Mahatma Jyotiba Phule

Rohilkhand University, Bareilly-243006
Uttar Pradesh, India

BACHELOR OF COMPUTER APPLICATION

UG - SYLLABUS

THE Three - YEAR **BCA** PROGRAMME

EFFECTIVE FROM 2024-25 SESSION

Course Structure

Bachelor of Computer Application Semester-wise Titles of the Papers						
Year	**Course Code**	**Course Title**	**Theory /Practical**	**Credits**	**Maximum Marks**	
					Internal	**External**
First Year (Certificate in Computer Application)		First Semester				
	BCA-101N	Computer Fundamentals and PC Software	Theory	4	25	75
	BCA-103N	Programming with C	Theory	4	25	75
	BCA-105N	Basic Mathematics	Theory	4	25	75
	BCA-107N	Communicative English	Theory	4	25	75
	BCA-109N	Principle of Management	Theory	4	25	75
	BCA-101P	**LAB:(PC Software lab)**	Practical	2	--	100
	BCA-103P	**LAB:(C Programming)**	Practical	2	--	100
		Second Semester				
	BCA-102N	Data Structures using C	Theory	4	25	75
	BCA-104N	Introduction to Database System	Theory	4	25	75
	BCA-****	**Elective Paper [one from the list] E1**	Theory	4	25	75
	BCA-106N	Business Organization & Management	Theory	4	25	75
	BCA-108N	Digital Electronics	Theory	4	25	75
	BCA-102P	**LAB:(Data Structure)**	Practical	2	--	100
	BCA-104P	**LAB:(RDBMS)**	Practical	2	--	100
Second Year (Diploma in Computer Application)		Third Semester				
	BCA-201N	Object oriented programming using JAVA	Theory	4	25	75
	BCA-203N	Numerical Analysis and Statistical Techniques	Theory	4	25	75
	BCA-****	**Elective Paper [one from the list] E2**	Theory	4	25	75
	BCA-205N	Operating System	Theory	4	25	75
	BCA-207N	Computer Organization and Architecture	Theory	4	25	75
	BCA-201P	**LAB:(JAVA Programming)**	Practical	2	--	100
	BCA-203P	**LAB:(NAST)**	Practical	2	--	100
		Fourth Semester				
	BCA-202N	Programming in Python	Theory	4	25	75
	BCA-204N	Unix and Shell Programming	Theory	4	25	75
	BCA-****	**Elective Paper [one from the list] E3**	Theory	4	25	75
	BCA-206N	Accounting and Financial Management	Theory	4	25	75
	BCA-208N	Computer Networks	Theory	4	25	75

	BCA-202P	**LAB:(Python Programming)**	Practical	2	--	100
	BCA-204P	**LAB:(Unix and Shell Programming)**	Practical	2	--	100

Note: **After BCA IV Semester examination students will go on 6 to 8 weeks industrial training/internship during summer vacations. And after successful completion of the training, the concerned students will submit their training completion certificate along with the training report in the form of a project.**

Third Year (Bachelor of Computer Application)	Fifth Semester					
	BCA-301N	Artificial Intelligence	Theory	4	25	75
	BCA-303N	Web Technologies	Theory	4	25	75
	BCA-****	**Elective Paper [one from the list] E4**	Theory	4	25	75
	BCA-305N	Computer Graphics and Animation	Theory	4	25	75
	BCA-303P	**LAB: (Web Technologies)**	Practical	2	--	100
	BCA-305P	**LAB: (Computer Graphics)**	Practical	2	--	100
	BCA-307P	Industrial training	Internship / Project	4	--	100
	Sixth Semester					
	BCA-302N	Introduction to Data science	Theory	4	25	75
	BCA-304N	Cloud Computing	Theory	4	25	75
	BCA-****	**Elective Paper [one from the list] E5**	Theory	4	25	75
	BCA-306N	Internet of Things	Theory	4	25	75
	BCA-302P	**LAB: (Data Science)**	Practical	2	--	100
	BCA-308P	**Major Project**	Project	6	--	100

Elective Papers (for BCA)

ListofElectivePapersE1

S.No.	Course Code	Course Title	To be Opted in the Semester
1	BCA-401E	Mathematics	II
2	BCA-402E	Environment and Ecology	II
3	BCA-403E	Introduction to E-Governance	II

Note: **In the second semester, mathematics (BCA-401E) will be a compulsory subject from the list of elective papers E1 for those students who did not have Mathematics in Intermediate (12th) class.**

List of Elective Papers E2

S.No.	Course Code	Course Title	To be Opted in the Semester
1	BCA-411E	Discrete Mathematics	III
2	BCA-412E	Personality and Soft Skills Development	III
3	BCA-413E	Information System for Business	III

List of Elective Papers E3

S.No.	Course Code	Course Title	To be Opted in the Semester
1	BCA-421E	E-Commerce	IV
2	BCA-422E	IT Acts and Cyber Laws	IV
3	BCA-423E	Software Engineering	IV

List of Elective Papers E4

S. No.	Course Code	Course Title	To be Opted in the Semester
1	BCA-431E	Introduction to Cyber Security	V
2	BCA-432E	GUI Programming	V
3	BCA-433E	Operation Research	V

List of Elective Papers E5

S. No.	Course Code	Course Title	To be Opted in the Semester
1	BCA-441E	Software Testing	VI
2	BCA-442E	Advanced Web Development Technologies	VI
3	BCA-443E	Blockchain Foundations	VI

Bachelor of Computer Application
Key Points of the Programme

1) CBCS (Choice based credit system):

In order to ensure multi-disciplinary approach in subjects at the UG-level, CBCS has been partially implemented from the 2nd semester to the 6th semester. Separate list of elective subjects (E1 to E5) has been provided in the syllabus for each semester and students will choose one elective subject from the list given for their respective semester.

2) Programme Prerequisites:

The eligibility requirement for admission to the First Year, Ist Semester of this program is that the candidate must have successfully completed the Class 10+2 examination with Mathematics as a subject and secured at least 50% marks (45% for SC/ST categories). ***Students aspiring to pursue a BCA who have not studied Mathematics in their 12th grade must enroll in Mathematics as an elective course (E1) during the second semester and successfully complete it.*** The purpose of the bridge course is to provide the mathematical foundation required for the BCA programmme.

3) Provision of Multiple-Exit and Awarding Certificate, Diploma, and Degrees:

In line with the provisions of NEP-2020, a multiple-exit system has been introduced. Students who earn a minimum of 48 credits after completing the first year of the BCA program will be awarded a one-year certificate upon exiting. Those who complete the second year and accumulate at least 96 credits will receive a two-year diploma, while students who earn 144 credits will be awarded a BCA degree. The certificate, diploma, or degree will only be granted once the student successfully clears all the required qualifying papers. The detailed term and conditions are given for the same in the ordinance.

4) Summer Training/Industrial Training:

After BCA IV Semester examination students will go on 6 to 8 weeks industrial training/internship during summer vacations. And after successful completion of the training, the concerned students will submit their training completion certificate along with the training report in the form of a project.

Programme Introduction

Computer Science is the study of computers and technology. Computers have been shaping the future of mankind with the great surge in technologies like machine learning and IoT in the last decade. The curriculum of our subject aims to provide any pupil in the course to understand the architecture, theory, and math behind the technologies that drive our modern world forward.
BCA in Computer Science facilitate the knowledge about the science behind computers and provide a platform to develop skills like programming, networking, front end development and database administration. It also focuses on the ethics of developing and working with new technologies by providing strong arguments for green computing, security, and user privacy protection.

PO1	Gain a complete exposure to the theories and practices of Computer science.
PO2	Get transformed into a skilled learner and active programmer to develop software applications for real problems.
PO3	Work as a value member or leader of team to develop software solutions
PO4	Demonstrate their professional and ethical responsibilities towards society.

Bachelor of Computer Application	
PSO 1	Understand, analyze and develop computer programs in the areas related to algorithm, web design and networking for efficient design of computer-based system.
PSO 2	To view the real-world problems from the spectacles of conceptual knowledge of Computer Science and to develop their solutions in a technical oriented way.
PSO 3	Apply standard software engineering practices and strategies in software project development using open-source programming environment to deliver a quality of product for business success.
PSO 4	Work in the IT sector as system engineer, software tester, programmer, web developer

B.C.A.

First Year

Detailed Syllabus

Bachelor of Computer Application			
Programme/Class:		**Year:** 1st	**Semester:** 1st
Subject Code: BCA-101 N	**Subject Title:** Computer Fundamentals and PC Software		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	The objective of this course is to familiarize students with complete computer's Fundamentals.		
CO 2:	Enhance skill of the packages commonly used in computing software.		
CO 3:	Understanding of different Operating systems.		
CO4:	Apply Word Processing Tools including Document Formatting, Using Graphics, Working with Macro and Mail Merge etc.		
Credits: 4		**Core Compulsory**	

Unit	Topic
I	Computers: Definition of computer, characteristics, computer generation & evolution of computers, Von Neumann Architecture, Classification of Computers, Instruction Execution Cycle, Basic Components of a computer system – Control Unit, ALU, I/ O Devices, Distributed Computer System, Parallel Computers, computer organization & block diagram representation, storage devices. Memory and its types. Types of Software – System software, Application software, Utility Software, Demoware, Shareware, Freeware, Firmware, Free Software. Computer Language and Software: Algorithm, Flowcharts, Machine Language, Assembly Language, High Level Language, Assembler, Compiler, Interpreter. Characteristics of Good Language.
II	Overview of Operating System: Definition, functions of operating system, concept of multiprogramming, multitasking, multithreading, multiprocessing, time-sharing, real time, single-user & multi-user operating system. Computer Virus: Definition, types of viruses, characteristics of viruses, anti-virus software. Disk Operating System (DOS): Introduction, History & Versions of DOS. DOS basics, Physical structure of disk, drive name, FAT, file & directory structure and naming rules, booting process, DOS system files. Basic DOS Commands Windows: features of windows, my computer, windows explorer, accessories. Managing multiple windows, arranging icons on the desktop, creating and managing folders, managing files and drives, logging off and shutting down windows. Entertainment – CD Player, DVD Player, Media Player, Sound Recorder, Volume Control.
III	PC Maintenance and Troubleshooting: Opening the PC and identification. Study of different blocks, Assembling and disassembling. Basic Device Configuration and Installation-Printers, Microphone, Monitor, Mother Board, Sound Card, Video Card, tips on Trouble Shooting. Introduction to Computer Hardware, Components of Mother-boards & its types, Ports, Slots, Connectors, add on cards, Power supply units, and cabinet types. Storage devices: Primary & Secondary storage medium. Internet: Definition, World Wide Web, Uniform Resource Locator, Web Browsers, IP Address, Domain Name, Internet Services Providers, Internet Security, Search Engines, Net Etiquette, Internet Services, Intranet, Extranet. E-mail, advantages and disadvantages of Email, format of email addresses, influences or impacts of internet to society, education, research etc. Cybercrimes, Hacker, Cracker.
IV	WORD PROCESSING: Introduction to Word processing, Names of some commonly used word processing software, Feature, document creating, formatting, standard toolbar, drawing toolbar, tables and other features. Mail-merge,Spell Check, Thesaurus, Find & Replace, Inserting Header, Footer, page number & pictures. Working with Tables, Introduction to power point, Auto -wizard, creating a presentation using Auto content wizard, Blank presentation, creating, saving and printing a presentation, adding slide to a presentation, slide view, outline view, slide sorter view, notes view and slide show view. Changing text font and size, selecting text style and color, to set header and footer. Using, bullets, clipart and word art gallery. Applying design template creating graph. Adding transitions and Animation effects, setting timings for slide show preparing note pages, preparing audience handouts.

V	Introduction To Spreadsheet (Excel sheet): Definition and Advantages of Electronic Worksheet, Working on Spreadsheets: Cell Referencing, Range & Related Operations, Setting, Saving And Retrieving Worksheet File. General Short-cut commands, Entering text and numeric data, Entering date and time different functions, formatting text and numeric data. Functions and Other Features: Classification and Usage of Various Built-In-Functions In Worksheet, Passwords, Protecting A Worksheet Printing of the worksheet, page margin setting and adding header and footer, Transferring Data to and From Non Worksheet Files, Database Handling, Creating, Naming & Executing Macros. Creating graphs.

Suggested Readings:

- Computers Fundamentals and Architecture by B. Ram
- Microsoft Windows XPStep by Step , PHI
- Norton, Introduction to Computers, McGraw Hill
- Ron Mansdield, Microsoft Office, BPB Publication
- P. K. Sinha & Priti Sinha, Computer Fundamentals, BPB Publications.
- Computer Fundamentals, Raja Raman – Prentice Hall of India.
- V. Rajaraman, Introduction to Computers, PHI.
- The AGI Training Team, Microsoft Office 2010 Digital Classroom, Wiley Publishing Inc.
- PC Software for Windows 98' made simple – R.K.Taxali – Tata McGraw Hill Publishers.

Suggested equivalent online courses:

- https://onlinecourses.swayam2.ac.in/cec23_cs13/preview

Bachelor of Computer Application			
Programme/Class:		**Year:** 1st	**Semester:** 1st
Subject Code: BCA-103 N	**Subject Title:** Programming with C		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Use the fundamentals of C programming in trivial problem solving.		
CO 2:	Illustrate the flowchart and design algorithm for a given problem and to develop C programs using operators		
CO 3:	Identify solution to a problem and apply control structures and user defined functions for solving the problem.		
CO4:	Apply skill of identifying appropriate programming constructs for problem solving.		
Credits:4		**Core Compulsory**	
Unit	**Topic**		
I	Evolution of C, Programming languages, Structure of a C program, compiling a C program, Character set in C, Keywords in C, Hierarchy of operators, Basic data types, Qualifiers used with basic data types, Variables in C, Type declaration, Output function, Input function and format specifiers, arithmetic operators, Unary operators, Relational and logical operators		
II	if statement, if else statement, for statement, while loop, do while statements, break statements, continue statements, switch statement, goto statement, ternary operators.		
III	Definition of Array, types of arrays, array declaration, array initialization, Advantages of arrays, accessing data from array, array inside the memory, multi-dimensional arrays. Character arrays, Array overflow, String Variables, Reading & writing strings, string handling functions		

IV	Declaring a function, calling a function, Advantages of functions variables, passing arguments to a function, nested functions, passing array to functions, recursion in functions, Call by value and Call by reference.
V	Pointers and function, Array of pointers, Pointer and Strings, Pointer to structure, Pointers with in structure, Introduction of Static and Dynamic memory allocation, Dynamic memory allocation, DMA functions, malloc() function, Sizeof() operator, Function free(), Function realloc().

Suggested Readings:

- Brian W.Kernighan and Dennis Ritchie, The C Programming Language" Pearson Publication.
- Let us C, Yashwant Kanetkar;
- K. R. Venugopal, S. R. Prasad, "Mastering C" McGraw-Hill Education India;
- E. Balagurusamy, "PROGRAMMING IN ANSI"' McGraw Hill Education India;

Suggested equivalent online courses:

- https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-cs40/

Bachelor of Computer Application			
Programme/Class:		**Year:** 1st	**Semester:** 1st
Subject Code: BCA-105 N	**Subject Title:** Basic Mathematics		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Perform basic computations in higher mathematics.		
CO 2:	Solve problems in Integral calculus, limits and Continuity, Coordinate Geometry, Matrices and Differential Equations.		
CO 3:	Develop and maintain problem-solving skills		
Credits: 4		**Core Compulsory**	

Unit	**Topic**
I	Test for Divisibility of Numbers; General Properties of Divisibility; Division and Remainder Rules; Principle of Prime Factorization; Difference between HCF and LCM; Definition and Comparison of Fractions; Insertion of any number of Fractions in between two given Fractions; Operation Order Sequence (VBODMAS); Algebraic Formula; Percentage and their Inter-conversion; Average; Ratio and Proportion. Binomial Theorem and expansions.
II	Definition of Sequence, Series and Progression; Definition of Arithmetic Progression (AP); nth term of an AP; sum of n terms of an AP; Arithmetic Mean (AM); Properties of AP; Definition of Geometric Progression (GP); nth term of a GP; Sum of n terms of a GP; Geometric Mean (GM); Properties of GP; Definition of Harmonic Progression (HP); Harmonic Mean (HM); Relations between AM, GM and HM.
III	Matrices: Definition of a Matrix; Various Types of Matrices; Operations on Matrices; Symmetric and Skew-Symmetric Matrices; Row Operations, Column Operations; Inverse of a Matrix by Elementary Row Operations. Determinants: Concept of Determinant; Minors and Co-factors in Determinants; Expansion of a Determinant; Properties of Determinants.
IV	Basic Formulae of Differentiation; Differentiation from the First Principle; Derivative of the Product of Functions, Quotient of two functions, Function of a function (Chain Rule). Derivatives of Exponential functions, Logarithmic functions, Inverse Trigonometric

	functions; Differentiation by Trigonometrical Transformations; Differentiation of Implicit functions; Differentiation using Logarithms.
V	Indefinite Integral: Basic Formulae and Standard results of Integration; Integration by Substitution; Integration using Trigonometric Identities; Integration by Parts.

Suggested Readings:

- R.S. Aggarwal, Senior Secondary School Mathematics for Class 11, Bharati Bhawan
- Aggarwal, R. S., Senior Secondary School Mathematics for Class 12, BharatiBhawan (Publishers & Distributors).
- B.C. Das & B. N. Mukherjee, Differential and Integral Calculus,

Suggested equivalent online courses:

-

Bachelor of Computer Application			
Programme/Class:		**Year:** 1st	**Semester:** 1st
Subject Code: BCA-107 N	**Subject Title:** Communicative English		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Ability to comprehend both the written and spoken texts. Ability to frame questions and answer them. Ability to write/speak grammatically correct sentences.		
CO 2:	Demonstrate the skill to write in English without grammatical error.		
CO 3:	Ability to participate in short group conversations. Ability to use collocations, fixed and semi-fixed expressions.		
CO4:	Express the viewpoints with confidence in English.		
Credits:4		**Core Compulsory**	

Unit	**Topic**
I	Introduction to Language Communication Importance of English Language, Basics of Communication – Process of Communication, Components of Communication, factors of Communication; Barriers to Communication – Physical, Psychological, Semantics, Organizational and Interpersonal Barriers; How to overcome Barriers.
II	Communication Skills in English Language Skills- Reading Skills and Listening Skills; Verbal Communication- Vocal Communication techniques and Oral Presentation; Non Verbal Communication- Personal appearance; Facial Expression, Movement, Posture, Gesture, Eye Contact.
III	Effective Writing, Abstracts and Summaries; Note Making; Report Writing- Structure and Layout, Elements of Structure, Front Matter, Main Body, Back Matter; Laboratory Reports.
IV	Grammar 1 Parts of Speech, Definition & Identification of 'Subject' and 'Predicate', Phrases & Clauses, Tense – Types of Tenses & their use.
V	Grammar 2 Voice – Active voice and Passive voice, Concept of Concord – What is Concord? Subject - Verb Agreement; Reported Speech – Direct and Indirect Speech.

Suggested Readings:

- R.C. Sharma & Krishna Mohan, Business Correspondence & Report Writing, A Practical Approach to Business and Technical Communication, Tata McGraw Hill.
- Wren &Martin, English Grammar and Composition, S. Chand Publisher.

Suggested equivalent online courses: •

Bachelor of Computer Application			
Programme/Class:		**Year:** 1st	**Semester:** 1st
Subject Code: BCA-109 N	**Subject Title:** Principle of Management		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Understanding Management Fundamentals:		
CO 2:	Mastering the Art of Planning and Decision-Making:		
CO 3:	Efficient Organizing and Staffing. Effective Leadership and Control.		
CO4:	Managing People and Organizational Behavior.Leveraging Computer Applications in Management		
Credits:4		**Core Compulsory**	
Unit	**Topic**		
I	Management: Meaning & concept, Management principles (Fayol & Taylor), Management process (in brief), Managerial levels, Roles & skills of a manager, Management Theories (Classical, Neo classical, Behavioral, Systems & Contingency)		
II	Planning: Meaning, Purpose & process, Decision making: Concept & process, Organizing: Process, Departmentation, Authority & Responsibility relationships, Decentralization. Staffing: Nature & Importance,		
III	Staffing: Concept, nature & importance of staffing. Directing: Motivation: concept & theories (Maslow's, Herzberg Two factor, McGregor's theory X & Y) , Leadership: Concepts & styles. Controlling: Nature, Importance, significance &Process of control.		
IV	Managing People - Meaning, Need of understanding human behavior in organization, Models of OB, Major concepts in OB (elementary)- Personality, Learning, Perception & Attitude Building.		
V	Relevance of Computer Applications in Different Functional Areas of Management viz.: Financial Management, Production Management, Human Resources Management and Marketing Management.		
Suggested Readings: • Stoner, Freeman& Gilbert, "Management" 6th Edition, Pearson International.; • Parag Diwan & L.N. Aggarwal, "Management Principles & Practices".			
Suggested equivalent online courses: •			

Bachelor of Computer Application			
Programme/Class:		**Year:** 1st	**Semester:** 2nd
Subject Code: BCA-102 N	**Subject Title:** Data Structures using C		
Course out comes:	On completion of the course, the student will be able to:		

CO 1:	Understand concepts such as Data Organizations, Need of Data Structures, Types of Data Structure, Algorithm Complexity, and Time-Space trade-off.
CO 2:	Study linear data structures such as stacks and queues and understand their difference
CO 3:	Study different techniques for solving problems like sorting and searching

Credits:4	**Core Compulsory**

Unit	**Topic**
I	Introduction to Data Structures: Basic Terminology, Elementary Data Organizations, Classification of data structures and its operations. Arrays: Representation of single and multidimensional arrays (up to three dimensions) ; sparse arrays - lower and upper triangular matrices and Tri-diagonal matrices; addition and subtraction of two sparse arrays. (Multidimensional, and, sparse arrays, to be given elementary treatment.)
II	Sorting Techniques: Insertion sort, selection sort and merge sort. Searching Techniques: linear search, binary search and hashing.
III	Stacks and Queues: Introduction and primitive operations on stack; Stack application: Polish Notations; Evaluation of postfix expression; Conversion from infix to postfix; Introduction and primitive operations on queues; D-queues and priority queues.
IV	Lists: Introduction to linked lists; Sequential and linked lists, operations such as traversal, insertion, deletion, searching, Two way lists and Use of headers Trees: Introduction and terminology; Traversal of binary trees; Recursive algorithms for tree operations such as traversal, insertion and deletion;
V	Introduction to and creation of AVL trees and m-way search trees - (elementary treatment to be given); Multilevel indexing and B-Trees: Introduction; Indexing with binary search trees; Multilevel indexing, a better approach to tree indexes; Example for creating a B-tree.

Suggested Readings:

- Yashavant Kanetkar, Data Structure through 'C', BPB Publications.
- S. Chottopadhyay, D. Ghoshdastidar and M.Chottopadhyay, Data Structure through C Language, BPB Publications.

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106102064

Bachelor of Computer Application		
Programme/Class:	**Year:**1st	**Semester:**2nd
Subject Code: BCA-104 N	**Subject Title:** Introduction to Database System	
Course out comes:	On completion of the course, the student will be able to:	
CO 1:	Understand terms related to database design and management.	
CO 2:	Assess various database models.	
CO 3:	Evaluate the normality of a logical data model, and correct any anomalies	
CO4:	Implement relational databases using MySQL.	

Credits:4	**Core Compulsory**

Unit	**Topic**

I	Database: Introduction to database, relational data model, DBMS architecture, data independence, DBA, database users, end users, front end tools
II	E-R Modeling: Entity types, entity set, attribute and key, relationships, relation types, E- R diagrams, database design using ER diagrams, and Suitable Examples for Practice.
III	Relational Data Model: Relational model concepts, relational constraints, primary and foreign key, Functional Dependency, Properties and Types of Functional Dependency, normalization: 1NF, 2NF, 3NF and Suitable Examples for Practice.
IV	Structured Query Language: Types of SQL statements, syntax for different SQL query statements, create a database table, create relationships between database tables, modify and manage tables, queries, forms, reports, modify, filter and view data, and Suitable Examples for Practice.
V	Database Security, Integrity and Control: Security and Integrity threats, Defense mechanism, Integrity, Recent trends in DBMS, Distributed and Deductive databases.

Suggested Readings:

- Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts McGraw Hill Education India Private Limited
- C.J. date, An introduction to Database Systems, Addison Wesley Longman Inc.
- R. Elmsasri, S. Navathe, Fundamentals of Database Systems, Pearson Education.
- MySQL : Reference Manual

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106104135

Bachelor of Computer Application			
Programme/Class:		**Year:** 1st	**Semester:** 2nd
Subject Code: BCA-106 N	**Subject Title:** Business Organization & Management		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Foundations of Business and Management		
CO 2:	Gain knowledge of various forms of business organizations		
CO 3:	Comprehend the concept of organizational structure		
CO4:	Understand the concept of coordination		
Credits:4		**Core Compulsory**	
Unit	**Topic**		
I	Concepts: Business, trade, industry and commerce – Business: Features of business- Trade: Classification, Aids to trade – Industry: Classification – Commerce – Relationship between trade industry and commerce – Functions of Business. Forms of Business Organization Sole Proprietorship: meaning – characteristics –Advantages &disadvantages Partnership - - Meaning – Characteristics – Kinds of Partners – Registration of Partnership – Partnership Deed – Limited liability Partnership (LLP)		
II	Definition – Management an Art, Science or Profession – Manager Defined – Manager vs Leader - Levels of Management – Skills of Management. Management Thought:		

	Contributions of Henry Fayol (14 principles) – F. W. Taylor's Scientific Management – Max Weber's theory of Bureaucracy
III	Planning: Definition - Importance - Steps in planning – limitations - Types of Plans Decision making: Definition – Process – types of decisions: – Programmed and non-programmed decisions – Strategic and routine decisions- major and minor decisions – Individual and group decisions.
IV	Meaning – Organization Structure – Organization chart – Formal and informal Organization – Span of Management – Factors determining Span of Management – Line and Staff concepts. Elements of Organization: Delegation of authority: Meaning – advantages and disadvantages Decentralization : Meaning – advantages and disadvantages
V	Motivation: Definition – Meaning-Types-Theories of motivation: The Need Hierarchy Theory – Hygiene approach to motivation Leadership: Definition - Leadership styles: Autocratic, Democratic, Free Reign – Managerial Grid. Coordination- Definition –need - Difficulties-Effectiveness-Definition –Control process Control -Definition –Control process-Essential of good control system-merits and demerits
Suggested Readings: ● Y.K. Bhushan, Business organization and management, Sultan Chand publisher. ● R.K. Sharma and Shashi k Gupta, Industrial Organization and Management, Kalyani Publications	
Suggested equivalent online courses: ●	

Bachelor of Computer Application			
Programme/Class:		**Year:** 1st	**Semester:** 2nd
Subject Code: BCA-108 N	**Subject Title:** Digital Electronics		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Understand Digital Computer and Digital Systems.		
CO 2:	Understand the logic and applications of Boolean algebra and logic gates.		
CO 3:	Understand the concept of Combinational circuits, Sequential circuits and memory		
Credits:4		**Core Compulsory**	
Unit	**Topic**		
I	Boolean Algebra Basics Laws of Boolean Algebra, Logic Gates, Simplifications of Boolean equations using K-maps. Logic gates NOT , AND, OR, Universal gates- NAND , NOR. EX-OR and EX-NOR gates.		
II	Review of various number systems (Binary, Octal, Hexadecimal), Definition of BCD , Gray codes and Excess – 3 codes and their application		
III	Arithmetic Circuits Adder, Subtractor, Parallel binary adder/Subtractor, binary multiplier and divider. Combinational Circuits Multiplexers, De-Multiplexers, decoders, encoders		

IV	Flip-flops S-R, D, J-K, T, Clocked Flip-flop, Race around condition, Master slave Flip-Flop, Realization of one flip-flop using other flip-flop. Shift Registers Serial-in-serial-out, serial-in-parallel-out, parallel-in-serial-out and parallel-in-parallel-out, Bi-directional shift register.
V	Counters Ripple counter, Synchronous Counter, Modulo Counters, Ring Counter, Twisted Ring Counter. Memory Devices - RAM, ROM, PAL & PLA

Suggested Readings:

- Morris Mano, "Digital Logic and Computer Design", PHI Publications.
- Raj Kamal, "Digital Systems", Principles and Design, Pearson.
- R. P. Jain, "Modern Digital Electronics", TMH, 3rd Edition.

Suggested equivalent online courses:

-

B.C.A.

Second Year

Detailed Syllabus

Bachelor of Computer Application			
Programme/Class:		**Year:** 2nd	**Semester:** 3rd
Subject Code: BCA-201 N	**Subject Title:** Object oriented programming using JAVA		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Use the syntax and semantics of java programming language and basic concepts of OOP.		
CO 2:	Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.		
CO 3:	Apply the concepts of Multi-threading and Exception handling to develop efficient and error free codes.		
Credits: 4		**Core Compulsory**	

Unit	**Topic**
I	Java introduction: History-Java and the Internet-Java Applets and Applications-Features of Java, Basic of OOP ,How Java differs from C and C++ , Java Program Structure, Simple Java Program, Java Tokens, Java Statements, Java Virtual Machine, Command Line Arguments, Constants, Variables, and Data Types, Type Casting, Operators and Expressions, Decision Making and Branching
II	Type Casting, Operators and Expressions, Decision Making and Branching. Classes, Objects and Methods, Constructors, Static Members, Nesting of Methods, Inheritance: Extending a. Class, Overriding Methods, final Variables and Methods, Final Classes, Finalize Methods, Abstract Methods and Classes
III	Interfaces: Introduction, Defining Interfaces, Extending Interfaces, implementing Interfaces, Accessing Interface Variables. Packages: Introduction, Java API Packages, Using system Packages, Naming Conventions, Creating Packages, Accessing a Packages, Using a Package, Adding a Class to a Package, Hiding Classes. Arrays, String and Vectors, String Handling, Wrapper Classes
IV	Managing Errors and Exceptions: Introduction, Types of Errors, Exceptions, Syntax of Exception Handling Code, Multiple Catch Statements, Using finally Statement, Throwing Our Own Exceptions, Using Exceptions for Debugging. 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.
V	Managing Input/Output Files in Java: Introduction, Concepts of Streams Stream Classes, Byte Stream Classes, Character Stream Classes, Using Streams, Other Useful I/O Classes, using the File Class, Input/Output Exceptions, and Creation of Files.

Suggested Readings:

- Balagurusamy, Programming with Java, A Primer 2nd Edition, Tata McGraw Hill, New Delhi
- Herbert Schildt, The Complete Reference- Java, 7th Edition, Tata McGraw- Hill Publishing Co. Limited, New Delhi.

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106105191

Bachelor of Computer Application			
Programme/Class:		**Year:** 2nd	**Semester:** 3rd
Subject Code: BCA-203 N	**Subject Title:** Numerical Analysis and Statistical Techniques		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Analyze statistical data graphically using frequency distributions and cumulative frequency distributions		
CO 2:	Analyze statistical data using measures of central tendency, dispersion and location		
CO 3:	Employee the principles of linear regression and correlation, including least square method, predicting a particular value of Y for a given value of X and significance of the correlation coefficient.		
CO4:	Use different probability distributions to solve simple practical problems.		
Total No. of Lectures-Tutorials-Practical(in hours per week): 4-0-0			

Unit	Topic
I	Mathematical Modeling and Engineering Problem Solving: A Simple Mathematical Model, Conservation Laws and Engineering Problems Approximations and Round-Off Errors: Significant Figures, Accuracy and Precision, Error Definitions, Round-Off Errors Truncation Errors and the Taylor Series: The Taylor Series, Error Propagation, Total Numerical Errors, Formulation Errors and Data Uncertainty
II	Solutions of Algebraic and Transcendental Equations: The Bisection Method, The Newton-Raphson Method, The Regula-falsi method, The Secant Method. Interpolation: Forward Difference, Backward Difference, Newton's Forward Difference Interpolation, Newton's Backward Difference Interpolation, Lagrange's Interpolation.
III	Solution of simultaneous algebraic equations (linear) using iterative methods: Gauss-Jordan Method, Gauss-Seidel Method. Numerical differentiation and Integration: Numerical differentiation, Numerical integration using Trapezoidal Rule, Simpson's 1/3rd and 3/10th rules. Numerical solution of 1st and 2nd order differential equations: Taylor series, Euler's Method, Modified Euler's Method, Runge-Kutta Method for 1st and 2nd Order Differential Equations.
IV	Least-Squares Regression: Linear Regression, Polynomial Regression, Multiple Linear Regression, General Linear Least Squares, Nonlinear Regression Linear Programming: Linear optimization problem, Formulation and Graphical solution, Basic solution and Feasible solution.
V	Random variables: Discrete and Continuous random variables, Probability density function, Probability distribution of random variables, Expected value, Variance. Distributions: Discrete distributions: Uniform, Binomial, Poisson, Bernoulli, Continuous distributions: uniform distributions, exponential, Normal distribution state all the properties and its applications.

Suggested Readings:

- Introductory Methods of Numerical Methods, S. S. Shastri
- Fundamentals of Mathematical Statistics, S. C. Gupta, V. K. Kapoor

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106103068

Bachelor of Computer Application			
Programme/Class:		**Year:**2nd	**Semester:**3rd
Subject Code: BCA-205 N	**Subject Title:** Operating System		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Understand fundamental operating system abstractions such as processes, threads, files, semaphores, IPC abstractions, shared memory regions, etc.,		
CO 2:	Analyze important algorithms e.g. Process scheduling and memory management algorithms		
CO 3:	Categorize the operating system's resource management techniques, dead lock management techniques, memory management techniques		
Credits:4		**Core Compulsory**	
Unit	**Topic**		
I	Introduction: Definition, Design Goals, Evolution; Batch processing, Multi-programming, Timesharing; Structure and Functions of Operating System.		
II	Process Management: Process states, State Transitions, Process Control Structure, Context Switching, Process Scheduling, Threads.		
III	Memory Management: Address Binding, Dynamic Loading and Linking Concepts, Logical and Physical Addresses, Contiguous Allocation, Fragmentation, Paging, Segmentation, Combined Systems, Virtual Memory, Demand Paging, Page fault, Page replacement algorithms, Global Vs Local Allocation, Thrashing, Working Set Model, Paging.		
IV	Concurrent Processes: Process Interaction, Shared Data and Critical Section, Mutual Exclusion, Busy form of waiting, Lock and unlock primitives, Synchronization, Classical Problems of Synchronization, Semaphores, Monitors, Conditional Critical Regions, System Deadlock, Wait for Graph, Deadlock Handling Techniques: Prevention, Avoidance, Detection and Recovery		
V	File and Secondary Storage Management: File Attributes, File Types, File Access Methods, Directory Structure, Allocation Methods, Free Space management; Disk Structure, Logical and Physical View, Disk Head Scheduling.		

Suggested Readings:

- A. Silberschatz, P. B. Galvin, G. Gagne, Operating System Concepts, Addison Wesley
- W. Stalling, Operating Systems, Internals and Design Principles, PHI.
- A. S. Tanenbaum, Modern operating Systems

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106102132

Bachelor of Computer Application			
Programme/Class:		**Year:**2nd	**Semester:**3rd
Subject Code: BCA-207 N	**Subject Title:** Computer Organization and Architecture		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Remember and understand the basics of computer architecture, organization and Design.		
CO 2:	Understand the operations of CPU, I/O and Memory		

CO 3:	Understand the concept of parallel processing and pipelining

Credits:4	**Core Compulsory**

Unit	**Topic**
I	Basic Organization: Stored Program Concept, Components of a Computer System, Machine Instruction, Opcodes and Operands, Instruction Cycle, Organization of Central Processing Unit: ALU, Hardwired & Micro programmed Control Unit, General Purpose and Special Purpose Registers.
II	Functioning of CPU: Instruction Formats, Op Codes, Instruction Types, Addressing Modes, Common Microprocessor Instructions, Multi-core Architecture, Multiprocessor and Multicomputer.
III	Memory Organization: Memory Hierarchy, Cache Memory, Main Memory (DRAM and ROM),Secondary Memory, Virtual Memory, Auxiliary memory, Associative memory, Characteristics of different types of Memory.
IV	I/O Organization: Peripheral devices, I/O interface, Modes of Transfer, Priority Interrupt, Direct Memory Access, Input-Output Processor, and Serial Communication. I/O Controllers, Asynchronous data transfer, Strobe Control, Handshaking.
V	Parallel processing, Amdahl's law, Pipelining, Flynn's classification, space-time diagram, speedup ratio, Arithmetic pipeline, Instruction pipeline

Suggested Readings:

- Morris Mano, Computer System Architecture, 3rd Edition, Prentice-Hall of India Private Limited.
- William Stallings, Computer Organization and Architecture, 4th Edition, Prentice Hall of India Private Limited.

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106103068

Bachelor of Computer Application		
Programme/Class:	**Year:** 2nd	**Semester: 4th**
Subject Code: BCA-202 N	**Subject Title:** Programming in Python	
Course out comes:	On completion of the course, the student will be able to:	
CO 1:	Remember the basic principles of Python programming language	
CO 2:	Implement object-oriented concepts in Python.	
CO 3:	Analyze Functional Programming Paradigm with Python.	
CO4:	Create tools for web scrapping.	

Credits:4	**Core Compulsory**

Unit	**Topic**
I	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.

II	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
III	Decision making and Branching: Control statements (Branching, Looping, Conditional Statement, Difference between break, continue and pass, default arguments. Defining Functions.
IV	Classes and Objects: An introduction to object-oriented programming in Python. objects, operator overloading, overriding, special methods. Inheritance, polymorphism and composition
V	Iterators and Generators: Iteration protocol, Inerrable objects, generators and generator expressions. Use of generators, assertions. Testing and debugging of a python project, Web Scrapping in Python.
Suggested Readings: ● T. Budd, Exploring Python, TMH. ● Allen Downey, Jeffrey Elkner, Chris Meyers. ● How to think like a computer scientist, learning with Python / 1st Edition.	
Suggested equivalent online courses: ●	

Bachelor of Computer Application			
Programme/Class:		**Year:** 2nd	**Semester: 4th**
Subject Code: BCA-204 N	**Subject Title:** Unix and Shell Programming		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Understanding Unix fundamentals		
CO 2:	Understand the states and data structures of Unix processes		
CO 3:	Develop shell scripts, understanding variables, expressions, etc.		
CO4:	Students will gain expertise in looping control structures		
Credits:4		**Core Compulsory**	
Unit	**Topic**		
I	Introduction: History, salient features, Unix system architecture, Unix command format, Unix internal and external commands, Directory commands, File related commands, Disk related commands, general utilities. Unix File System: Boot inode, super and data block, in-core structure, Directories, conversion of pathname to inode, inode to a new file, Disk block allocation. Process Management: Process state and data structures of a Process, User vs, kernel node, context of a Process, background processes, Process scheduling commands, Process terminating and examining commands.		
II	Secondary Storage Management: Formatting, making file system, checking disk space, mountable file system, disk partitioning, file compression. Special Tools and Utilities: Filters, Stream editor SED and AWK, Unix system calls and library functions, Processes, signals and Interrupts, storage and compression facilities.		

III	Shell Programming: vi editor, shell types, shell command line processing, shell script features, executing a shell script, system and user-defined variables, expr command, shell screen interface, read and Eco statement, command substitution, escape sequence characters, shell script arguments, positional parameters, test command, file test, string test, numeric test
IV	Conditional Control Structures-if statement, case statement Looping Control Structure-while, until, for, statements. Jumping Control Structures – break, continue, exit.

Suggested Readings:

- UNIX-Concepts & Applications, Sumitava Das, TMH
- Learning UNIX Operating System, Peek, SPD/O'REILLY
- Understanding UNIX, Srirengan, PHI.
- Learning the Vi Editor, Lamb, SPD/O'REILLY
- Essentials Systems Administration, Frisch, SPD/O'REILLY

Suggested equivalent online courses:

-

Bachelor of Computer Application			
Programme/Class:		**Year:** 2nd	**Semester:**4th
Subject Code: BCA-206 N	**Subject Title:** Accounting and Financial Management		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Identify and apply accounting principles, concepts, and conventions in practical scenarios.		
CO 2:	Understand the purpose and preparation of a trial balance.		
CO 3:	Explore standard costing, its objectives, advantages, and limitations.		
CO4:	Learn to prepare cost sheets and tender price statements.		
Credits:4		**Core Compulsory**	

Unit	**Topic**
I	Introduction to Accountancy: definition, objectives, advantages & limitations; Accounting Principles, Concepts & Conventions, Double entry System; Rules of Debit & Credit – Modern (American) Approach & Traditional rules (British Approach), Journal; Accounting equation. Ledger Accounts: Meaning, classifications, ledger posting from journal entries, ledger posting from Cash book, Accounting for Cash - Cash book (three column Cash book).
II	Trial Balance: Meaning, special features and objectives; Preparation of trial balance, financial statements (with adjustment): Meaning of Trading, Profit & Loss a/c and Balance Sheet, Adjustments: Closing stock, outstanding expenses, prepaid expenses, Accrued income, advance income, bad debts, provision for bad and doubtful debt, provision for discount on debtors and creditors, Depreciation, interest on capital, interest on drawing, interest on loans.
III	Ratio Analysis: Meaning of Accounting ratios, objectives and limitations. Types of ratios and their usefulness – Liquidity Ratio, Current ratio, Profitability Ratio, Efficiency ratio, solvency ratios, Stock turnover ratio, Gross Profit Ratio, Net Profit Ratio, Debit Equity Ratio, Debtors turnover Ratio.
IV	Introduction to Management accounting: Meaning, objectives, nature & scope, advantages & limitations of Management accounting. Differences between Financial Accounting and Management Accounting, Management Accounting and Cost Accounting. Management Accountant's position, roles and responsibilities. Standard costing- Meaning, objective,

	advantages & limitations of Standard Costing.
V	Budgeting: Definition, Budget Vs Forecasts, and Essentials of budgeting. Types of Budgets – Functional, Master, Fixed, flexible Budget and zero-based budget. (Theory and simple problems), Budgetary Control: Meaning, objectives, advantages and limitations. Unit Costing: Preparation of Cost Sheet and Tender Price Statement.
Suggested Readings: • N. Maheshwari, Cost and Management Accounting, Sultan Chand & Sons. • Basu & Das, Practice in Accountancy, Vol-I, Rabindra Library. • M. N. Arora, Cost & Management Accounting, Vikas Publishing House Pvt Limited.	
Suggested equivalent online courses: •	

Bachelor of Computer Application			
Programme/Class:		**Year:** 2nd	**Semester:**4th
Subject Code: BCA-208 N	**Subject Title:** Computer Networks		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Understanding of computer networks, data communication, and the key components involved.		
CO 2:	Grasp the OSI and TCP/IP network models, including the roles and interactions of different layers.		
CO 3:	Learn about remote logging (TELNET), electronic mail protocols (SMTP, POP, IMAP), file transfer (FTP), and web protocols (HTTP).		
CO4:	Explore essential security services such as message confidentiality, integrity, authentication, and digital signatures.		
Credits:4		**Core Compulsory**	
Unit	**Topic**		
I	Computer Networks: Introduction to computer network, data communication, Network components, Uses of networks and Topologies, Categories of Network (LAN, MAN & WAN), Transmission Media, Trace-route and socket API, Protocols and layering, Reference models (Internet, OSI), LAN switching (switch, hubs, Repeater, Bridge, Gateway, Router)		
II	Network Models: Client/ server network and Peer-to-peer network, OSI layers and functionalities, TCP/IP layers and functionalities. TC/IP Protocol suite.		
III	Addressing and Routing: Logical Addressing- IPv4 Addresses, IPv6 Addresses. TCP/IP datagram Format, Internet protocol- Internetworking, IPv4, IPv6, transition from IPv4 to IPv6. Address Mapping- ARP, RARP, BOOTP, DHCP, Error Reporting- ICMP. Multicasting-IGMP		
IV	Network Applications: DNS-Name space, Distribution of name space, DNS in the Internet, resolution, DDNS. Remote logging- TELNET, Electronic Mail- SMTP, POP, IMAP, File Transfer- FTP, WWW, HTTP, Network Management: SNMP.		

V	Network Security: Security services- message confidentiality, message integrity, Message authentication, Digital signature, Entity authentication, Key management- Symmetric, Asymmetric. Security in the Internet: IPSec, TLS, PGP, VPN and Firewalls

Suggested Readings:

- Behrouz. A. Forouzan : Data Communication and Networking, Tata McGraw Hill Publication.
- Andrew. S.Tanenbaum : Computer Networks, Prentice Hall Publication.

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106105080

B.C.A.

Third Year

Detailed Syllabus

Bachelor of Computer Application			
Programme/Class:		**Year:3rd**	**Semester:5th**
Subject Code: BCA-301 N	**Subject Title:** Artificial Intelligence		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Understand the basics of Artificial Intelligence and gain knowledge of the learning process and its models. Understand basic concepts of machine learning, ANN, SVM and fuzzy logic		
CO 2:	Understand different types of search techniques.		
CO 3:	Understand different knowledge representation schemes.		
CO4:	Understand the AI applications in the design of expert systems.		
Credits:4		**Core Compulsory**	

Unit	**Topic**
I	Introduction: Definitions and Approaches, History of AI, Philosophical Foundations of AI, Turing's Test, Searle's Chinese Room, Symbolic and Connectionist AI, Concept of Intelligent Agents.
II	AI Problem Solving: Problem solving as state space search, production system, control strategies and problem characteristics; Search techniques: Breadth First and Depth-first, Hill-climbing, Heuristics, Best-First Search, A* algorithm, Problem reduction and AO* algorithm, Constraints satisfaction, Means Ends Analysis, Game Playing.
III	Knowledge Representation and Reasoning: Predicate and prepositional logic, Resolution, Unification, Deduction and theorem proving, Question answering;
IV	Forward versus backward reasoning, Matching, Indexing, Semantic Net, Frames, Conceptual Dependencies and Scripts.
	Applications: Introduction to Natural Language Processing, Expert System.

Suggested Readings:

- S. Russel, P. Norvig, Artificial Intelligence: A Modern Approach, Pearson.
- E. Rich, K. Knight, Artificial Intelligence, Tata McGraw Hill.
- N. J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann.

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106102220

Bachelor of Computer Application			
Programme/Class:		**Year:3rd**	**Semester:5th**
Subject Code: BCA-303 N	**Subject Title:** Web Technologies		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Understand best technologies for solving web client/server problems		
CO 2:	CO 2: Analyze and design real time web applications		
CO 3:	Use Java script for dynamic effects and to validate form input.		
CO4:	Analyze to Use appropriate client-side and Server-side application technology		
Credits:4		**Core Compulsory**	

Unit	Topic
I	Web Basics and Overview: Introduction to Internet, World Wide Web, Web Browsers, URL, MIME, HTTP, Web Programmers Toolbox. HTML Common tags: List, Tables, images, forms, frames, Cascading Style Sheets (CSS) & its Types. Introduction to Java Script, Declaring variables, functions, Event handlers (onclick, onsubmit, etc.,) and Form Validation.
II	Introduction to XML: Document type definition, XML Schemas, Presenting XM, Introduction to XHTML, Using XML Processors: DOM and SAX. PHP: Declaring Variables, Data types, Operators, Control structures, Functions.
III	Web Servers and Servlets: Introduction to Servlets, Lifecycle of a Servlet, JSDK, Deploying Servlet, The Servlet API, The javax. Servlet Package, Reading Servlet parameters, Reading Initialization parameters. The javax.servlet HTTP package, Handling Http Request & Responses, Cookies and Session Tracking.
IV	Database Access: Database Programming using JDBC, JDBC drivers, Studying Javax.sql.* package, Connecting to database in PHP, Execute Simple Queries, Accessing a Database from a Servlet. Introduction to struts frameworks.
V	JSP Application Development: The Anatomy of a JSP Page, JSP Processing. JSP Application Design and JSP Environment, JSP Declarations, Directives, Expressions, Scripting Elements, implicit objects. Java Beans: Introduction to Beans, Deploying java Beans in a JSP page.

Suggested Readings:

- Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech
- Core SERVLETS ANDJAVASERVER PAGES VOLUME 1: CORE TECHNOLOGIES By Marty Hall and Larry Brown Pearson

Suggested equivalent online courses:

-

Bachelor of Computer Application			
Programme/Class:		**Year:**3rd	**Semester:**5th
Subject Code: BCA-305 N	**Subject Title:** Computer Graphics and Animation		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Understand the basics of computer graphics, different graphics systems and applications of computer graphics.		
CO 2:	Understand various algorithms for scan conversion and filling of basic objects and their comparative analysis		
CO 3:	Understand various algorithms for scan conversion and filling of basic objects and their comparative analysis. Extract scene with different clipping methods and its transformation to graphics display device.		
CO4:	Understanding animation and its principles.		
Credits:4		**Core Compulsory**	

Unit	Topic

I	Introduction and applications History of Computer Graphics, what is CG, Types of Computer Graphics, Area of Computer Graphics, Display Devices: Refresh CRT, Random Scan and Raster scan monitors, Color CRT, Plasma Panel displays LCD Panels, Raster-scan System, Random scan System, Graphic software, Input/output Devices, Tablets
II	2D Transformation: 2D Transformation, Use of homogeneous coordinate Systems, Composite Transformation: Translation, Scaling, Rotation, Mirror Reflection, Rotation about an arbitrary point. Clipping and Windowing, Clipping Operation, Line Clipping Algorithms: The Mid-Point subdivision method, Cohen-Sutherland Line Clipping Algorithms, Polygon Clipping, Sutherland Hodgeman Algorithms, Text Clipping,3D Transformation:3D Transformation, Translation, Rotation, Scaling, Projection, Types of projection.
III	Points and Lines, Frame buffer, Line Drawing Algorithms, Circle Generating Algorithms, EllipseGenerating Algorithms.
IV	Quadric Surfaces: Sphere, Ellipsoid and Torus, Superquadrics: Superellipse, Superellipsoid, Curve drawing, Spline Representation Cubic Spline, parametric representation, need for cubic curves, drawing cubic Beziers curves & Surfaces, Beziers curves and B-spline curves & Surfaces B-spline curves (No derivation needed).
V	Animation: Introduction to Animation, Principles of Animation, Types of Animations, Tweaking & Morphing

Suggested Readings:

- S. Harringion, Computer Graphics – A programming, Tata McGraw Hill.
- J.D. Foley & A VanDam, Fundamentals of Interactive Computer Graphics, Addison Wesley.
- Hearn & P.M. Baker, Computer Graphics, Prentice Hall India.

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106102063

Bachelor of Computer Application			
Programme/Class:		**Year:**3rd	**Semester:**5th
Subject Code: BCA-307 P	**Subject Title:** Industrial Training		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Identify various technologies and fields for practical training.		
CO 2:	Understand the industrial problems and applying engineering knowledge to solve the industrial problems.		
CO 3:	Analyze ethical practices and tools in used in different technologies		
CO4:	Design and develop the skills to make software/hardware, reports and presentation, related to industrial training.		
Credits:4		**Core Compulsory**	
Unit	**Topic**		

	Students will have to undergo 6 to 8 weeks of Summer/industrial training/internship during the summer vacation after BCA IV semester examination. After successful completion of the training, the concerned students will submit their training completion certificate along with the training report in the form of a project. The internship of the said student will be evaluated by internal and external examiners/experts in BCA 5th Sem on the basis of their training report, presentation and oral examination etc.

Bachelor of Computer Application			
Programme/Class:		**Year:**3rd	**Semester:**6th
Subject Code: BCA-302 N	**Subject Title:** Introduction to Data science		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Understand the concept of Data Science and its evolution		
CO 2:	Explore techniques for data cleaning, data integration and transformation processes.		
CO 3:	Learn to create visual representations of data using tools like box plots, pivot tables, and heat maps.		
CO4:	Understand the concept of generalization error and its importance in model evaluation.		
Credits:4		**Core Compulsory**	

Unit	**Topic**
I	Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.
II	Data Collection and Data Pre-Processing Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.
III	Exploratory Data Analytics Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.
IV	Model Development Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.
V	Model Evaluation Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

Suggested Readings:

- Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.
- Cathy O'Neil and Rachel Schutt, "Doing Data Science", O'Reilly.

Suggested equivalent online courses:

- https://onlinecourses.swayam2.ac.in/imb23_mg64/preview

Bachelor of Computer Application			
Programme/Class:		**Year:** 3rd	**Semester:** 6th
Subject Code: BCA-304 N	**Subject Title:** Cloud Computing		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Understand the key dimensions of the challenges and benefits of Cloud Computing.		
CO 2:	Describe the principles of Parallel and Distributed Computing and evolution of cloud computing from existing technologies		
CO 3:	Implement different types of Virtualization technologies and Service Oriented Architecture systems		
CO4:	Choose among various cloud technologies for implementing applications.		

Unit	Topic
I	Introduction to Parallel and Distributed Computing; Introduction to Cloud Computing; Characteristics and benefits of cloud computing; Historical developments and evolution of cloud computing: Distributed Systems, Virtualization, Web 2.0, Service-oriented computing, Utility Computing; Cloud Computing Reference Model.
II	Introduction to virtualization; Characteristics of virtualized environments; Taxonomy of virtualization techniques; Virtualization and cloud computing; Pros and cons of 46 virtualization; Technology examples: Xen: paravirtualization, VMware: full virtualization, Microsoft Hyper-V.
III	Cloud Computing Architecture; Service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS); Deployment models: Public, Private, Hybrid, Community; IaaS: Introduction to IaaS, Resource Virtualization i.e. Server, Storage and Network virtualization.
IV	PaaS: Introduction to PaaS, Cloud platform & Management of Computation and Storage; SaaS: Introduction to SaaS, Cloud Services, Web services, Web 2.0, Web OS; Case studies related to IaaS, PaaS and SaaS.
V	Economics of the cloud; Open Challenges in Cloud Computing; Introduction to emerging computing paradigms and research challenges: Edge Computing, Mobile Cloud Computing, Fog Computing etc.; Introduction to IoT Cloud; Study on simulators related to cloud computing and emerging computing paradigms.

Suggested Readings:

- R. Buyya, C. Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing, McGraw Hill Education
- B. Sosinsky, Cloud Computing Bible, Wiley.

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106105167

Bachelor of Computer Application			
Programme/Class:		**Year:**3rd	**Semester:**6th
Subject Code: BCA-306 N	**Subject Title:** Internet of Things		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Comprehensive Understanding of IoT Fundamentals		
CO 2:	Proficiency in IoT Network Engineering		
CO 3:	Data and Analytics Expertise for IoT		
CO4:	Application of IoT Across Industries		
Credits:4		**Core Compulsory**	

Unit	Topic
I	Introduction to IoT: Genesis of IoT, IoT and Digitization, IoT Challenges, Comparing IoT architectures, a simplified IoT architecture, The core IoT functional Stack, IoT data management and compute stack.
II	Engineering for IoT Networks: Sensors, Actuators, Smart Objects, Sensor Networks, IoT Access Technologies, IP as the IoT Network Layer, Applications protocols for IoT.
III	Data and Analytics for IoT: An introduction to data analytics for IoT, Machine Learning, Big data analytics tools and technology, edge streaming analytics, network analytics
VI	Cloud storage models and Communication APIs of IoT Systems, IoT Security Challenges, IoT System's Security Practices
V	IoT in Industry: Manufacturing, Oil and Gas, Utilities, Smart and Connected Cities, Transportation, Mining, Public Safety.

Suggested Readings:

- D. Hanes, G. Salgueiro, P. Grossetete, R. Barton, J. Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, CISCO.
- Rajkamal, Internet of Things, McGraw Hill Education.
- Arshdeep Bahga, Vijay Madisetti," Internet of Things (A Hands-on-Approach)", University Press India Pvt. Ltd.

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106105166

Bachelor of Computer Application			
Programme/Class:		**Year:**3rd	**Semester:**6th
Subject Code: BCA-308 P	**Subject Title: Major Project**		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Identify the complex Programming problems for software project and applying technical knowledge to solve the problems.		
CO 2:	Understanding the systematic process & sound technical knowledge about the project		
CO 3:	Demonstrate different methodologies for making projects and documentation/report writing.		
CO4:	Design software solutions to various problems used for societal benefits.		

Credits:4	Core Compulsory

Unit	Topic
I	Project work is part of the BCA program which will provide students with hands-on experience in developing quality software applications. During the development of the project, a student shall involve himself in all the stages of the software development life cycle (SDLC) like requirements analysis, systems design, software development/coding, testing and documentation, with an overall emphasis on the development of reliable software systems. The primary emphasis of the project work is to understand and gain the knowledge of the principles of software engineering practices, and develops good understanding of SDLC. Every student shall undertake Project work in the V semester starting with the project synopsis and culminating with the project report in the VI semester. Students are encouraged to choose a project, of six months' duration either at place of work or any other location. It is advised to students to develop their project for solving problems of software industry or any research organization. Topics selected, should be appropriate enough to justify as a BCA project.

B.C.A.

Electives

Detailed Syllabus

Bachelor of Computer Application			
Programme/Class:		**Year:** 1st	**Semester:** 2nd
Subject Code: BCA-401 E	**Subject Title:** Mathematics		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Fundamental Understanding of Mathematical Concepts		
CO 2:	Analytical and Problem-Solving Skills		
CO 3:	Mathematical Communication and Representation		
CO4:	Application to Real-World Problems		
Credits: 4		**Elective**	

Unit	Topic
I	**SETS:** Sets, Subsets, Equal Sets, Universal Sets, Finite and Infinite Sets, Properties, Operation on Sets, Union, Intersection and Complements of Sets, Cartesian Product, Cardinality of Set, Simple Applications, Power Set, Proper set, Equivalent set.
II	**RELATIONS AND FUNCTIONS**: Properties of Relations, Types of Relations, Equivalence Relation, Partial Order Relation Function: Domain and Range, Onto, Into and One to One Functions, Composite and Inverse Functions, Mathematical Induction.
III	**FUNCTIONS OF SEVERAL VARIABLES:** Limit and Continuity, Indeterminate Forms, Partial Differentiation, Chain Rule, Extrema of Functions of 2 Variables, Euler's Theorem, Jacobian Theorem, Vector Differentiation Gradient, Divergent, Curl.
IV	**Infinite Series:** Convergent series, Divergent series Oscillatory series, Leibnitz test (Alternating Series test), Positive term series test, p-series test, Comparison test, D'Almberts ratio test, Cauchy's nth root test, Rabbe's test. and Logarithmic test.
V	**Mean Value Theorems:** Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean Value theorem and Maclaurin series for Sin x, Cos x, Tan x, log(1-x), log(1+x)m, ex etc, Indeterminate forms, maxima and minima(Application of maxima or minima to simple problems).

Suggested Readings:

- Advanced Engineering Mathematics, Erwin Kreyszig
- Prof. P.N. Chatterji Infinite Series
- S.K. Sarkar, "Discrete Maths", S. Chand & Co.
- Shanti Narayan, Differential Calculus

Suggested equivalent online courses:

-

- **This course can be opted as an elective by the students of following subjects:** List of Elective Papers E1.
- This Mathematics subject will be a compulsory from the list of elective papers E1 for those students who did not have passed Intermediate (12th) class with Mathematics subject. It will be treated as an elective for remaining students.

Bachelor of Computer Application			
Programme/Class:		**Year:** 1st	**Semester:** 2nd
Subject Code: BCA-402 E	**Subject Title:** Environment and Ecology		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Students will gain a comprehensive understanding of natural resources.		
CO 2:	Students will develop a heightened awareness of environmental pollution		
CO 3:	Students will be able to apply their knowledge of natural resources and ecosystems to evaluate real-world environmental problems and make informed decisions about resource management.		
CO4:	Students will develop critical thinking skills by analyzing complex environmental issues and evaluating potential solutions based on scientific evidence.		
Credits: 4		**Elective**	

Unit	Topic
I	Introduction & Natural Resources - Definition, Scope and importance Renewable Resources and associated problems: Forest Resources, Water Resources, Minerals Resources, Food Resources, Energy Resources, Land Resources
II	Ecosystems: Concept of Ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Food chains, food webs and ecological pyramids
III	Biodiversity and its Conservation: Definition of Biodiversity, Biodiversity at national and local levels, Hot-spots of biodiversity in India, Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts; Endangered and endemic species of India. Conservation of biodiversity
IV	Environmental Pollution: Definition, Causes, Effects and Control measures of :- Air Pollution, Water Pollution, Soil Pollution, Noise Pollution, E Waste; Solid Waste Management : Causes, effects and control measures of urban and industrial wastes, Disaster Management: Floods, Earthquakes, Cyclones and Landslides
V	Social Issues, Development and the Environment: Sustainable development. (concept only), Water conservation; Rain water harvesting. Shifting Cultivation and its impact, Wasteland reclamation; Population growth; Population explosion Global Warning and Green House effects, Ozone layer depletion

Suggested Readings:

- S.S. Dara, A Textbook of Environmental Studies & Pollution Control, S.Chand & Co. N. Delhi.
- Sovan Roy, Environmental Science: A Comprehensive Treatise on Ecology and Environment, Publishing Syndicate.

Bachelor of Computer Application			
Programme/Class:		**Year:** 1st	**Semester:** 2nd
Subject Code: BCA-403 E	**Subject Title:** Introduction to E-Governance		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Grasp the basics of E-Governance, its importance, and its impact on personal and professional life.		

CO 2:	Understand terminologies related to National e-Governance Plan and its framework.
CO 3:	Analyze and the development process of E-Governance Projects
CO4:	Understanding the Reengineering of E-Governance process

Credits:4	**Elective**

Unit	**Topic**
I	E-Governance: Introduction to e-Governance, Needs of E-Governance, Issues in E-Governance applications and the Digital Divide; Evolution of E-Governance, Its scope and content, components of e-Governance, Present global trends of growth in E-Governance, Areas of e-Government, Critical success and failure factors for eGovernance. Role of social media in e-Governance.
II	E-Governance Approaches in India-The National e-Governance Plan: Introduction to NeGP, National e-Governance Plan, NeGP vision, The framework for e- Governance, National e-Governance strategy, Major Components of National e-Governance Plan, Mission Mode Projects, Infrastructure pillars of NeGP, Capacity Building initiatives under NeGP, Brief overview of Mizoram eGovernance initiatives.
III	E-Governance Project Development and Management: Introduction to e-Government Project Development, Conceptualization Phase, Architect Phase, Define Phase, Support Phase, e-Government Project Management Phase. Business Model for e-Government Projects, Public Private Partnership for e-Government. Security for e-Governance Projects.
IV	Capacity Building & Change Management: Capacity Building for e-Governance, Governance structure for e-Gov Projects, Change Management for eGovernance Projects. Role of Leadership in e-Governance Projects.
V	Government Process Re-engineering: Process Reforms for e-Governance Projects, Tools and techniques for Government Process Re-engineering, Legal Reforms, Technology Management and Enterprise Architecture for e-Governance, Case Studies in eGovernment (G2C, G2B). Studies in eGovernment (G2C, G2B).

Suggested Readings:

- C.S.R. Prabhu: E-Governance: Concepts and Case Studies, Prentice-Hall of India Pvt. Limited.
- Backus, Michiel: E-Governance in Developing Countries, IICD Research Brief, No. 1.

Suggested equivalent online courses:

Bachelor of Computer Application			
Programme/Class:		**Year:**2nd	**Semester:**3rd
Subject Code: BCA-411 E	**Subject Title:** Discrete Mathematics		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Understand sets and perform operations and algebra on sets.		
CO 2:	Analyze logical propositions via truth tables. Understand and construct correct mathematical arguments.		
CO 3:	Determine properties of relations, identify equivalence and partial order relations, sketch relations		

CO4:	Understand algebraic structures, graph theory.

Credits:4	**Elective**

Unit	**Topic**
I	Introduction of set; Sets and Elements; Universal Set and Empty Set; Subsets; Venn Diagrams; Set Operations; Boolean algebra: partial ordering, lattice and algebraic systems, principle of duality, basic properties of algebraic systems defined by lattices, distributive and complemented lattices, Boolean lattices and Boolean algebra, uniqueness of finite Boolean algebra, Boolean functions and Boolean expressions.
II	Introduction; Propositions and Compound Propositions; Basic Logical Operations; Propositions and truth Tables; Tautologies and Contradictions; Logical Equivalence; Algebra of Propositions; Conditional and Biconditional Statements; Arguments; Logical Implication; Propositional Functions, Quantifiers; Negation of Quantified Statements; Normal Forms; Predicate Logic.
III	Permutations and Combinations: Factorial Notation; Fundamental Principle of Counting; Permutations (including practical problems); Combinations (including practical problems). Binomial Theorem: Binomial Coefficient and Pascal's Triangle; Binomial Theorem for Positive Integral Index; Observations in a Binomial Expansion – general term, middle terms, pth term from the end and the beginning, coefficient, independent term.
IV	Group theory: definitions of semi-group, monoid, group, permutation group and simple examples. Cosets, Lagrange's theorem, normal subgroup, homomorphism, Burnside's theorem (statement only) and its simple applications, codes and group codes.
V	Graphs and Multigraphs; Subgraphs, Isomorphic and Homeomorphic Graphs; Paths and Connectivity; Cutpoints and Bridges; Eulerian and Hamiltonian Graphs;Labeled and Weighted Graphs; Complete, Regular and Bipartite Graphs; Tree; Spanning Trees; Minimum Spanning Trees; Planar and Nonplanar Graphs; Graph Colorings; Linked Representation of a Graph (Adjacency Matrix and Incidence Matrix).

Suggested Readings:

- C.L.Liu, Elements of Discrete Mathematics, 3Ed, TMH.
- S. Lipschutz& M. L. Lipson, Discrete Mathematics (Schaum's Series),Tata McGraw Hill.

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106103205

Bachelor of Computer Application			
Programme/Class:		**Year:**2nd	**Semester:**3rd
Subject Code: BCA-412 E	**Subject Title:** Personality and Soft Skills Development		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Grasp the basics of personality development, its importance, and its impact on personal and professional life.		
CO 2:	Learn motivational techniques to boost self-confidence and personal development.		
CO 3:	Effective Written Communication		
CO4:	Oral Communication and Public Speaking		

Credits:4	Elective

Unit	Topic
I	Introduction to Personality Development, Basics of Personality Development and its importance- Definition, Components and Scope, Communication Skills and Personality Development.
II	Grooming Personality- Motivation, Leadership skills and team building, Goal setting, Time Management and Effective planning.
III	Element of a letter, Email Communication- introduction, techniques for writing effective e-mail, email etiquette, Letter Writing Job Application letters, writing Resume.
IV	Business Letter Business Letters- Letter of Enquiry, quotations, order and acknowledgement letters, complaint and adjustment letters.
V	Oral Communication-Facing Interview-Viva Voce, Different forms of classroom interaction-seminar, paper presentation, Group Discussion, Public Speaking

Suggested Readings:

- Rajiv K Mishra, Personality Development, Rupa& Co.
- Wallace and Masters, Personal Development for Life Work, 9th Edition, Thomson

Suggested equivalent online courses:

- https://nptel.ac.in/courses/109104107

Bachelor of Computer Application		
Programme/Class:	**Year:**2nd	**Semester:**3rd
Subject Code: BCA-413 E	**Subject Title:** Information System for Business	
Course out comes:	On completion of the course, the student will be able to:	
CO 1:	Remember the role of Information System in an organization.	
CO 2:	Understand terminologies related to Information System.	
CO 3:	Analyze the development process of an Information System.	
CO4:	Understand ethics and responsibilities of a person and organization in a Digital Age.	

Credits:4	Elective

Unit	Topic
I	What is an Information System, Components of Information System, Role of Information System, System hardware, Moore's Law, Role of Software in an organization, Types of Software,
II	Data and Databases, Types of Databases, Big Data, Data Warehouse, Networking and Communication, History of Internet, Organizational Networking, Information System Security Triad, Tools of Information Security, Personnel Information Security.
III	Why IT matters, Collaborative Systems, Decision Support Systems, Business process, role of Information System in Business process, ERP Systems, People in Information System, emerging roles

IV	Information System Development, System Development Lifecycle, Types of Programming Languages, What is Globalization, Impact of Internet on Globalization, what is digital divide, Steps to alleviate Digital Divide.
V	Ethics in Information System, Intellectual Property and Copyright, Patent, Responsibilities of individual, organization and government in Information Age, Future Trends in Information System.

Suggested Readings:

- Information Systems for Business and Beyond by David T. Bourgeois, PhD, The Saylor Academy.
- Business Information Systems, by Paul Bocji, Pearson.
- Principle of Information System, Ralph Stair.

Suggested equivalent online courses:

-

Bachelor of Computer Application		
Programme/Class:	**Year:**2nd	**Semester:**4th
Subject Code: BCA-421 E	**Subject Title:** E-Commerce	
Course out comes:	On completion of the course, the student will be able to:	
CO 1:	Understanding E-commerce Fundamentals	
CO 2:	Develop strategies for marketing, sales, promotions, purchasing etc.	
CO 3:	Identify the requirements and impacts of e-business and develop strategic positioning	
CO4:	Recognize security risks on the internet, networks, and websites	

Credits:4	**Elective**

Unit	**Topic**
I	Introduction to the E-commerce: Meaning and concept, e-commerce versus traditional commerce, electronic commerce and Physical Commerce, different type of ecommerce, some e-commerce scenario, Advantages of e-commerce. Limitations of e-commerce: technical and non-technical limitations. Model of Ecommerce: B2B, B2C, C2B, C2C.
II	Internet Payment System: Characteristics of payment system, SET Protocol for credit card payment, E-cash, E-check, Micropayment system. E-commerce strategies: Strategies for marketing, Sales and Promotions, Strategies for Purchasing and support activities, Strategies for Web Auctions, Virtual Communities and web portals
III	E-Business - Introduction: E-Business vs E-commerce, Characteristics of e-Business, e-Business role and their challenges, e-business Requirements, impacts of e-business. E-business strategies: Strategic positioning, Levels of e-business strategies, Strategic planning process, Strategic alignment, the consequences of e-Business, Success factors for implementation of e-business strategies. Business models, Business process and collaborations.
IV	Integration of Application: Approaches to Middleware, RPC and RMI, Enterprise Application Integration, e-business Integration, loosely Coupled e-Business solutions for integration, Service Oriented Architecture, EAI and web services, web service-security. E-commerce Infrastructure Cluster of Servers, Virtualization Techniques, Cloud computing, Server consolidation using cloud.

V	E-security – Security on the internet, network and web site risks for e-business, use of firewalls, secure physical infrastructure. The Information Technology Act 2000 and its highlights related to e-commerce.

Suggested Readings:

- Henry Chan, E-Commerce- Fundamentals and Application, Wiley Publication.
- David Whiteley, E- Commerce- Strategies, Technology and Applications, Tata McGraw Hill.

Suggested equivalent online courses:

-

Bachelor of Computer Application		
Programme/Class: Diploma in Computer Application	**Year:** 2nd	**Semester:** 4th
Subject Code: BCA-422 E	**Subject Title:** IT Acts and Cyber Laws	
Course out comes:	On completion of the course, the student will be able to:	
CO 1:	Understanding Cyber Law Fundamentals.	
CO 2:	Recognize the evolution of cyber-crime and its various manifestations	
CO 3:	Understand the concept of digital contracts and the role of digital signatures in modern business transactions.	
CO4:	Explore organizational and management issues related to cyber law, including jurisdictional challenges	
Credits: 4	**Elective**	

Unit	Topic
I	Basic Concepts of Technology and Law: Definition Cyber Law, cyber law: Cyber-crimes, electronic & Digital Signature, Intellectual property, Data protection and privacy, Scope and needs of Cyber Laws, The jurisprudence of Indian Cyber Law.
II	Evolution of cyber-crime, Cyber Fraud and Cyber Cheating, Virus on the Internet, Email spoofing, Email bombing, cyber stalking, Denial of service attracts, cyber Terrorism, Salami attack, Online gambling, Sale of illegal articles, Internet time theft, Web jacking, Data diddling, Intellectual Property crimes, Web defamation, Cyber Pornography.
III	Law of Digital Contracts: The essence of Digital Contracts, The system of Digital signatures, Digital Signature Certificates, Certifying Authorities and Liabilities, The role and function of certifying authority.
IV	E-Governance and IT Act 2000 & Amendments: Legal recognition of electronic records, Legal recognition of digital signature, Use of electronic records and digital signatures in Government and its agencies. Information technology Act 2000: Object and Scope of the IT Act: Genesis, Object, and Scope of the Act. Major issues address by the IT Act, Extend and jurisdiction of IT Act, Applicability of IT Act, and Relevant Authorities in India.
V	Copyright: Meaning, Ownership and Assignment, License of Copyright, Copyright Protection of Content on the Internet. Management Issues: Organizational Issues Introduction, Cyber law: Management issues, Cyber law: Organizational issues, Jurisdictional issues, Online Dispute Resolution (ODR)

Suggested Readings: • Farooq Ahmad, Cyber Law in India- (Pioneer Books), New Era Law Publ. • VivekSood, Cyber Law Simplified, Tata McGraw Hill.
Suggested equivalent online courses: •

Bachelor of Computer Application			
Programme/Class: Bachelor of Computer Application		**Year:**2rd	**Semester:**4th
Subject Code: BCA-423 E	**Subject Title:** Software Engineering		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Familiarize Software and Software Engineering.		
CO 2:	Evaluate the Software Requirement Analysis.		
CO 3:	Design about the Structured Analysis.		
CO4:	Identify the Software Design. Appropriate about the Software Testing methods		
Credits:4		**Elective**	
Unit	**Topic**		
I	Introduction to Software Engineering: Definition, Software development and life-cycle models, CMM, Software Quality, role of metrics and measurement.		
II	Requirements Analysis and Specification: SRS Building Process, Specification Languages, Validation of SRS, metrics, monitoring and control, Object Oriented analysis		
III	Software Project Planning: Software Cost Estimation Techniques, Project Scheduling & Tracking, Project Team Standards, software configuration management.		
IV	Software Design and Implementation: Design Concepts and Notations, Functional &Object-Oriented Design Concepts, Design Strategies, Design specification and verification, Metrics, Design Translation Process.		
V	Software Testing and Reliability: Strategies & Techniques, Debugging, Software Maintenance, Software Reliability and Availability Models, Software Reengineering, Cleanroom Approach, Software Reuse. Introduction to IEEE Standards, Case Studies.		
Suggested Readings: • R. S. Pressman, Software Engineering: A Practitioner's approach, McGraw-Hill. • I. Sommerville, Software Engineering: Pearson Education.			
Suggested equivalent online courses: • https://nptel.ac.in/courses/106101061			

Bachelor of Computer Application		
Programme/Class:	**Year:**3rd	**Semester:**5th

Subject Code: BCA-431 E	Subject Title: Introduction to Cyber Security
Course out comes:	On completion of the course, the student will be able to:
CO 1:	Remember the broad set of technical, social & political aspects of Cyber Security.
CO 2:	Understand the importance of ethical hacking, its tool and ethical hacking process.
CO 3:	Analyze security principles to system design.
CO4:	Understand the methods for authentication, access control, intrusion detection and prevention in Cyber Security.
Credits:4	**Elective**

Unit	Topic
I	Introduction to Cyber Security, Need for security, Concept of Cyber Space, Cyber Crimes and Cyber-attack. Fundamental security principles – threats, attacks and vulnerability. Key Security triad – Confidentiality, Integrity and Availability.
II	Introduction to different classes of security attacks – active and passive. Impact of attacks on an organization and individuals. Principles of Cyber security – Apply cyber security architecture principles. Cyber security models (the CIA triad, the star model, the Parkerianhexad).
III	Defining a Cyber Security policy, General security expectations, roles and responsibilities in the organization – Stakeholders.
IV	Introduction to key security tools including firewalls, anti-virus and cryptography – Identify security tools and hardening techniques – Prevention of cyber-attacks. Security Countermeasure tools and techniques – Encryption standards.
V	Cyber security testing – Penetration testing. System Level Solutions – Intrusion Detection System (IDS) and Intrusion Protection System (IPS). Basic Concept of Ethical Hacking. Protecting against Cyber Crime – Identity Theft, Cyber Stalking and Investment fraud.

Suggested Readings:

- William Stallings, Principle of Computer Security", McGraw Hill Education.
- Computer Network Security, by Joseph M. Kizza, Publisher, Springer International Edition.
- Security in Computing, by Charles P. Pfleeger, Shari Lawrence, Publisher: Pearson India

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106106248

Bachelor of Computer Application		
Programme/Class:	**Year:**3rd	**Semester:**5th
Subject Code: BCA-432 E	**Subject Title:** GUI Programming	
Course out comes:	On completion of the course, the student will be able to:	
CO 1:	Understanding of the .NET Framework	
CO 2:	Proficiency in Visual Basic programming	
CO 3:	Understanding of OOP concepts	
CO4:	Proficiency in creating data-driven web forms	
Credits:4	**Elective**	

Unit	Topic
I	An overview of the .NET framework. Common Language Runtime (CLR), Code Loading and Execution, Common Type System(CTS),Common Language Specification(CLS), MSIL. Introduction to .NET Architecture, Event-Driven Programming, components of Visual Studio 2010 IDE Introduction to visual basic language, different data types, variable, type conversion, constant, enumerations operators, statement, scope and lifetime of variables, selection statements, looping statements, arrays. Procedures and function, parameter passing in functions.
II	Working with simple applications and complex applications. Working with forms: Textbox, Label, Button, Listbox, Combobox, Checkbox, PictureBox, Radio Button, Panel, Scroll bar, Timer, ListView, TreeView, Toolbar, StatusBar, Link Label – their Properties, Methods and events. DialogBoxes: OpenFileDialog, SaveFileDialog, FontDialog, ColorDialog, PrintDialog. Designing menus: Menu, ContextMenu, access & shortcut keys. Major Error Types: Syntax, Execution and logic errors. Exception, Exception handling and user defined exception. Debugging and breakpoints
III	Introduction to object-oriented programming, class, object, methods and properties, creating a class, inheritance, overloading and overriding, polymorphism, encapsulation, constructors, interface. Access modifiers: Public, Private, Protected, Friend. Using namespace, using imports statement, creating class library.
IV	Introduction to data access, overview of ado.net, ado.net architectures and its components. Using visual tools for data access, data form wizard. Working with Connection, Command, Data Reader, Data Adapters. Working with Data Set, Data Tables, Data Columns and Data Rows, Using Data View, Working with Data Grid View. Reporting using Report wizard, Data binding with different controls.
V	ASP.NET 4.0, Web form vs windows form – advantages and disadvantages. Web applications pieces. Benefits of ASP.NET web pages. Website files: global. asa, web. config. Thin-client architecture, Web forms for client and server-side processing. Performing data validation, site layout, themes and navigation. Using Grid view to build data-driven web form. Deploying desktop and web application using wizard. Create a setup application
Suggested Readings: ● Thearon Willis, Bryan Newsome: Beginning Microsoft Visual Basic, Wiley India Pvt. Ltd. ● Evangelos Petroutsos, Mastering Microsoft Visual Basic, Wiley India Pvt. Ltd.	
Suggested equivalent online courses: ●	

Bachelor of Computer Application			
Programme/Class:		**Year:** 3rd	**Semester:** 5th
Subject Code: BCA-433 E	**Subject Title:** Operation Research		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	Define and formulate linear programming problems and appreciate their limitations		
CO 2:	Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.		
CO 3:	Determine the optimal solution for Transportation problems and Assignment problems.		

CO4:	Decide an optimal replacement period/policy for a given item/equipment/machine.
CO5:	Explain the concepts of dynamic optimization and its application in real-world problems and define the solution concepts and optimality conditions
CO6:	Simulate different real life probabilistic situations using Monte Carlo simulation technique and Plan, Schedule and Control the given project.

Credits:4	**Elective**

Unit	**Topic**
I	Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem: Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, big-M method, two-phase method, degeneracy and unbound solutions, Free slack, Total slack, Crashing, Resource allocation.
II	Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the steppingstone method and MODI method. Assignment Problem: Formulation, Hungarian method for optimal solution. Solving unbalanced problem. Traveling salesman problem as assignment problem
III	Sequencing models: Solution of Sequencing Problem, Processing n Jobs through 2 Machines, Processing n Jobs through 3 Machines, Processing 2 Jobs through m machines, Processing n Jobs through m Machines.
IV	Dynamic programming: Characteristics of dynamic programming, Dynamic programming approach for Priority Management, Employment Smoothening, Capital Budgeting, Stagecoach/Shortest Path, Cargo Loading and Reliability problems
V	Simulation: Advantages of Simulation, Limitations of Simulation, Monte-Carlo Simulation, Random Numbers. CPM and PERT: Drawing of networks, Removal of redundancy, Network computations bang, Sandwich.

Suggested Readings:

- Rader, D. J., Deterministic Operations Research: Models and Methods in Linear Optimization, J. Wiley & Sons.
- Taha, H. A., Operations Research, Pearson
- P. SankaraIyer," Operations Research", Tata McGraw-Hill.
- J K Sharma., "Operations Research Theory & Applications", Macmillan India Ltd.

Suggested equivalent online courses:

- https://nptel.ac.in/courses/110/106/110106062/
- https://nptel.ac.in/courses/111/107/111107128/
- https://nptel.ac.in/courses/112/106/112106134/

Bachelor of Computer Application		
Programme/Class:	**Year:**3rd	**Semester:**6th
Subject Code: BCA-441 E	**Subject Title:** Software Testing	
Course out comes:	On completion of the course, the student will be able to:	
CO 1:	Understanding Software Testing Fundamentals.	
CO 2:	Exploring Testing Approaches and Techniques.	
CO 3:	Specialized Testing for Diverse Environments.	

CO4:	Software Testing Strategies and Metrics. Exploring Specialized Testing Tools

Credits:4	**Elective**

Unit	**Topic**
I	SOFTWARE TESTING- Introduction, Nature of errors, testing principles and Testing fundamentals, Debugging.
II	APPROACHES TO TESTING – I White Box Testing, Black Box Testing, Gray Box Testing, Unit Testing. Integration – Top down, Bottom up, Big-bang, Sandwich.
III	TESTING FOR SPECIALIZED ENVIRONMENTS -Testing GUI's, Testing of Client/Server Architectures, Testing Documentation and Help facilities, Testing for Real-Time systems.
IV	SOFTWARE TESTING STRATEGIES AND SOFTWARE METRICS-Validation Testing, System Testing, Verification, Performance Testing, Regression Testing, Agile Testing, Acceptance Testing, Smoke Testing, Load Testing, Introduction, Basic Metrics, Complexity Metrics.
V	SPECIALIZED TESTING AND TESTING TOOLS (INTRODUCTION-) Test case design, JUnit, Apache JMeter, Winrunner, Loadrunner, Rational Robot.

Suggested Readings:

- Ron Patton, Software Testing, Sams Publishing.
- Naresh Chauhan, Software Testing- Principal and Practices, Oxford University Press;
- Srinivasan Desikan, Software Testing- Principal and Practices, Pearson Education.

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106101163

Bachelor of Computer Application		
Programme/Class:	**Year:**3rd	**Semester:**6th
Subject Code: BCA-442 E	**Subject Title:** Advanced Web Development Technologies	
Course out comes:	On completion of the course, the student will be able to:	
CO 1:	JavaScript Fundamentals	
CO 2:	Develop components, manage component state and props, and understand the lifecycle of React components.	
CO 3:	Basics of Node.js, including setup and modules.	
CO4:	Develop Python applications and connect them to MongoDB.	

Credits:4	**Elective**

Unit	**Topic**
I	Introduction to JavaScript, Applying JavaScript (internal and external) Understanding JS Syntax, Introduction to Document and Window Object, Variables and Operators, Data Types and Num Type Conversion, Math and String Manipulation, Objects and Arrays, Date and Time, Conditional Statements, Switch Case, Looping in JS, Functions

II	Introduction, Templating using JSX, Components, State and Props, Lifecycle of Components, Rendering List and Portals, Error Handling, Routers, Redux and Redux Saga, Immutable.js, Service Side Rendering Unit Testing, Webpack
III	Node js Overview, Node js - Basics and Setup, Node js Console, Node js Command Utilities, Node js Modules, Node js Concepts, Node js Events, Node js with Express js, Node js Database Access
IV	SQL and NoSql Concepts, Create and Manage MongoDB, Migration of Data into MongoDB, MongoDB with PHP, MongoDB with NodeJS Services Offered by MongoDB
V	Python Installation & Configuration, developing a Python Application, Connect MongoDB with Python

Suggested Readings:

- MASTERING HTML, CSS & Java Script Web Publishing by Laura Lemay, Rafe Colburn, Jennifer Kyrnin. BPB Publications.
- The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer, by Chris Northwoo, APRESS Publisher.
- ASP.NET Core 3 and Angular 9: Full-stack web development with .NET Core 3.1 and Angular 9 by Valerio De Sanctis, Packt Publishing Limited Publisher.
- Full Stack Development with MongoDB, By Manu Sharma, BPB Publisher.
- Advanced Web Development with React, By Mohan Mehul, BPB Publisher.

Suggested equivalent online courses:

-

Bachelor of Computer Application			
Programme/Class:		**Year:**3rd	**Semester:**6th
Subject Code: BCA-443 E	**Subject Title:** Blockchain Foundations		
Course out comes:	On completion of the course, the student will be able to:		
CO 1:	To articulate the fundamentals of Blockchain		
CO 2:	Able to understand cryptographic concepts underlying Blockchain technology.		
CO 3:	To examine various types of Blockchain networks and consensus algorithms.		
CO4:	To make use of wallet transactions, crypto tokens, analyze the block details and Blockchain network.		
Credits:4		**Elective**	

Unit	**Topic**
I	Why Blockchain Technology, Blockchain Bitcoin Blockchain, Blockchain Architecture, Conceptualization, Blockchain components, Cryptocurrencies, Characteristics of cryptocurrencies, Alt coins, Crypto wallets, Creation of Blocks, Wallet Transactions, Transaction details in a Block, Merkle Tree, Hash functions, pseudo random numbers, Puzzle friendly and collision resistant hash, public key cryptosystem, Generation of keys, Digital signatures, Zero-knowledge systems.
II	Blockchain types-Public Blockchain, Private Blockchain, Federated Blockchain, Permissionless, Permissioned Blockchain Networks, Ethereum blockchain, Go Ethereum, Gas, Gas price, Gas Limit, ETH, MetaMask, Public Test Networks, set up a Ethereum node using Geth.

III	Mining in Blockchain, Steps in Mining, Double spending, Consensus protocols, PoW, Hashcash, Attacks on Bitcoin, Sybil Attacks, 51% Attack, eclipse attacks, DDoS Attacks, Replay Attacks, Byzantine fault, node failure.
IV	Proof of Stake, Difference between PoW vs PoS, Byzantine General Problem, BFT (Byzantine fault tolerance), PBFT (Practical Byzantine fault tolerance), Delegated Proof of Stack, Paxos Consensus algorithm, Raft Algorithm, Solo Miner, Pool Miners, Smart contracts in Blockchain, Solidity, Data types in solidity, Operators, State variables, Global Variables, Local variables.
V	Remix, Compilation of smart contracts, Deployment environments, JavaScript Environment, Injected Web3, Web3 Provider, Solidity arrays, Solidity functions, Structs in solidity, Inheritance, Special variables, Solidity mapping, Function overloading, Personal Blockchain network, Ganache, Contract deployment to Ganache network, Modifiers in solidity, Events.

Suggested Readings:

- Bettina Warburg, Bill Wanger and Tom Serres, Basics of Blockchain, independently published.
- Holbrook and Joseph, Architecting enterprise blockchain solutions, John Wiley & Sons.
- Bashir and Imran, Mastering blockchain: "Distributed ledger technology, decentralization, and smart contracts explained, Packt Publishing Ltd.
- Pathak, Nishith and Anurag Bhandari, IoT, AI, and Blockchain for. NET: Building a Next Generation Application from the Ground Up, Apress.

Suggested equivalent online courses:

-