing Trading Account, Profit and Loss Account and Balance Sheet for a Sole Proprietor.	**07**
	4.	**Financial Statements:** Understanding contents of Financial Statements of a Joint Stock Company as per Companies Act 2013.	**05**
	5.	**Accounting Standards (AS):** Indian Accounting Standards: Concept, Benefits, Procedure for Issuing Indian Accounting Standard in India, Salient Features of Indian AS issued by ICAI. International Financial Reporting Standards (IFRS): Features, Uses and Objective of IFRS, IFRS Issued by IASB and Concept of Harmonisation and Convergence, Obstacle in Convergence	**05**
		Total Hours	**30**

TEXT BOOK	1. Anthony R. N., Hawkins D. F., and Merchant K. A.; *Accounting Text and Cases*; McGraw Gill. 2. Maheshwari, S.N. and Maheshwari, S. K.; Financial Accounting; Sultan Chand and Sons

REFERENCE BOOK/ SUGGESTED READING	3. Grewal T. S.; Double Entry Book Keeping; Sultan Chand and Sons 4. Gupta, R.L.; Advanced Accounting; Sultan Chand and Sons 5. Bhattacharya, A.; Essentials of Financial Accounting; Pearson Education 6. J. R. Monga; Financial *Accounting*: Concepts and Applications; Mayur Paperbacks

Course: GENERATIVE AI			**Semester: V**
Course Code: BCA 303	**L T P**	**3 0 0**	**Credits:3**

OBJECTIVE	Dive deep into the world of generative AI, exploring cutting-edge techniques and practical applications across various domains. Through a combination of expert-led sessions, hands-on exercises, and collaborative projects, you'll gain a solid understanding of the underlying principles and tools used in generative AI.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Describe the core concepts and advantages of Generative AI. 2. Utilizing leading Language Models and LLM Architectures. 3. Implement Basic Generative Pre-trained Transformer like Chat GPT. 4. Understand the practical applications of GPT and apply it to your problem solution. 5. Understand and use the concepts of prompt engineering.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1.	**Introduction to Generative AI:** Definition and scope of Generative AI Overview of generative models and their applications Importance of Generative AI in various domains Brief discussion on ethical considerations and challenges	**9**
	2.	**Language Models and LLM Architectures:** Introduction to language models and their role in AI Traditional approaches to language modeling Deep learning-based language models and their advantages Overview of popular LLM architectures: RNNs, LSTMs, and Transformers	**9**
	3.	Generative Pre-trained Transformer: Introduction to GPT and its significance Pre-training and fine-tuning processes in GPT Architecture and working of GPT models Overview of GPT variants and their use cases	**9**

	4.	A Practical Application of GPT: Introduction to ChatGPT and its purpose Training data and techniques for ChatGPT Handling user queries and generating responses Tips for improving ChatGPT's performance	**9**
	5.	Prompt Engineering: Enhancing Model Outputs Understanding the concept and significance of prompt engineering Strategies for designing effective prompts Techniques for controlling model behavior and output quality Best practices for prompt engineering in generative AI	**9**
		Total Hours	**45**
TEXT BOOKS:	1. Caelen, O., &Blete, M.-A. Developing Apps with GPT-4 and ChatGPT: A practical guide for Python developers. Independently published. 2. Foster, D., & Friston, K. Generative Deep Learning: Teaching machines to paint, write, compose, and play . O'Reilly Media.		
REFERENCE BOOK/SUGGESTED READING	3. Jesse Roberts PhD , Gaining An Edge In Life & Business With AI Unleashing the Power of Generative AI and Chat GPT. 4. Gandhi,S.,Ehl,C., Generative AI: The Future of Everything; Kindle Edition. 5. Husain, A. Generative AI for leaders: Harnessing the potential of generative AI in organizations. McGraw-Hill Education. 6. Kapur, R. AI made simple: A beginner's guide to generative intelligence. Independently published. 7. Whitfield, E. J. Generative AI for beginners: Understanding AI models and their applications. Independently published.		

Course: ARTIFICIAL INTELLIGENCE LAB			Semester: V
Course Code: BCA 301P	L T P	0 0 4	Credits: 2

Suggested List of Practicals

1. Write a program to implement DFS
2. Write a program to implement BFS
3. Write a Program to find the solution for travelling salesman Problem
4. Write a program to implement Water-Jug problem.
5. Write a program to implement Alpha-Beta Pruning.
6. Write a program to implement 8 puzzle problem.
7. Write a program to implement Towers of Hanoi problem.
8. Write a program to implement A* Algorithm.
9. Write a program to implement Hill Climbing Algorithm.

Course: SOFT SKILL -II			Semester: V
Course Code: BCA 304	L T P	2 0 0	Credits: 2

OBJECTIVE	To understand the nuances of written communication through a practice-based approach.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Demonstrate an understanding of the fundamentals of professional and business writing, including tone, clarity, and appropriateness in workplace communication. 2. Construct well-organized and logically sequenced paragraphs for various business contexts, ensuring accuracy and managerial relevance. 3. Apply professional writing formats to prepare business correspondence, summaries, and persuasive/informative documents effectively. 4. Plan, draft, revise, and refine written content by following structured writing processes to develop impactful reports and case analyses. 5. Engage in practical writing activities such as business case analysis and questionnaire-based writing to enhance real-world communication competence.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Professional Writing - The Basics :**Written Business Communication Basics, Being Managerially Appropriate, Getting it Write the First Time, Types & orders of paragraph writing.	**15**
	2	**Professional Writing - Applications** : Business Correspondence, Reports and Summaries, Informative and Persuasive Communication	
	3	**Writing Skills Overview:** Planning the Writing Project, Organizing the Content, Writing the first draft, revising the draft, strengthen one's writing skills.	
	4	**Written Business Case Analysis Practice.** Filling questionnaires designed for formal & informal interviews.	**15**
		Total Hours	**30**
TEXT/ REFERENCE BOOK	1. Bovee, Courtland and Thrill, John; *Business Communication Essentials - A Skills-based Approach to Vital Business* ;Prentice Hall.		

Course: Project-I			Semester: V
Course Code: BCA 305P	L T P	0 0 6	Credits: 3

OBJECTIVE	To develop software to solve the real life problem by the programming and database concepts they have acquired during the course tenure
LEARNING OUTCOME	**On successful completion of the course, students will be able to:** Should develop a working software model for any problem they have chooses.

SEMESTER VI

Course: DATA WAREHOUSE AND DATA MINING			Semester: VI
Course Code: BCA 306	L T P	4 0 0	Credits: 4

OBJECTIVE	To enable the students to understand concepts of data warehouse and data mining, architectures, applications, design and implementation of data mining and data ware housing concepts.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Understand mathematical foundations of data mining tools. 2. Understand and implement classical models and algorithms in data warehouses and data mining. 3. Characterize the kinds of patterns that can be discovered by association rule, mining, classification, and clustering. 4. Understand data mining techniques in various applications like social, scientificand environmental context. 5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1.	Data Mining overview, Data Warehouse and OLAP Technology, Data Warehouse Architecture, metadata repository, Data Preprocessing – Data Integration and Transformation, Data Reduction, Data Mining Primitives: Data Mining Task, Task-Relevant Data, The Kind of Knowledge to be Mined, KDD	**10**
	2.	Mining Association Rules in Large Databases, Association Rule Mining, Market Basket Analysis: Mining A Road Map, The Apriori Algorithm: Finding Frequent Item sets, Improving the Efficiently of Apriori, Mining Frequent Item sets without Candidate Generation	**15**

	3.	Introduction to Classification, Prediction, Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Bayes Theorem, Naïve Bayesian Classification, Classification Based of Concepts from Association Rule Mining, Other Classification Methods, k-Nearest Neighbor Classifiers, , Prediction, Linear and Multiple Regression	**15**
	4.	Cluster Analysis, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Classical Partitioning Methods: k-Means	**08**
	5.	Partitioning Methods in Large Databases: From k-Medoids to CLARANS, Hierarchical Methods, Density-Based Methods	**12**
		Total Hours	**60**
TEXTBOOKS:	1. Kimball, R., Ross, M., & Thornthwaite, W.The data warehouse toolkit: The definitive guide to dimensional modeling . Wiley. 2. Inmon, W. H., & Linstedt, D. Mastering data warehouse design: Relational and dimensional techniques. Wiley.		
REFERENCE BOOK/ SUGGESTED READING	3. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World: A Practical Guide for Building Decision Support Systems, lie", Pearson Education. 4. M.H.Dunham,"DataMining:Introductory and Advanced Topics" Pearson Education, 5. Jiawei Han, Micheline Kamber, "Data Mining Concepts & Techniques" Elsevier 6. Shmueli, G., Patel, N. R., & Bruce, P. C. Data mining for business intelligence: Concepts, techniques, and applications in Microsoft Office Excel with XLMiner . Wiley. 7. Jain, A., & Agrawal, R. Data mining and data warehousing: Principles and practical techniques. Cambridge University Press.		

Course: DATA ANALYSIS WITH R			Semester: VI
Course Code: BCA 307	L T P	4 0 0	Credits: 4

OBJECTIVE	To enable the students to understand data analytics, data visualization and statistical model for data analytics using R.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Understand key terminologies, concepts and techniques employed in Statistical Analysis. 2. Implement Probability and Probability Distributions to solve a wide variety of problems. 3. Conduct and interpret a variety of Hypothesis Tests to aid Decision Making. 4. Understand, Analyse, Interpret Correlation and Regression. 5. To analyse the underlying relationships between different variables and creating data for analytics.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1.	**Introduction to Data Analysis:** Overview of Data Analytics, Need of Data Analytics, Nature of Data, Classification of Data: Structured, Semi-Structured, Unstructured, Characteristics of Data, Applications of Data Analytics.	**10**
	2.	**R Programming Basics:** Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions, R packages.	**12**
	3.	**Data Visualization using R:** Reading and getting data into R (External Data): Using CSV files, XML files, Web Data, JSON files, Databases, Excel files. Working with R Charts and Graphs: Histograms, Boxplots,Bar Charts, Line Graphs, Scatterplots, Pie Charts	15
	4.	**Statistics with R:** Random Forest, Decision Tree, Normal and Binomial distributions, Time Series Analysis, Linear and Multiple Regression, Logistic Regression,	15
	5.	**Prescriptive Analytics:** Creating data for analytics through designed experiments, Creating data for analytics through active learning, Creating data for analytics through reinforcement learning	**8**
		Total Hours	**60**
TEXTBOOKS:	1. Grolemund, G., & Wickham, H. *R for data science: Import, tidy, transform, visualize, and model data*. O'Reilly Media. 2. Motwani,Bharti. Data Analytics with R.,Wiley.		

REFERENCE BOOK/ SUGGESTED READING	1. Baumer, B. S., Kaplan, D. T., & Ward, D. S. Modern data science with R . CRC Press. 2. Gardener, M. Data science for R programmers . Packt Publishing. 3. Jared P Lander, R for everyone: advanced analytics and graphics, Pearson Education. 4. Dunlop, Dorothy D., and Ajit C. Tamhane. Statistics and data analysis: from elementary to intermediate. Prentice Hall. 5. G Casella and R.L. Berger, Statistical Inference, Thomson Learning.

Course: DATA ANALYSIS WITH R LAB			**Semester: VI**
Course Code: BCA 307P	**L T P**	**0 0 2**	**Credits: 1**

Suggested List of Practicals

1. Downloading, installing and setting path for R.
2. Write an R script to change the structure of a Data frame
3. Demonstrate the following aggregate functions in R: sum, mean, count, min, max
4. Write an R script to handle missing values in a dataset.
5. Write an R script to handle missing values in a dataset.
6. Write an R script to handle outliers.
7. Write an R script to handle invalid values.
8. Write a program to Perform Logistic Regression analysis on the dataset and plot the results
9. Write a program to Implement K-means algorithm in R.
10. Filter data using filter().
11. Select specific columns with select().
12. Arrange data with arrange().
13. Create new variables using mutate().
14. Summarize data with summarise() and group_by().
15. Calculate mean, median, mode, standard deviation, variance.

Course: PROJECT-II			Semester: VI
Course Code: BCA 308P	L T P	0 0 6	Credits: 3

OBJECTIVE	To develop software to solve the real-life problem by the programming and database concepts they have acquired during the course tenure
COURSE OUTCOME	**On successful completion of the course, students will be able to:** Should develop a working software model for any problem they have chooses.

LIST OF ELECTIVES

Group I (Advanced Programming)

Course: DOT NET TECHNOLOGY			Semester:
Course Code: BCA-AP 101	L T P	2 0 4	Credits: 4

OBJECTIVE	To familiarize with Microsoft.Net, and C# technologies, as well as working with variables, data types, standard programming skills & Windows form.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Acquire the knowledge of the structure and model of the programming language C # 2. Understand the use of programming language C # for various programming technologies. 3. Evaluate user requirements for software functionality required to decide whether the programming language C # can meet user requirements. 4. Develop variety of software programs in C # 5. Understand Distributed Application in C#, .		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1.	**The .NET Framework:** Introduction, Common Language Runtime, Common Type System, Common Language specification, The Base Class Library, The .Net class library Intermediate language, Just-in time Compilation, Garbage Collection, Application Installation and Assemblies, Web services, Unified classes.	**15**
	2.	**C# Basics:** Introduction, Data Types, Identifiers, Variables and constants, C# statements, Object Oriented Concept, Object and Classes, Arrays and Strings, System collections, Delegates and Events, Indexes, Attributes, versioning.	**12**

	3.	**C# Using Libraries:** Namespace- System, Input Output, Multi-Threading, Networking and Sockets, Data Handling, Windows Forms, C# in web application, Error Handling	**08**
	4.	**Advanced Features Using C#:** Web services, Windows services, messaging, Reflection, COM and C#, Localization	**08**
	5.	**Advanced Features Using C#:** Distributed Application in C#, XML and C#, Unsafe Mode, Graphical Device Interface with C#, CASE Study (Messenger Application)	**08**
		Total Hours	60
TEXTBOOKS:	1. Kumar, A. Enterprise application development with C# 9 and .NET 5. Packt Publishing. 2. Stellman, A., & Greene, J. Head First C# . O'Reilly Media.		
REFERENCE BOOK/ SUGGESTED READING	3. Balagurusamy, "Programming with C# ", TMH 4. Wiley," Beginning Visual C# ,Wrox 5. Jeffrey Richter, "Applied Microsoft .NET Framework Programming", (Microsoft) 6. Ferrone, H. Learning C# by developing games with Unity. Packt Publishing. 7. Price, M. J. C# 9 and .NET 5 – Modern cross-platform development. Packt Publishing.		

Course: ADVANCED JAVA PROGRAMMING			**Semester:**
Course Code: BCA-AP102	**L T P**	**2 0 4**	**Credits: 4**

OBJECTIVE	Be able to put into use the advanced features of the Java language to build and compile robust applications
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Understand Graphical User Interface (GUI) networking, and database manipulation. 2. Students learn to access database through Java programs, using Java Database Connectivity (JDBC). 3. Use advanced technology in Java such as Internationalization, and Remote method Invocation. 4. Learn how to work with Servelets. 5. Develop web application using Java Servlet and Java Server Pages technology.

COURSE DETAILS	Unit No.	Topic	Hours
	1.	**Building Desktop Applications with Swing:** Introduction To Swing, MVC Architecture, Applets, Applications and Pluggable Look and Feel, Basic swing components: Text Fields, Buttons, Toggle Buttons, Checkboxes, and Radio Buttons	**12**
	2.	**Java Networking Essentials**: Java database Programming, java.sql Package, JDBC driver,Network Programming With java.net Package, Client and Server Programs, Content and Protocol Handlers	**15**
	3.	**Java Database Connectivity (JDBC):** RMI architecture, RMI registry, Enterprise application concepts, n-tier application concepts, J2EE platform, HTTP protocol, web application, Web containers and Application servers	**8**
	4.	**Developing Web Applications using Servlets:** Server-side programming with Java Servlet, HTTP and Servlet, Servlet API, life cycle, configuration and context, Request and Response objects, Event handling, Introduction to filters with writing simple filter application	**15**
	5.	**JSP and JavaBeans for Dynamic Web Content:** JSP architecture, JSP page life cycle, JSP elements, Expression Language, Tag Extensions, Tag Extension API, Tag handlers, JSP Fragments, Tag Files, Core Tag library, overview of XML Tag library, SQL Tag library and Functions Tag library	**10**
		Total Hours	**60**
TEXTBOOKS:	1. Schildt, H. *Java: The Complete Reference* . McGraw-Hill Education. 2. Sierra, K., & Bates, B. *Head First Java* . Shroff/O'Reilly.		
REFERENCE BOOK/ SUGGESTED READING	3. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI. 4. Introduction to Java programming, By Y.DanielLiang,Pearson Publication. 5. Koskela, L. Test-Driven: TDD and Acceptance TDD for Java Developers. Manning Publications. 6. Oaks, S. Java Performance: The Definitive Guide. O'Reilly Media. 7. Garcia, A., &Farcic, V. Test-Driven Java Development. Packt Publishing.		

Course: MOBILE PROGRAMMING			Semester:
Course Code: BCA-AP103	L T P	2 0 4	Credits: 4

OBJECTIVE	To introduce the fundamentals of the Android platform and enable students to understand the structure and lifecycle of Android applications for effective mobile app development.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Learn the basic and important design concepts and issues of mobile applications. 2. To understand the components and structure of mobile application development frameworks for Android and windows OS-based mobiles. 3. Experiment with the method of storing, sharing and retrieving data in Android Applications. 4. Examine responsive user interface across wide range of devices. 5. Create a mobile Application by using various components like activity, views, services, content providers and receivers.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1.	**Mobile Application Development** Mobile Applications and Device Platforms - Alternatives for Building Mobile Apps -Comparing Native vs. Hybrid Applications - The Mobile Application Development Lifecycle-The Mobile Application Front-End-The Mobile Application Back-End Key Mobile Application Services-What is Android-Android version history-Obtaining the Required Tools- Launching Your First Android Application-Exploring the IDE-Debugging Your Application-Publishing Your Application.	**12**
	2.	**Understanding Activities** Linking Activities Using Intents-Fragments-Displaying Notifications- Understanding the Components of a Screen-Adapting to Display Orientation-Managing Changes to Screen Orientation-Utilizing the Action Bar-Creating the User Interface Programmatically Listening for UI Notifications.	**08**
	3.	**Using Basic Views** Using Picker Views -Using List Views to Display Long Lists-Understanding Specialized Fragments - Using Image Views to Display Pictures -Using Menus with Views Using Web View-Saving and Loading User Preferences-Persisting Data to Files-Creating and Using Databases.	**15**
	4.	**Sharing Data in Android-Creating Your Own Content Providers** Using the Content Provider- SMS Messaging -Sending Email-Displaying Maps- Getting Location Data- Monitoring a Location.	**15**
	5.	Consuming Web Services Using HTTP-Consuming JSON Services-Creating Your Own Services - Binding Activities to Services - Understanding Threading.	**10**
		Total Hours	**60**

TEXTBOOKS:	1. Burton, M. Android App Development For Dummies. Wiley. 2. Neuburg, M. Mastering Ios 18 Development. O'Reilly Media
REFERENCE BOOK/ SUGGESTED READING	3. Griffiths, D. Head firstKotlin: A Brain-Friendly Guide . O'Reilly Media. 4. Portales, R.Mastering Android game development). Packt Publishing. 5. Boyer, R. Android 9 development cookbook . Packt Publishing. 6. Neuburg, M. Programming iOS 16 . O'Reilly Media. 7. Neuburg, M. iOS 16 programming fundamentals with Swift. O'Reilly Media

Course: ADVANCED WEB TECHNOLOGY WITH PHP			**Semester:**
Course Code: BCA-AP104	**L T P**	**2 0 4**	**Credits: 4**

OBJECTIVE	To equip students with the knowledge of advanced web technologies using PHP and PHP-MySQL for designing and developing dynamic, database-driven web applications.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Describe the structure and working of the World Wide Web and design static web pages using HTML5 and CSS for formatting, layout, and styling. 2. Implement structured data using XML along with DTDs and schemas, and create responsive web pages using the Bootstrap framework. 3. Develop dynamic and interactive client-side web applications using JavaScript, DOM manipulation, AJAX, and jQuery. 4. Write server-side scripts using PHP, manage form data, and implement web interactions through sessions and cookies. 5. Build database-driven web applications by integrating PHP with MySQL using procedural, object-oriented, and PDO approaches.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1.	**Introduction to Internet:** Concept of WWW, Internet and WWW, HTTP Protocol: Request and Response, Web browser and Web servers. HTML: Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, frames and frame sets, Overview and features of HTML5.	**10**
	2.	**Style sheets:** Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes. XML, DTD and Schemas. Frameworks: Introduction to Bootstrap. Creating responsive webpages with bootstrap. JavaScript: Introduction to JavaScript, The Basics of JavaScript: Overview of JavaScript, Object Orientation and JavaScript.	**12**

	3.	**General Syntactic Characteristics-** Primitives, Operations, and expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Callback Functions, Java Script HTML DOM, Ajax - Introduction, advantages &disadvantages, Purpose of it, ajax based web application. jQuery -Introduction to jQuery: Overview and Basics	**8**
	4.	**Introduction to PHP:** PHP Basics Syntax, PHP Variables, Global Array and Expression, PHP Operators, PHP Conditional Events and Switch case, PHP Flow Control and Loops, Types of Errors, Array, For each Loop, String Manipulation and Regular Expression, Global Array, String inbuilt functions, Math functions, Array Inbuilt functions	**15**
	5.	**Using HTML Forms:** PHP form handling, get data sent from form fields through GET and POST method, form validation, sessions and cookies. Introduction to PHP MySQL: PHP-MySQL Connection overview, 3 different approaches – procedure, object oriented, PDO; PHP-MySQL function to connect to database, access database, fetch result.	**15**
		Total Hours	**60**
TEXTBOOKS:	1. Nixon, R. Learning PHP, MySQL, JavaScript & CSS: A step-by-step guide to creating dynamic websites . O'Reilly Media. 2. Beighley, L., & Morrison, M. Head First PHP & MySQL: A brain-friendly guide . O'Reilly Media		
REFERENCE BOOK/ SUGGESTED READING	3. Butler, T. PHP & MySQL: Novice to ninja . SitePoint. 4. Ullman, L. PHP and MySQL for dynamic web sites .Peachpit Press. 5. Forbes, A. The joy of PHP: A beginner's guide to programming interactive web applications with PHP and MySQL . BeakCheck LLC. 6. Robin Nixon, Learning PHP, My SQL and Java Script Kindle Edition -OReilly Media 7. Smith, M. PHP Crash Course: The complete, modern, hands-on guide.No Starch Press.		

Group II (Cloud Technology & Information Security)

Course: NETWORK SECURITY AND CRYPTOGRAPHY			Semester:
Course Code: BCA-CI101	L T P	3 1 0	Credits: 4

OBJECTIVE	To provide a comprehensive understanding of cryptographic principles, algorithms, and protocols that ensure the confidentiality, integrity, and authenticity of data in communication systems.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Explain and analyze classical and modern encryption techniques, including DES, Triple DES, Blowfish, and block cipher modes, for ensuring data confidentiality. 2. Apply number theory concepts and public key algorithms like RSA to design secure cryptographic systems. 3. Demonstrate secure key exchange and key management techniques using protocols such as Diffie-Hellman, ISAKMP, and elliptic curve cryptography. 4. Evaluate the security of hash functions and message authentication codes, and implement digital signature algorithms for data integrity and authentication. 5. Analyze network and system security mechanisms including authentication protocols, secure email, web security, and firewall design for protecting digital communication.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1.	**Introduction of Cryptography:** Introduction To security: Attacks, Services and Mechanisms, Conventional Encryption: Conventional Encryption Model, Steganography, Block Cipher Principles, DES Standard, DES Strength, Differential and Linear Crypt analysis, Block Cipher Modes of Operations. Double DES, Triples DES, Blowfish, International Data Encryption Algorithm, Placement of Encryption Function, Key Distribution, Random Number Generation and Traffic confidentiality	**15**
	2.	**Number Theory and Public Key Encryption:** Fermat's and Euler's Theorem, Primality Testing, Chinese Remainder Theorem, Public-Key Cryptography: Principles of Public-Key Cryptosystems, RSA Algorithm.	**08**
	3.	**Key Management:** Key Management scenario in secret key and public key cryptography, Diffie Hellman Key Exchange algorithm, OAKLEY and ISAKMP key management protocol, Elliptic Curve Cryptography	**10**

	4.	**Hash Functions:** Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Function Birthday Attacks, Security of Hash Function and MACS, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA), Digital Signatures, Digital Signature Standard (DSS).	**15**
	5.	**Network and System Security:** Authentication Applications: Kerberos, X.509, Electronic Mail Security, Pretty Good Privacy (PGP),S/Mine Security: Architecture, Authentication Header, Encapsulating Security Payloads, Combining Security Associations, Key Management, Web Security: Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction (SET), System Security: Intruders, Viruses, Firewall Design Principles, Trusted Systems.	**12**
		Total Hours	**60**
TEXTBOOKS	1. William Stallings, Cryptography and Network Security - Principles and Practice, Pearson Education. 2. Jones, R., & Smith, J. *Applied cryptography and network security: Principles, techniques, and applications* . Wiley.		
REFERENCE BOOK/ SUGGESTED READING	3. C K Shyamala, N Harini, Dr. T.R. Padmanabhan, Cryptography and Network Security, Wiley India. 4. Forouzan Mukhopadhyay, Cryptography and Network Security, Mc Graw Hill. 5. Mark Stamp, Information Security, Principles, and Practice, Wiley India 6. Atul Kahate, Cryptography and Network Security, Mc Graw Hill. 7. McClure, S., Scambray, J., & Kurtz, G. . Hacking exposed 7: Networksecurity secrets and solutions. McGraw-Hill Education.		

Course: VIRTUALIZATION AND CLOUD COMPUTING			Semester:
Course Code: BCA-CI102	L T P	3 1 0	Credits: 4

OBJECTIVE	Provides an insight into cloud computing and enable students to understand concept of application-based building blocks for processing of data		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Understand the key dimensions of the challenges and benefits of Cloud Computing. 2. Describe the principles of Parallel and Distributed Computing and evolution of cloud Computing from existing technologies. 3. Implement different types of Virtualization technologies and Service Oriented Architecture systems. 4. Choose among various cloud technologies for implementing applications. 5. Install and use current cloud technologies.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1.	**Introduction:** Cloud-definition, benefits, usage scenarios, History of Cloud Computing, Cloud Architecture, Types of Clouds, Players in Cloud Computing, issues in Clouds.	**08**
	2.	**Cloud Services:** Types of Cloud services, Software as a Service, Platform as a Service, Infrastructure as a Service, Database as a Service, Monitoring as a Service, Communication as services. Service Providers- Google, Amazon, Microsoft Azure, IBM, Sales force.	**15**
	3.	Collaborating Using Cloud Services Email Communication over the Cloud, CRM Management, Project Management, Event Management, Task Management, Calendar, Schedules, Word Processing, Presentation, Spreadsheet, Databases, Desktop, Social Networks and Groupware.	**10**
	4.	**Virtualization for Cloud** : Need for Virtualization, Pros and cons of Virtualization, Types of Virtualization, System VM, Process VM, Virtual Machine monitor, Virtual machine properties, HLL VM, Hypervisors, Xen, KVM, VMWare, Virtual Box, Hyper-V.	**15**
	5.	**Cloud Security:** Infrastructure Security- Network level security, Host level security, Application level security, Data security, Authentication in cloud computing, Cloud security challenges.	**12**
		Total Hours	**60**
TEXTBOOKS:	1. Comer, D. E. The Cloud Computing Book: The future of computing explained . Chapman and Hall/CRC. 2. Buyya, R., Vecchiola, C., & Selvi, S. T. Mastering cloud computing: Foundations and applications programming . McGraw-Hill Education.		

REFERENCE BOOK/ SUGGESTED READING	3. Barrie Sosinsky, Cloud Computing Bible, Wiley-India. 4. Thomas Erl, Cloud Computing: Concepts, Technology & Architecture, Pearson. 5. James E Smith, Ravi Nair, Virtual Machines, Morgan Kaufmann Publishers. 6. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier. 7. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press.

Course:WIRELESS COMMUNICATIONS AND VOIP SECURITY			**Semester:**
Course Code:BCA-CI103	**L T P**	**3 1 0**	**Credits: 4**

OBJECTIVE	Understand the different routing protocols have an in-depth knowledge on network architecture and design issues
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Demonstrate their understanding of the functioning of wireless communication systems and evolution of different wireless communication systems and standards. 2. Compare different technologies used for wireless communication systems. 3. Explain the architecture, functioning, protocols, capabilities and application of various wireless communication networks. 4. Demonstrate an ability explain multiple access techniques for Wireless Communication 5. Demonstrate an ability to evaluate design challenges, constraints and security issues associated with Ad-hoc wireless networks.

COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1.	**Introduction:** Introduction to Wireless Networks - Wireless Network Topologies -Characteristics of the Wireless Medium -GSM Cellular Network concept – Cellular transmission principles Typical cell layout - Signals Transmission interference- Cell splitting - TDMA technology – Spread spectrum and CDMA technology - GPRS – 3G- 4G and Long term evolution- 5G	**08**
	2.	**Wireless LAN Standards:** Evolution of IEEE 802.11- Introduction to IEEE 802.11 - General Description- Medium Access Control (MAC) for the IEEE 802.11 -WLANs Physical Layerfor IEEE 802.11 -WLANs; Radio systems -IR Systems Applications	**10**
	3.	**Bluetooth:** Bluetooth and IEEE 802.15- Bluetooth Specifications - Bluetooth Architectures - Bluetooth Protocols - Bluetooth Service Discovery - Bluetooth MAC - Bluetooth Packet Structure - Bluetooth Audio - Bluetooth Addressing - Bluetooth Limitations – Zigbee	**15**

	4.	**WAP:** The WAP Forum - WAP Service Model - WAP Protocol Architecture - WAP Programming Model – Mobile applications and Mobile IP - Mobile adhocnetworks(MANET) Wireless Routing Protocol - Cluster Switch Gateway Routing (CSGR) - Ad Hoc On-Demand Distance Vector Routing (AODV). Dynamic Source Routing (DSR) - Zone Routing Protocol (ZRP) - Source Tree Adaptive Routing (STAR).	**15**
	5.	**Satellite Communication:** Overview of Satellite Systems - Orbits and Launching Methods - Geostationary Orbit - Radio Wave propagation - Interference - Satellite Access - Satellites in Networks - Direct Broadcast Satellite (DBS) Television - Satellite Services - INSAT, VSAT, Remote Sensing- Satellite Mobile and Specialized Services.	**12**
		Total Hours	**60**
TEXTBOOKS:	1. Hartpence, B. Packet guide to Voice over IP: A system administrator's guide to VoIP technologies. O'Reilly Media. 2. Ahson, S. A., & Illyas, M. VoIP handbook: Applications, technologies, reliability, and security . CRC Press.		
REFERENCE BOOK/ SUGGESTED READING	3. Jochen Schiller, Mobile Communications, 2nd Edition, Addison-Wesley. 4. Chai-KeongToh, AdHoc Mobile Wireless Networks: Protocols and Systems, Addition Wesley. 5. Dennis Roddy, Satellite Communications,McGraw hill. 6. Cory Beard, William Stallings,Wireless Communication Networks and Systems,Pearson. 7. William Stallings, Wireless communications, and Networks, PearsonEducation Asia		

Course: ETHICAL HACKING AND CYBER LAW			**Semester:**
Course Code:BCA-CI104	**L T P**	**3 1 0**	**Credits: 4**

OBJECTIVE	The objective of this course is to provide students with a comprehensive understanding of the fundamental concepts, challenges, and practices in the field of cyber security. It aims to equip learners with knowledge of cyberspace, cyber threats, and critical infrastructure security, while exploring various forms of cyber crimes, hackers, and malicious software. The course introduces ethical hacking and social engineering techniques along with their countermeasures, emphasizing the importance of vulnerability assessment and information assurance.
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Remember the broad set of technical, social & political aspects of Cyber Security. 2. Understand the importance of ethical hacking, its tools and ethical hacking process. 3. Analyze security principles to system design. 4. Understand the methods for authentication, access control, intrusion detection and Prevention in Cyber Security. 5. Understand the method for Intrusion Detection Systems and Detection Tools.

COURSE DETAILS	Unit No.	Topic	Hours
	1.	**Introduction to Cyber Security:** Importance and challenges in Cyber Security, Cyberspace, and Cyber threats, Cyber warfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure	**10**
	2.	**Hackers and Cyber Crimes:** Types of Hackers - Hackers and Crackers, Cyber-Attacks and Vulnerabilities, Malware threats, Sniffing, Gaining Access – Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks. Worms, Trojans, Viruses, Backdoors.	**15**
	3.	**Ethical Hacking and Social Engineering:** Ethical Hacking Concepts and Scopes, Threats and Attack Vectors, Information Assurance, Threat Modeling, Enterprise Information Security Architecture, Vulnerability Assessment and Penetration Testing - Types of Social Engineering - Insider Attack - Preventing Insider Threats - Social Engineering Targets and Defence Strategies	**15**
	4.	**Cryptography:** Cryptography in Practice, Historical Perspectives - Algorithms - Hashing Functions - Symmetric Encryption, Asymmetric Encryption, Quantum Cryptography, Cryptography Algorithm Uses	**10**
	5.	**Intrusion Detection Systems:** History of Intrusion Detection Systems, IDS Overview, Network-Based IDSs, Host-Based IDSs, Intrusion Prevention Systems, Honeypots and Honeynets - Tools.	**10**
		Total Hours	**60**
TEXTBOOKS:	1. Stuttard, D., & Pinto, M. The Web Application Hacker's Handbook: Finding And Exploiting Security Flaws . Wiley. 2. Allsopp, W. Advanced Penetration Testing: Hacking The World's Most Secure Networks . Wiley		
REFERENCE BOOK/ SUGGESTED READING	1. Nina Godbole, Sumit Belapure, “Cyber Security”, Willey. 2. Yuri Diogenes, Cybersecurity - Attack and Defense Strategies: Infrastructure security with RedTeam and Blue Team tactics, Pearson. 3. Engebretson, P. The basics of hacking and penetration testing: Ethical hacking and penetration testing made easy. Syngress. 4. Kim, P. The hacker playbook 2: Practical guide to penetration testing . Independently published. 5. Weidman, G. Penetration testing: A hands-on introduction to hacking . No Starch Press.		

Group III (Business Analytics)

Course: MACHINE LEARNING			Semester:
Course Code: BCA-BA101	L T P	3 1 0	Credits: 4

OBJECTIVE	Understand the need for machine learning for problem solving and study the various algorithms in machine learning.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Learn the basics of learning problems with hypothesis and version spaces. 2. Understand the machine learning algorithms as supervised learning and unsupervised learning and apply and analyze the various algorithms of supervised and unsupervised learning. 3. Analyze the concept of neural networks for learning linear and non-linear activation functions. 4. Learn the concepts in tree, probability and graphical based models and methods. 5. Understand the fundamental concepts of Genetic Algorithm and Analyze and design the genetic algorithms for optimization engineering problems.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1.	**Introduction to Machine Learning:** Introduction, Perspectives & Issues in ML, designing learning systems, Concepts of hypotheses, Version space, inductive bias, Performance metrics-accuracy, precision, recall, sensitivity, specificity, AUC, RoC.	**10**
	2.	**Supervised Learning:** Decision Trees Leaming: Basic algorithm (ID3), Issues in Decision Tree Learning - Overfitting, Solutions to overfitting. Instance-based learning: k-nearest neighbour learning. Support Vector Machines: Introduction, Handling data that are linearly separable. Artificial Neural networks: Introduction, Perceptrons, Multi-layer networks and back-propagation.	**15**
	3.	**Probabilistic and Stochastic Models:** Bayesian Learning - Bayes theorem, Concept learning, Maximum likelihood, Bayes optimal classifier, Naive Bayes classifier. Expectation Maximization and Gaussian Mixture Models, Hidden Markov models.	**12**
	4.	**Association Mining and Unsupervised Learning :** Association Mining: Apriori algorithm. Finding frequent itemsets, mining association rules, FP- growth - FP trees, mining frequent items from an FP-Tree. Hierarchical vs non-hierarchical clustering, Agglomerative and divisive clustering, K-means clustering, K-medoid clustering,	**15**
	5.	Genetic Algorithms Genetic Algorithms - Representing hypothesis, Genetic operators and Fitness function and selection, Simple applications of the Genetic Algorithm, application of GA in Decision tree, Genetic Algorithm based clustering	**08**
		Total Hours	**60**

TEXTBOOKS:	1. Géron, A.,Hands-On Machine Learning With Scikit-Learn, Keras, And Tensorflow: Concepts, Tools, And Techniques To Build Intelligent Systems . O'Reilly Media. 2. Goodfellow, I., Bengio, Y., & Courville, A., Deep Learning. MIT Press.
REFERENCE BOOK/ SUGGESTED READING	3. Burkov, A. Machine Learning Engineering. O'Reilly Media. 4. Ng, A., Machine Learning Yearnings: Technical Strategy For Machine Learning Engineers, Deeplearning.Ai. 5. Bishop, C. M. Pattern Recognition And Machine Learning. Springer. 6. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press. 7. Charu C. Aggarwal, "Data Clustering Algorithms And Applications", CRC Press.

Course: BUSINESS INTELLIGENCE			**Semester:**
Course Code: BCA-BA102	**L T P**	**3 1 0**	**Credits: 4**

OBJECTIVE	To become familiar with the ethics and basics of Business Intelligence and Decision Support Systems.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Understand concepts and components of Business Intelligence (BI). 2. Evaluate the technologies that make up BI (data warehousing, OLAP). 3. Understand how BI will help an organization. 4. Identify the technological architecture that makes up BI systems. Plan the implementation of a BI system. 5. Understanding of data visualization.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1.	Introduction to Business Intelligence (BI),Definition and scope of Business Intelligence, Components and architecture of BI systems, Data warehousing and data integration.	**10**
	2.	Data Analysis and Reporting Data visualization techniques, Reporting tools and dashboards, Online Analytical Processing (OLAP).	**15**
	3.	Data Mining and Predictive Analytics Data mining techniques and algorithms, Predictive modeling and forecasting, Pattern recognition and association rules.	**15**
	4.	Business Performance Management Key Performance Indicators (KPIs), Balanced Scorecard approach, Performance monitoring and benchmarking	**12**
	5.	**Data Visualization** Objective, choose effective chart, features of charts, Area Charts; Column charts, Line charts, Pie charts, Point Chart, customize chart options.	**08**
		Total Hours	**60**

TEXTBOOKS:	1. Gautam, Sangeeta, IBM Cognos; Business Intelligence; IBM Press 2. Sharda, R., Delen, D., & Turban, E. *Business Intelligence, Analytics, and Data Science: A Managerial Perspective* . Pearson
REFERENCE BOOK/ SUGGESTED READING	3. Wilfried, Grossmann, Rinderle Ma,Stefanie; Fundamentals of Business Intelligence; Springer. 4. Loshin, David; Business Intelligence; Elsevier. 5. Volitich, Dan, Ruppert, Gerard; IBM Cognos; Business Intelligence 10: The Official Guide; McGraw-Hill. 6. Turban, E, Sharda, R, Delen, Dursun, and King, David; Business Intelligence: A Managerial Approach; Pearson. 7. Marr, B. (2022). Data Strategy: How to Profit from a World of Big Data, Analytics, and the Internet of Things. Wiley.

Course: LOW CODE NO CODE			**Semester:**
Course Code: BCA-BA103	**L T P**	**3 1 0**	**Credits: 4**

OBJECTIVE	Understand the principles and benefits of LCNC development and navigate and utilize popular LCNC platforms such as deployment of applications using NCNC tools.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. Describe the core concepts and advantages of LCNC developments. 2. Utilizing leading LCNC platforms to create, test, and deploy applications. 3. Implement Basic design principles to enhance user experience and functionality. 4. Integrating LCNC applications with existing systems and databases. 5. Analyze and solve business problems by developing tailored LCNC solutions.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1.	**Introduction to Low Code/No Code:** Gain a comprehensive understanding of what low code and no code development entail. Explore real-world use cases and success stories, Exploring low-coding solutions & databases: dataverse concepts, data storing solutions, basic app user interface development.	**10**
	2.	**Basic low-code application development:** modifying forms, adding controls, displaying data. Advanced Low-code application development: model driven apps, common data model integration.	**12**
	3.	**Mobile asset tracking:** integrate API's, extract datasets from GPS, Barcodes and QR codes Mixed reality integration into application: adding 3D environment tools. Automating processes: Power Automate concepts, business processes automation. Building an advanced automated solution.	**8**

	4.	**Getting started with data visualization tools:** Using advanced tools for data visualization, modeling, and analysis: creating reports with Power BI. Working with Power BI more efficiently: connecting, transforming, and visualizing the data	**15**
	5.	**Introduction to Power Virtual Agents:** building, testing, and deploying simple chatbot ,Enhancing Power Virtual Agents bots: using Power Automate to add actions; managing topics.	**15**
		Total Hours	**60**
TEXTBOOKS:	1. Cox, J., Lambert, J., Microsoft Access 2013: Step by Step. Redmond: Microsoft Press. 2. Weston, M., Learn Microsoft PowerApps. Birmingham: Packt Publishing Ltd.		
REFERENCE BOOK/ SUGGESTED READING	3. Mendoza, E., Microsoft Power Apps Cookbook. Birmingham: Packt Publishing Ltd. 4. Pertilä, T. Power Apps and Mixed reality. Available online @ elearning.ism.lt.		

Course: SOFTWARE TESTING			**Semester:**
Course Code: BCA-BA104	**L T P**	**3 1 0**	**Credits: 4**

OBJECTIVE	To study fundamental concepts in software testing and discuss various software testing issues and solutions in software.		
COURSE OUTCOMES	**Upon completion of the course students should be able to:** 1. List a range of different software testing techniques and strategies and be able to apply specific(automated) unit testing method to the projects. 2. Distinguish characteristics of structural testing methods. 3. Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible. 4. Discuss the functional and system testing methods. 5. Demonstrate various issues for object-oriented testing.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1.	**Fundamental of Test and Analysis:** Software Test and Analysis in a Nutshell: Engineering Process and Verification, Basic Questions; When do Verification and Validation Start and End? What Technique should be Applied? How can we Assess the Readiness of a Product? How can we ensure the Quality of Successive Releases? A Framework for Test and Analysis: Validation and Verification, Degrees of Freedom, Varieties of Software. Basic Principles: Sensitivity, Redundancy, Restriction, Partition, Visibility and Feedback. Test and Analysis Activities within a Software Process: The Quality Process, Planning and Monitoring, Quality Goals, Dependability Properties, Analysis, Testing, Improving the Process and Organizational Factors.	**10**

	2.	**Problems and Methods:** Test Case Selection and Adequacy: Test Specification and Cases, Adequacy Criteria, Comparing Criteria, Functional Testing: Random versus Partition Testing Strategies, A Systematic Approach, Choosing a Suitable Approach, Combinatorial Testing: Category-Partition Testing, Pairwise Combination Testing, Catalog-Based Testing, Structural Testing: Statement Testing, Branch Testing, Condition Testing, Path Testing, Procedure Call Testing, Comparing Structural Testing Criteria.	**12**
	3.	**Data Flow Testing:** Definition-Use Associations, Data Flow Testing Criteria, Data Flow Coverage with Complex Structures, The Infeasibility Problem. Testing Object Oriented Software: Issues in Testing Object Oriented Software, An Orthogonal Approach to Test, Intra-class Testing, Testing with State Machine Models, Interclass Testing, Structural Testing of Classes, Oracles for Classes, Polymorphism and Dynamic Binding, Inheritance, Genericity and Exception.	**15**
	4.	**Planning and Monitoring the Process:** Quality and Process, Test and Analysis Strategies, Test and Analysis Plans, Risk Planning, Monitoring the Process, Improving the Process, The Quality Team. Integration and Component-based Software Testing: Integration Testing Strategies, Testing Components and Assemblies. System, Acceptance and Regression Testing: System Testing, Acceptance Testing, Usability, Regression Testing, Regression test Selection Techniques, Test Case Prioritization and Selective Execution.	**08**
	5.	**Model Based Testing**: Deriving Test Cases from Finite State Machines, Testing Decision Structures, Deriving Test Cases from Control and Data Flow Graphs, Deriving Test Cases from Grammars. Automating Analysis and Test: Automation and Planning, Process Management, Static Metrics, Test Case Generation and Execution, Static Analysis and Proof, Cognitive Aids, Version Control, Debugging, Choosing and Integrating Tools. Documenting Analysis and Test: Organizing Documents, Test Strategy Document, Analysis and Test Plan, Test Design Specification Documents, Test and Analysis Reports.	**15**
		Total Hours	**60**
TEXTBOOKS:	1. Jorgensen, P. C. *Software testing: A craftsman's approach*. Shroff Publishers and Distributors Pvt. Ltd. 2. Graham, D., Black, R., & van Veenendaal, E. Foundations of software testing: ISTQB certification . Cengage Learning.		

REFERENCE BOOK/ SUGGESTED READING	3. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, Auerbach Publications. 4. Aditya P Mathur: Foundations of Software Testing, Pearson. 5. Crispin, L., & Gregory, J. Agile testing: A practical guide for testers and agile teams. Addison-Wesley. 6. Kaner, C., Bach, J., & Pettichord, B. Lessons learned in software testing: A context-driven approach. Wiley. 7. Graham, D., & Evans, G. Foundations of Software Testing: ISTQB Certification . Cengage Learning