

SYLLABUS
(Effective from academic session 2019-20)

FOR THE DEGREE

OF

Bachelor of Computer Applications
Six-Semester Full Time Programme

SCHOOL OF BASIC SCIENCES



MANIPAL UNIVERSITY
JAIPUR

ELIGIBILITY OF THE CANDIDATES:

The candidate must have passed in 10+2 with 50% marks in Science, Arts, Commerce streams or A Level or IB or American 12th grade with Mathematics as one the subjects up to 10th.

Program specific outcomes for Bachelor of Computer applications (BCA) program:

- [PSO.1.]** Prepare professionally trained in the areas of programming, databases, software engineering, web- designing and networking and other completer application areas to acquire knowledge in various domain-based prospects
- [PSO.2.]** Encourage to communicate effectively and to improve their competency skills to solve real time problems
- [PSO.3.]** Clarity on both conceptual and application-oriented skills of Computer Applications in Business context.

Year	FIRST SEMESTER					SECOND SEMESTER							
	Sub. Code	Subject Name	L	T	P	C	Sub. Code	Subject Name	L	T	P	C	
I	MA1102	Mathematics- I	3	1	0	4	MA1202	Mathematics –II	3	1	0	4	
	CA1101	Computer Fundamentals	3	1	0	4	CM1229	Financial and Accounting Management	3	0	0	3	
	CA1102	Fundamentals of Digital Systems	3	1	0	4	CA1201	Data Structures	3	1	0	4	
	CA1103	C Programming	3	1	0	4	CA 1202	Database Management System	3	1	0	4	
	LN1108	Technical Communication	2	0	0	2	CA1203	Principles of Programming Languages	3	1	0	4	
	CA1130	C Programming Lab	0	0	2	1	CA1230	Data Structures Lab	0	0	2	1	
	CA1131	Fundamentals of Digital Systems Lab	0	0	2	1	CA1231	Database Management System Lab	0	0	2	1	
				14	4	4	20				15	4	4
Total Contact Hours (L + T + P)			22			Total Contact Hours (L + T + P)			23				

II	THIRD SEMESTER						FOURTH SEMESTER					
	MA2107	Basic Statistics and Probability	3	1	0	4	MA2210	Numerical Methods	3	1	0	4
CA2101	Computer Organization and Architecture	3	1	0	4	CA2201	Operating Systems	3	1	0	4	
CA2102	Web Programming	3	1	0	4	XX XXXXX	Open Elective-I	3	0	0	3*	
CA2103	Object Oriented Programming using Java	3	1	0	4	CA2202	Python Programming	3	1	0	4	
CA2104	Data Communication & Protocols	3	1	0	4	CA2203	Software Engineering	3	1	0	4	
CA2130	Web Programming Lab	0	0	2	1	CA2230	Operating System Lab	0	0	2	1	
CA2131	Object Oriented Programming using Java Lab	0	0	2	1	CA2231	Python Programming Lab	0	0	2	1	
						CY1003	Environmental Science	2	1	0	3	
		15	5	4	22			17	5	4	24	
Total Contact Hours (L + T + P)		24				Total Contact Hours (L + T + P) + OE		23 + 3 = 26				
III	FIFTH SEMESTER						SIXTH SEMESTER					
	CA3101	Data Warehousing using OLAP	3	1	0	4	CA3201	Cryptography Fundamentals	3	1	0	4

	CA3102	Mobile Application Development	3	1	0	4	CA3202	Fundamentals to Machine Learning	3	1	0	4
	CA3103	OOAD Using UML	3	1	0	4	CA3203	Fundamentals to Mobile Computing	3	1	0	4
	CA3140-2	Program Elective-I	3	0	0	3	XX XXXX	Open Elective-II	3	0	0	3*
	CA3104	Introduction to Cloud Computing	3	1	0	4	CA3230	Machine Learning Lab	0	0	2	1
	CA3130	Data Warehousing Lab	0	0	2	1	CA3260	Project	-	-	4	2
	CA3131	Mobile Application Development Lab	0	0	2	1						
			15	4	4	21			12	3	6	18
	Total Contact Hours (L + T + P)		23			Total Contact Hours (L + T + P) + OE		(9+3+6)+3=21				

Programme Electives

CA3140 Enterprise Resource Planning

CA3141 Decision Support System

CA3142 E-Commerce

Bachelor of Computer Applications

I Year First Semester

MA 1102: MATHEMATICS- I [3 1 0 4]

Function: Definition, domain and range of function, types of functions (into, onto, one to one), composite function. Limit: Definition, first principle, properties, and simple problems related to limit. Some standard limits. Continuity: Definition, continuity of sum, product, difference and quotient of two continuous functions, simple problems. Special Functions: Trigonometric functions and their properties, exponential functions, logarithmic functions, hyperbolic functions, inverse circular functions and related properties, simple problems. Rational functions, partial fraction and simple problems. Differentiation: Definition, differentiation of simple functions using first principle, differentiation of trigonometric functions and inverse circular functions, method of substitution, differentiation of product and quotient of functions, maxima and minima of a function of single variable. Integration: Definition, integration of simple functions using substitution, integration of trigonometric and inverse circular functions and related problems, integration by parts, integration of rational functions. Definite integral and their properties, simple problems. Reduction formula and simple problems.

References:

1. S. Narayan, *Differential Calculus*, S. Chand & Co, Delhi, 2012.
2. S. Narayan, *Integral Calculus*, S. Chand & Co, Delhi, 2012.
3. M.D. Raisinghania, *Differential Calculus*, Delhi, 2010.
4. D. Mukherjee, *Integral Calculus*, U.N. Dhur, 1977.
5. N. Piskunov, *Differential and Integral Calculus*, Vol I & Vol II, CBS, 2000.

CA1101: COMPUTER FUNDAMENTALS [3 1 0 4]

Introduction: Basic Definitions, Data, information, bits, byte, software, hardware, memory, Characteristics of a computer. Block diagram of a computer. Generation of Computers, Types of Computers, Memory and its types, Input Devices, Output Devices, Monitors Characteristics, Digital and Analog signals. Video Standard: VGA, SVGA, Types of printer, Storage Devices: Primary Vs Secondary memory, Storage Fundamentals, Data Storage and Retrieval Methods, Various Storage Devices. Types of software: System Software, Application Software. Operating Systems: types and functions. Programming Languages: Machine Language, Assembly language, High level language. Assembler, Compilers and Interpreter. Introduction to MS-Office.

References:

1. S.K. Basanadra, *Computers Today*, Galgotia Publications, (1e) 2010.
2. P.K. Sinha, P. Sinha, *Computer Fundamentals*, (6e), BPB Publications, 2007.
3. A. Leo, M. Leon, *Introduction to Computers*, (1e), Vikas Publishing House, 2009.

CA1102: FUNDAMENTALS OF DIGITAL SYSTEMS [3 1 0 4]

Introduction: Number system, Boolean algebra, De-Morgan's law, simplification of Boolean algebra, Logic Gates: basic and universal gates, simplification method: K-map and tabulation method. Combination circuit: introduction to combinational circuit, half adder circuit, full adder circuit, half subtracted, full subtracted, binary parallel adder, carry propagation, magnitude comparator, decoder, encoder, multiplexer, demultiplexer circuit, design of code converter, parity bit generator and checker. Sequential circuit: Introduction to flip flop. Types of flip flop: S-R, D, J-K, T, Clocked flip flop. S-R latch, Master-Slave flip flop, realization of one flip flop using other flip flop. Counter and shift registers: Synchronous counters, asynchronous counter, ring counter, serial-in-parallel out, parallel-in-serial out, parallel-in-parallel out, bidirectional shift registers.

References:

1. M. Mano, *Digital Logic and Computer Design*, (1e), Pearson Education India, 2017.
2. R. P. Jain, *Modern Digital Electronics*, (3e), Tata McGraw-Hill Education, 2003.
3. R.L. Tokheim, *Digital Electronics: Principles and Applications*, (6e), Tata McGraw Hill, 2007.
4. H. W. Gothman, *Digital electronics*, (2e), PHI Publications, 2009.

CA1103: C PROGRAMMING [3 1 0 4]

C Fundamentals: C program structure, Simple I/O operations, Operators and Expressions: Operator precedence and associativity, bitwise operators, arithmetic expressions, evaluation of expressions, Flow of Control: Statements and blocks, switch case statement, looping constructs. Arrays: arrays- Declaration and Initialization, sorting. Strings: String - operations on strings, built-in string handling functions, programs on strings. Functions: Modular programming, function declaration, definition and function call, Types of functions, function returning more values, function with operators, function and decision statements, function and loop operators, function with Arrays.

Reference:

1. E. Balaguruswamy, *Programming in ANSI C*, (5e) Tata McGraw Hill, 2012.
2. E. Balaguruswamy, *Computing Fundamentals & C Programming*, (2e), TataMcGraw Hill, 2017.
3. R. Thareja, *Computer Fundamentals and Programming in C*, (1e), Oxford University Press, 2016.
4. B. A. Forouzan, R. F. Gilberg, *Computer Science: A structured programming Approach Using C*, (3e), Cole Publishing Company-Cengage, 2007.

LN1108: TECHNICAL COMMUNICATION [2 0 0 2]

Introduction to communication: Types of communication, Process of communication, Principles of communication, Channels of communication, Verbal and non-verbal communication, Formal and informal communication, Barriers to communication. Vocabulary: Word formation, Affixes, Compound words, Synonyms, Antonyms, Homophones and Homonyms, Misspelt words. Grammar: Punctuations, Parts of speech, Active and passive voice, Direct and indirect speech, Concord, Common errors. Techniques of effective sentence constructions, Précis writing. Structure and format of letter writing: Letter of Enquiry, Quotations, Orders, Tenders, Complaint/adjustment letters, Job application letter, Resume, Group discussion. Art of Public Speaking: Tips for effective presentations.

References:

1. A. Koneru, *Professional Communication*, (1e), Tata McGraw Hill, 2008.
2. L. C. Bovee, J. V. Thill, B. E. Schatzman, *Business Communication Today*, (7e), Pearson Education, 2004.
3. L. Sen, *Communication Skills*, (2e), Prentice Hall, 2007.
4. M. Raman, S. Sharma, *Technical Communication: Principles and Practice*, (2e), Oxford University Press, 2013.

CA1130: C PROGRAMMING LAB [0 0 2 1]

Introduction to MS-Office, Excel & Powerpoint, Simple C Programs (expression oriented operations). Programs to illustrate various operators in C. Programs using branching constructs (if, if-else-if, switchcase). Programs using looping constructs (for, while, do-while, continue, break). Programs on 1D Arrays, Programs on 2D Arrays. Programs on strings. Programs using functions (with and without recursion), passing parameters by value and reference.

Reference:

1. E. Balaguruswamy, *Programming in ANSI C*, (5e), Tata McGraw Hill, 2012.
2. E. Balaguruswamy, *Computing Fundamentals & C Programming*, (2e), TataMcGraw Hill, 2017.
3. R. Thareja, *Computer Fundamentals and Programming in C*, (1e), Oxford University Press, 2017.
4. B. A. Forouzan, R. F. Gilberg, *Computer Science: A structured programming Approach Using C*, (3e), Cole Publishing Company-Cengage, 2007

CA1131: FUNDAMENTALS OF DIGITAL SYSTEMS LAB [0 0 2 1]

Study of BASIC Gates, Universal Gates, Study of Full and Half Adder and Subtractor using Gates. Study of Magnitude Comparator. Study of Multiplexer, Study of Demultiplexer. Implementation of flip flops using NAND. Study of Shift Register, Design of Counter, Study of IC 7490, Vi Characteristic of TTL and CMOS.

References:

1. M. Mano, *Digital Logic and Computer Design*, (1e), Pearson Education India, 2017.
2. R. P. Jain, *Modern Digital Electronics*, (3e), Tata McGraw-Hill Education, 2003.

Second Semester

MA 1202: MATHEMATICS –II [3 1 0 4]

Differential Calculus: Successive differentiation, Leibnitz's theorem, polar curve, angle between radius vector and tangent, angle of intersection between two curves, derivative of arc (Cartesian and polar), curvature, radius of curvature, evolute, related problems. Rolle's Theorem, mean value theorem (Cauchy's and Lagrange's), in determinant form, partial derivatives, Euler's theorem, maxima and minima of functions of two variables. Linear Algebra: Basic concepts, matrix addition, scalar multiplication, matrix multiplication, linear system of equations, Gauss elimination, rank of a matrix, Solution of Linear Systems: Existence, uniqueness, determinants, Cramer's rule, inverse of a matrix, Gauss-Jordan elimination. Infinite Series: Convergence, divergence, comparison test, ratio test, Cauchy's root test, Cauchy's integral test, alternating series, Leibnitz's theorem, absolute and conditional convergence, expansion of functions into Taylor's and Maclaurin's series.

References:

1. S. Narayan, P.K. Mittal, *Differential calculus*, S. Chand & Co, Delhi, 2012.
2. S. Narayan, P.K. Mittal, *Integral calculus*, S. Chand & Co, Delhi, 2012.
3. M.D. Raisinghania, *Differential calculus*, S. Chand & Co, Delhi, 2010.
4. B. N. Mukherjee, *Integral Calculus*, U.N. Dhur, 1977.
5. N. Piskunov, *Differential and integral calculus*, Vol I & Vol II, CBS, 2000.

CM 1229: FINANCIAL AND ACCOUNTING MANAGEMENT [3 1 0 4]

General Purpose Cost Statement: Evolution of Cost Accounting, Cost Accounting Concepts, Generally Accepted Cost Accounting Principles and Cost Accounting Standards, Cost Accounting Standards, Business Process Analysis: Materials, Employee Costs, Direct Expenses, Overheads, Treatment of Special Items, Cost Sheet, Overview of Financial Management: Objective of Financial Management, Key Decisions of Financial Management, Planning Environment, Functions of Financial Management, Sources of Finance, International Sources, Emerging Role of Finance Manager, Securities and Exchange Board of India Act. 1992, Future Value, Present Value, Tools for Financial Analysis and Planning: Funds Flow Statement Cash Flow Statement, Ratio Analysis, Identification of Information Required to Assess Financial Performance, Working Capital Management and Leverage Analysis: Working Capital - Meaning and Definition, Kinds of Working Capital, Adequacies and Inadequacies of Working Capital, Danger of too high amount of Working Capital, Danger of inadequacies or low amount of Working Capital, Working Capital Cycle, Working Capital Financing, Inventory Management, Management of Receivable, Determinants of Credit Policy, Cash Management, Leverages, EBIT-EPS Indifference Point Level, Calculation of Indifference Point, Cost of Capital: Cost of Capital, Capital Structure, Dividend Decisions.

References:

1. J. Pratt, *Financial Accounting in an Economic Context*, (5e), John Wiley & Sons, 2010.

CA1201: DATA STRUCTURES [3 1 0 4]

Introduction: Definitions, Concept of Data Structures, Overview of Data Structures. Arrays: Definitions, terminologies, 1D Array: Memory allocation, Operations on array, Application of Arrays, 2D and 3D Array representation, Linked Lists: Definition, Single Linked List: Representation in memory, operations (insertion, deletion, modify etc.), Circular Linked List, Double Linked List. Stacks: Definition, Array and linked-list representation of stack, Operations on Stack: Push, Pop, application of stack: infix to postfix, evaluation of arithmetic expression, tower of Hanoi. Queues: Definition, Array and linked-list representation of Queue. Operations on Queue: Insertion, Deletion. Various Queue Structure: Circular Queue, Priority Queue. Insertion, Deletion operations on a Circular Queue and Priority Queue, Sorting and Searching: Insertion Sort, Selection Sort, Merge Sort, Linear Search, Binary Search. Tree: Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, insertion and deletion, Binary search trees, Applications of Trees- Some balanced tree mechanism, eg. AVL trees, 2-3 trees, Height Balanced, Weight Balance, B Tree, B+ Tree, Graph-Matrix Representation of Graphs, Elementary Graph operations.

References:

1. A. M. Tenenbaum, *Data Structures Using C*, (1e), Pearson Education, 2008.
2. R. Thareja, *Data Structures Using C*, (2e), Oxford University Press, 2014.

CA1202: DATABASE MANAGEMENT SYSTEM [3 1 0 4]

Introduction: Introduction to Database management system, some examples, characteristics of the database approach, Relational Model. ER Models: Database modeling using the entity-relationship model, entity types, entity sets attributes and keys, relationships. Database Design: Functional dependencies and normalization for relational databases. SQL the Relational Database Standard: Data definition, constraints, Basic Queries in SQL, More complex SQL queries, Insert, Update and Delete Statements in SQL. Transaction Processing: Transaction processing concepts: Introduction to transaction processing, transaction and system concepts, desirable properties of transactions, schedules and recoverability. Introduction to Cursors and Triggers.

References:

1. R. Ehmasri, S. Navathe, *Fundamentals of Database Systems*, (6e), Addison-Wesley, 2011.
2. A. Silberschatz, H. F. Korth, S. Sudarshan, *Database System Concepts*, (6e), McGraw-Hill, 2013.
3. C.J. Date, *Introduction to Database Systems*, (8e), Pearson Education, 2003.

CA1203: PRINCIPLES OF PROGRAMMING LANGUAGES [3 1 0 4]

Introduction: Programming language - design, spectrum and the study motivation, Compilation and interpretation. Programming environments. Names, Scope, and Bindings: Concept of binding time, Object lifetime and storage management, Scope rules and implementing scope, the binding of reference environments, Binding within a scope, Separate compilation; Control Flow: Expression evaluation, Structured and unstructured flow, Sequencing, Selection, Iteration, Recursion, Nondeterminacy. Data Types: Type systems and checking, Records and variants, Arrays, Strings, Sets, Pointers and recursive types, Lists, Files and Input/Output, Equality testing and assignment. Subroutines and Control Abstraction: Stack layout, calling sequences, Parameter passing, Generic subroutines and modules, Exception handling, Co-routines. Data Abstraction, Object Orientation: Object oriented programming, Encapsulation and Inheritance, Dynamic method binding. Functional Languages: Origins, Concepts, Scheme, Evaluation order, Higher-order functions, Functional programming in perspective; Logic Languages: Concepts, Prolog, Logic programming in perspective; Scripting Languages: Common characteristics.

References:

1. M.L. Scott, *Programming Language Pragmatics*, (4e), Elsevier, 2009.
2. J. C. Mitchell, *Concepts in programming languages*, (1e), Cambridge University Press, 2002.
3. R. Sethi, *Programming languages Concepts and Constructs*, (2e), Pearson Education, 1996.
4. R Sebesta, *Concepts of Programming Languages*, (8e), Pearson Education, 2008.

5. A. Tucker, R. Noonan, *Programming languages, (2e)*, Tata McGraw-Hill, 2007.

CA1230: DATA STRUCTURES LAB [0 0 2 1]

Programs based on Sorting and Searching algorithms: Bubble, Insertion, selection, Merge sort. Linear and Binary search. Programs based on Array and its operation insertion, deletion etc. Stacks: Push, Pop, Queues, Linked Lists, Implement generalizes representation of Link List for polynomial, matrix, recursion, Trees, Graphs.

References:

1. A. M. Tenenbaum, *Data Structures Using C, (1e)*, Pearson Education, 2008.
2. R. Thareja, *Data Structures Using C, (2e)*, Oxford University Press, 2014.

CA1231: DATABASE MANAGEMENT SYSTEM LAB [0 0 2 1]

MySQL setup: data migration from MySQL to portable file as well as uploading data from portable file to MySQL. SQL: Creating, Altering, and Dropping tables with Constraints, Insert Table. Detailed SELECT with sub-queries, EQUI-JOINS, correlated sub-queries. GROUPING, SET, UPDATE, DELETE, VIEWS. PL/SQL: Program Development: Iterative PL/SQL Blocks.

References:

1. R. Ehmasri, S. Navathe, *Fundamentals of Database Systems, (6e)*, Addison-Wesley, 2011.
2. A. Silberschatz, H. F. Korth, S. Sudarshan, *Database System Concepts, (6e)*, McGraw-Hill, 2013.
3. C.J. Date, *Introduction to Database Systems, (8e)*, Pearson Education, 2003.

II Year Third Semester

MA2107: BASIC STATISTICS AND PROBABILITY [3 1 0 4]

Basic Statistics: Population, sample and data condensation, definition and scope of statistics, concept of population and simple with illustration, raw data, attributes and variables, classification, frequency distribution, cumulative frequency distribution. Measures of Central Tendency: Concept of central tendency, requirements of a good measure of central tendency, arithmetic mean, median, mode, harmonic mean, geometric mean for grouped and ungrouped data. Measures of Dispersion: Concept of dispersion, absolute and relative measure of dispersion, range variance, standard deviation, coefficient of variation. Permutations and Combinations: Permutations of 'n' dissimilar objects taken 'r' at a time (with or without repetitions), $nPr = n!/(n-r)!$ (without proof). Combinations of 'r' objects taken from 'n' objects, $nCr = n!/(r!(n-r)!)$ (Without proof). Simple examples, applications. Probability: Sample space, events and probability, experiments and random experiments, ideas of deterministic and non-deterministic experiments, definition of sample space, discrete sample space, events, types of events, union and intersections of two or more events, mutually exclusive events, complementary event, exhaustive event, simple examples. Classical definition of probability, addition & multiplication theorems of probability without proof (up to three events are expected). Definition of conditional probability. Definition of independence of two events, total probability theorem and Baye's theorem, simple numerical problems. Multiple correlation and regression (for the three variables only).

References:

1. S. C. Gupta, *Fundamentals of statistics, (7e)*, Himalaya Publishing House, 2016.
2. A.M.Gun, M.K.Gupta, D. Gupta, *Fundamentals of statistics,(1e)*, World Press, 2016.
3. V.K.Rohtagi, *An Introduction to Probability and Mathematical Statistics, (1e)*, Wiley, 1976.
4. S.P. Gupta, *Statistical Methods, (1e)*, S.Chand, 2012.

CA2101: COMPUTER ORGANIZATION AND ARCHITECTURE [3 1 0 4]

General Computer Architecture: Block Diagram of typical Computer, Memory Section, Input/Output Section, CPU, Registers, Arithmetic Unit, Instruction handling Areas, Stacks. Micro operations: Register Transfer, Bus and Memory Transfer, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Unit. Basic Computer Organization and Design: Instruction Codes, Operation code, Timing and Control, Instruction Cycle, Memory Reference Instructions, Input Output Instructions and Interrupts. Control Memory: Control Word, Microinstruction, Microprogramming, Control Memory, Hardwired Central Processing Unit: General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, RISC, CISC Pipelining and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Vector Processing, Array Processors Input Output Organization: I/O Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, DMA, IOP, Serial Communication. Memory Organization: Associative Memory, Cache Memory, And Virtual Memory Introduction to Microprocessor: Machine Language, Assembly Language, Assembler, High Level Language, Compiler, Interpreter, Internal Architecture 8085.

References:

1. C. Hammacher, *Computer Organization*, (5e), Tata McGraw-Hill, 2011.
2. M.M. Mano, *Computer System Architecture*, (3e), Pearson, 2007.
3. B.Govindarajalu, *Computer Architecture and Organization*, (2e), Tata McGraw-Hill, 2017.

CA2102: WEB PROGRAMMING [3 1 0 4]

Introduction:HTML, features, uses & versions Using various HTMLsyntax, Head & Body Sections, , Inserting texts, Text alignment, Using images in pages, Hyperlinks – text and images, bookmarks, Backgrounds and Color controls, creating and using Tables in HTML, and presentation, Use of font size & Attributes, List types and its tags. Cascading Style sheets – defining and using simple CSS. Use of Frames and Forms in web pages, Image editors, Issues in Web site creations & Maintenance. Web Designing: Introduction to WYSIWYG Design tools, Introduction to Dreamweaver, Website Creation and maintenance, Web Hosting and Publishing Concepts; Client-Side Programming: The JavaScript Language, History and Versions; Introduction to JavaScript in Perspective: Syntax, Variables and Data Types, Statements, Operators, Literals, Functions, Objects, Arrays, Built-in Objects, JavaScript Debuggers; Representing Web Data: XML-Documents and VocabulariesVersions and Declaration-Namespaces, Displaying XML Documents in Browsers; Server-Side Programming: Java Servlets-Architecture , Overview- Servlet, Generating Dynamic Content, Life Cycle, Parameter Data, Sessions, Cookies; Electronic commerce: E - Business model, E – Marketing, Online payments and security. Database and Connectivity: ADO.Net. Distributed Application in C#, Visual programming interface with C#. Web controls, Web Forms.

References:

1. S. Powers, *Dynamic Web Publishing*, (2e),Sams , 1997.
2. K. Jamsa, K. King, *HTML & Web Design*, (1e), McGraw-Hill, 2002.
3. M. Michaelis, *Essential C# 3.0: For .NET Framework*, (2e), Pearson, 2010.
4. S. Johnson, *Using Active Server Pages*, (1e) Que, 2000.

CA2103: OBJECT ORIENTED PROGRAMMING USING JAVA [3 1 0 4]

Introduction to OOP: Features of Java, How Java is different from C++, Data types, Control Statements, identifiers, arrays, and operators. Inheritance: Multilevel hierarchy, method overriding, abstract classes, Final classes, String Class. Packages and Interfaces: Defining, Implementing and Importing Packages. Exceptions: Fundamentals, Types, Uncaught Exceptions, Multiple catch Clauses, Java's Built-in Exception. Multithreading: Creating, Implementing and Extending thread, thread priorities,

synchronization suspending, resuming and stopping Threads. String: String Constructors, Various Types of String Operations. Basic Packages of Java: Java.lang, Java.util, Java.i.o. Event Handling: Event Model, Event Classes, Sources of Events, Event Listener Interfaces AWT: Working with Windows, AWT Controls, Layout Managers Applet Class, Architecture, Skeleton, Display Methods. Swings: JApplet, Icons, labels, Text Fields, Buttons, Combo Boxes. Introduction to JSP.

References:

1. H. Schildt, *Java The Complete Reference*, (10e), Tata McGraw-Hill, 2017.
2. E. Balaguruswamy, *Programming with JAVA*, (5e,) McGraw-Hill, 2014.
3. D. Liang, *Introduction to JAVA Programming*, (7e), Pearson, 2009.

CA2104: DATA COMMUNICATION & PROTOCOLS [3 1 0 4]

Data Transmission: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity. Transmission Media: Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission. Signal Encoding Techniques: Analog and Digital Signals, Digital-To-Digital Conversion: Line Coding Schemes, Block Coding, Scrambling, Analog-To-Digital Conversion: Pulse Code Modulation, Delta Modulation, Digital-To-Analog Conversion: Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying. Digital Data Communication Techniques: Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error Correction, Line Configurations. Data Link Control Protocols: Flow Control, Error Control, High-Level Data Link Control (HDLC). Multiplexing: Frequency-Division Multiplexing (FDM), Time-Division Multiplexing (TDM), Code-Division Multiple Access (CDMA). Spread Spectrum: The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS). Cellular Wireless Communication Techniques: Introduction, Generations: 1G, 2G, 3G, 4G, and 5G.

References:

1. W.Stallings., *Data and Computer Communications*, (8e), Pearson Education, 2007.
2. B. Forouzan, *Data Communications & Networking*, (5e), McGraw Hill, 2012.
3. T. Bertsekas, K. Dimitri, G. Gallager, T. Robert, *Data Networks*, (2e), Prentice Hall of India, 2011.
4. L. Peterson, T. Davie, *Computer Networks: A Systems Approach*, (5e), Morgan Kaufmann Publishers, 2012.

CA2130: WEB PROGRAMMING LAB [0 0 2 1]

Simple HTML document using basic elements like: <HTML>, <body>, <head>, <title>,
, <hr>. Text formatting tag: center, sup, em, ins, sub, font, h1 to h6, computer output tag: code, kbd, samp, tt, var, pre. Programming based on HTML, HTML with CSS, DHTML with JavaScript, Servlet, JSP and Database Connectivity Web pages. Classes and Objects, Display records by using database, Data list link control & Data binding using dropdown list control, Inserting record into a database & Deleting record into a database, Data binding using data list control & Data list control templates, Data binding using data grid & Data grid control template, Data grid hyperlink & Data grid button column, Creating own table format using data grid, Web Form application.

References:

1. M. Michaelis, *Essential C# 3.0: For .NET Framework*, (2e), Pearson, 2010.
2. S. Johnson, *Using Active Server Pages*,(1e) Que, 2000.

CA2131: OBJECT ORIENTED PROGRAMMING USING JAVA LAB [0 0 2 1]

Java programs using classes & objects and various control constructs such as loops etc, and data structures such as arrays, structures and functions. Java programs for creating Applets for display of images and texts. Programs related to Interfaces & Packages. Input/Output and random files programs in Java. Java programs using Event driven concept. Programs related to network programming.

References:

1. R.Elmasri ,S. Navathe, D. V. L. N. Somayajulu, S.K. Gupta, *Fundamentals of Database Systems*, (6e), Pearson, 2011 .
2. T.Connolly, C.Begg, *Database Systems – A Practical Approach to Design, Implementation and Management*, (4e), Pearson , 2005.

**II Year
Fourth Semester**

MA2210: NUMERICAL METHODS [3 1 0 4]

Finite Differences: Definition of operators and derivation of inter-relations among them, properties of Δ and E (without proof), factorial notation for positive and negative exponent, representation of polynomial in factorial notations. Interpolation With Equal Intervals: Newton's forward difference formula, Newton's backward difference formula. Interpolation with unequal intervals. Central Difference Interpolation Formula: Gauss forward, Gauss backward, Stirling's formula. Numerical Integration: Trapezoidal rule and its geometrical significance, Simpson's one-third rule, Simpson's three-eighth rule. Solution of Algebraic and Transcendental Equations: Secant, Regula-Falsi method, Newton-Raphson Method, Iterative method. Solution of Ordinary differential equations: Picard method, Taylor series method, Euler methods, Euler's modified method, Runge-Kutta methods.

References:

1. R. K. Jain, S.R.K.Iyengar, *Numerical Methods*,(1e), New Age International Publishers,2013 .
2. B. S. Grewal, *Numerical Methods*, Khanna publications, (1e), 2013.
3. J.H.Mathews, K.D. Fink, *Numerical Methods using MATLAB*, (4e), Pearson, 2015.
4. C.F.Gerald ,P.O. Wheatley, *Applied Numerical Analysis*,(7e), Pearson, 2007.

CA2201: OPERATING SYSTEMS [3 1 0 4]

Introduction: Basic concepts, Simple Batch Systems, Multi-programmed Batched Systems, TimeSharing Systems, Protection; Processes and CPU scheduling: Process Concept, Process scheduling, Operation on Processes, Cooperating Processes, Inter-process Communication. Scheduling Criteria, Scheduling algorithms; Process Synchronization: The Critical-Section problem, Synchronization Hardware, Basics of Semaphores; Deadlocks: Deadlock characterization, Methods of Handling Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection & Recovery from Deadlock; Memory Management: Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging. Virtual Memory: Demand paging, Page replacement, Page-replacement algorithms.

References:

1. A.Silberschatz ,P.B Galvin,G.Gagne ,*Operating system concepts*,(9e), Wiley, 2016 .
2. H.M.Deitel, *An introduction to operating system*,(1e) ,Wiley, 1983.

CA2202: PYTHON PROGRAMMING [3 1 0 4]

Python concepts: Expressions, values, types, variables, programs & algorithms, control flow, file I/O, the Python execution model. Data structures: List, set, dictionary (mapping), tuple, graph (from a thirdparty library), List slicing (sublist), list comprehension (shorthand for a loop), Mutable and immutable data structures, Distinction between identity and (abstract) value. Functions: Procedural abstraction, functions as values, recursion, function design methodology. The Python Library: String and Text Handling, Data Structures and Algorithms, Threading, Networking, Web Programming, Graphical Programming, Database Access

References:

1. D. M. Beazley, *Python Essential Reference*, (1e) Amazon Books, 2010.
2. M. Lutz, *Programming Python*, (4e), O'Reilly Media, 2010.

CA2203: SOFTWARE ENGINEERING [3 1 0 4]

Introduction to System Concepts: Definition, Elements of System, Characteristics of System, Types of System, System Concepts. Introduction to Software Engineering: Definition, Need for software Engineering, Software Characteristics, Software Qualities (McCall's Quality Factors) Requirement Analysis: Definition of System Analysis, Requirement Anticipation, Knowledge and Qualities of System Analyst, Role of a System Analyst, Feasibility Study And It's Types, User Transaction Requirement, User design Requirements, SRS(System Requirement Specification) Software Development Methodologies: SDLC (System Development Life Cycle), Waterfall Model, Spiral Model, Prototyping Model, Introduction to Agile Model. Analysis and Design Tools: Entity Relationship Diagrams, Data Flow Diagrams (DFD), Data Dictionary & Elements of Data Dictionary, Pseudo code, Input And Output Design. Structured System Design: Modules Concepts and Types of Modules, Structured Chart, Qualities of Good Design, Coupling, Types of Coupling, Cohesion, Types of Cohesion. Software Testing: Definition, Test characteristics, Types of testing - BlackBox Testing, White-Box Testing, Stress Testing, Performance Testing.

References:

1. R. S. Pressman, *Software Engineering*, (5e), Tata McGraw Hills, 2009.
2. I. Sommerville, *Software Engineering*, (6e), Pearson Education Asia, 2005.
3. P.Jalote,*An Integrated Approach to Software Engineering*,(3e) , Narosa , 2010.

CA2230: OPERATING SYSTEM LAB [0 0 2 1]

Basic Unix Commands: date, clear, chmod, man, mail, passwd, pwd, cat, ls, mv, mkdir, cd, rm, rmdir, wc etc, introduction to Vi editor ; UNIX shell : wild cards, redirection, pipes, sequencing, grouping, background processing, command substitution, sub shells; Shell programming: shell scripts variables, loops (for, while), and conditional statements (if else, case), Shell variables, arguments to shell procedure, test command, arithmetic with EXPR command, interactive shell procedures with read ;CPU scheduling Algorithms: FCFS,SJF,RR; Semaphores: Readers Writers Problem, Producer-Consumer Problem; Deadlock Avoidance: Bankers Algorithm; Memory allocation: First fit, worst fit, best fit, next fit; Page Replacement : FIFO,Optimal, LRU.

References:

1. M.Bach, *Design of Unix Operating System*,(1e) ,PH I, 2015
2. G.Glass, *Unix for Programmers and Users- A complete guide*, (3e), PHI, 2003

CA2231: PYTHON PROGRAMMING LAB [0 0 2 1]

Implement a sequential search, create a calculator program, Explore string functions, Implement Selection Sort, Implement Stack, Read and write into a file, Demonstrate usage of basic regular expression, Demonstrate use of advanced regular expressions for data validation. Demonstrate use of List, Demonstrate use of Dictionaries, Create Comma Separate Files (CSV), Load CSV files into internal Data Structure. Write script to work like a SQL SELECT statement for internal Data Structure made in earlier exercise. Write script to work like a SQL Inner Join for an internal Data Structure made in earlier exercise.

References:

1. D. M. Beazley, *Python Essential Reference*, (1e) Amazon Books, 2010.
2. M. Lutz, *Programming Python*, (4e), O'Reilly Media, 2010.

CY1003: ENVIRONMENTAL SCIENCE [3 0 0 3]

Introduction: Multidisciplinary nature, scope and importance, sustainability and sustainable development. Ecosystems: Concept, structure and function, energy flow, food chain, food webs and ecological succession, examples. Natural Resources (Renewable and Non-renewable Resources): Land resources and land use change, Land degradation, soil erosion and desertification, deforestation. Water: Use and over-exploitation, floods, droughts, conflicts. Energy resources: Renewable and non-renewable energy sources, alternate energy sources, growing energy needs, case studies. Biodiversity and Conservation: Levels, biogeographic zones, biodiversity patterns and hot spots, India as a mega-biodiversity nation; Endangered and endemic species, threats, conservation, biodiversity services. Environmental Pollution: Type, causes, effects, and controls of Air, Water, Soil and Noise pollution, nuclear hazards and human health risks, fireworks, solid waste management, case studies. Environmental Policies and Practices: Climate change, global warming, ozone layer depletion, acid rain, environment laws, environmental protection acts, international agreements, nature reserves, tribal populations and rights, human wildlife conflicts in Indian context. Human Communities and the Environment: Human population growth, human health and welfare, resettlement and rehabilitation, case studies, disaster management, environmental ethics, environmental communication and public awareness, case studies. Field Work and visit.

References:

1. R. Rajagopalan, *Environmental Studies: From Crisis to Cure*, Oxford University Press, 2016.
2. A. K. De, *Environmental Studies*, New Age International Publishers, New Delhi, 2007.
3. E. Bharucha, *Text book of Environmental Studies for undergraduate courses*, Universities Press, Hyderabad, 2013.
4. R. Carson, *Silent Spring*, Houghton Mifflin Harcourt, 2002.
5. M. Gadgil & R. Guha, *This Fissured Land: An Ecological History of India*, University of California Press, 1993.
6. M. J. Groom, K. Meffe Gary and C. R. Carroll, *Principles of Conservation Biology*, OUP, USA, 2005.

III Year Fifth Semester

CA3101: DATA WAREHOUSING USING OLAP [3 1 0 4]

Data Warehousing Introduction: Data Warehouse, Data Warehouse Architecture, Implementation, Data Warehousing to Data Mining, Data warehousing components, building a data warehouse, mapping the data warehouse to an architecture, data extraction, Transform and Load, cleanup transformation tools, metadata, Data Warehouse characteristics and definition; The purpose of Data Warehouse; Data Marts:

Data Warehouse Cost-Benefit Analysis / Return on Investment; OLAP: Patterns and models – Data visualization principles, Data Mining functionalities, Major issues in Data Mining.

References:

1. J.Han, M. Kamber, *Data Mining Concepts and Techniques*, (3e), Elsevier, 2011.
2. M. Berry, G. Linoff, *Data Mining Techniques*, (3e), Wiley, 2011.
3. T.H. Davenport, J.G.Shankar, *Competing on Analytics*, (1e), Harvard Business Review, 2007.
4. R.N Prasad, S. Acharya, *Fundamentals of Business Analytics*, (2e), Wiley, 2011.

CA3102: MOBILE APPLICATION DEVELOPMENT [3 1 0 4]

Introduction: Android, Android versions and its feature set The various Android devices on the market, The Android Market application store, Android Development Environment - System Requirements, Android SDK, Installing Java, and ADT bundle - Eclipse Integrated Development Environment (IDE). An Overview of Threads, The Application Main Thread. Multimedia: Audio, Video, Camera Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures. Android Architecture Overview: The Android Software Stack, The Linux Kernel, Android Runtime - Dalvik Virtual Machine, Android Runtime – Core Libraries, Dalvik VM Specific Libraries, Java Interoperability Libraries, Android Libraries, Application Framework, Android Software Development Platform: Understanding Java SE and the Dalvik Virtual Machine, The Directory Structure of an Android Project , Common Default Resources Folders. Android Framework Overview: Android Application Components, Android Activities: Defining the UI, Android Services: Processing in the Background, Broadcast Receivers: Announcements and Notifications Content Providers: Data Management, Android Intent Objects: Messaging for Components Android Manifest XML: Declaring Your Components. Understanding Android Views, View Groups and Layouts Designing for Different Android Devices, Views and View Groups, Android Layout Managers, The View Hierarchy, Designing an Android User Interface using the Graphical Layout Tool. Graphical User Interface Screen with views: Displaying Text with TextView, Retrieving Data from Users, Using Buttons, Check Boxes and Radio Groups, Getting Dates and Times from Users, Using Indicators to Display Data to Users. Displaying Pictures: Gallery, ImageSwitcher, GridView, and ImageView views to display images, Creating Animation. Files, Content Providers, and Databases: Saving and Loading Files, SQLite Databases, Android Database Design, Exposing Access to a Data Source through a Content Provider, Content Provider Registration, Native Content Providers.

References:

1. B. Phillip , C. Stewart, B. Hardy, K. Marsicano, Android Programming, *The Big Nerd Ranch Guide*, (3e), Big Nerd Ranch LLC, 2017.
2. R. Meier, *Professional Android 4 Application Development*, (3e), Wiley India (Wrox), 2012.
3. J. C. Sheusi, *Android Application Development for Java Programmers*, (1e), Cengage Learning, 2013.
4. W.M.Lee, *Beginning Android 4 Application Development*, (1e), Wiley India (Wrox), 2013.

CA3103: OOAD USING UML [3 1 0 4]

Complexity The inherent complexity of software, The Structure of complex systems, Bringing order to chaos, on designing complex systems, Categories of analysis and Design methods. The Object Model: The evolution of object model, Elements of object model. Classes and Objects: The Nature of an Object, Relationship among objects, nature of a class, Relationship among classes. Introduction to Modeling and UML: Importance of modeling, principles of modeling, object oriented modeling, overview of UML conceptual model of the UML, Architecture. Basic Structural Modeling: Common Mechanism: Terms and Concepts, Common modeling techniques. Diagrams, Class Diagrams. Advanced Structural Modeling: Interfaces, Types and Roles, Packages, Object Diagrams. Basic Behavioral Modeling: Interaction,

Interaction diagram, Use case, Use case diagram. Advanced Behavioral Modeling: State Machines, State Diagrams. Case Study: Any application can be discussed with help of an open tool. Architectural Modeling: Deployment, Deployment Diagram, Collaboration.

References:

1. G.Booch, R.A.Makimchul, M.W.Eagel, J.Conallen, K.A.Houston, *Object Oriented Analysis and Design with Applications*, (3e), Addison-Wesley Professional, 2013.
2. G.Booch, J.Rumbaugh, I.Jacobson, *The Unified Modeling Language User Guide*, (2e), Addison-Wesley Professional, 2013.
3. M.Blaha, J.Rumbaugh, *Object Oriented Modeling and Design with UML*, (2e), Pearson, 2010.

CA3104: INTRODUCTION TO CLOUD COMPUTING [3 1 0 4]

Introduction to Cloud Computing, Evolution, Benefits and Barriers, Cloud SPI models, Cloud Computing Vs Cluster Computing, Technology Involved in Cloud Computing, NIST Cloud architecture, Modern Cloud architecture, Cloud Characteristics, Service Model and Deployment Model, Types of hypervisor. Data and Network Management- Introduction- Objectives, Classic datacenters (CDCs) technologies, Virtualised Data Centers (VDCs), Storage Virtualization, Virtual Machine Storage Options, Block & File level Storage Virtualization, Virtual Provisioning, Compute Virtualisation, Virtual Machine Components, Compute Virtualisation Techniques, Converting Physical Machines to Virtual Machines, Desktop and Application Virtualisation. Virtualized Data Center– Networking- Network virtualization in VDC, VDC network infrastructure and components, Virtual LAN (VLAN) and Virtual SAN (VSAN), Components of VDC Network Infrastructure, Virtual Network Component, VLAN and VSAN Technologies, Network traffic management techniques in VDC Service. Management in Cloud Computing, Service Level Agreements (SLAs), Quality of Service (QoS), Billing and Accounting, Scaling Cloud Hardware, Managing Data, Cloud Security and Privacy, Infrastructure security, Data security and Storage, Data privacy, access management, Cloud computing standards and Interoperability, technical considerations for migration to the cloud. Migrating to the Cloud- Introduction- Objectives, Cloud Services for individuals- Available Services - Skytap Solution, Cloud Services Aimed at the mid – market, Live Migration. Case Studies.

References:

1. R. K.Buyya, J. Broberg, A. M. Goscinski, *Cloud Computing: Principles and Paradigms*, (1e) Wiley Publications, 2013.
2. S. Barrie, *Cloud computing bible*, (1e), John Wiley & Sons, 2010.
3. N. Antonopoulos, L. Gillam, *Cloud Computing: Principles, Systems and Applications*, (1e), springer, 2012.
4. T. Mather, S.Kumaraswamy, S.Latif, *Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance*, (1e), O'Reilly, 2009.
5. R. L. Krutz, R. D.Vines, *Cloud Security: A Comprehensive Guide to Secure Cloud Computing*, (4e), Wiley, India, 2010.

CA3130: DATA WAREHOUSING LAB [0 0 2 1]

Reading data from files and working with datasets, Graphs, Classifiers: Lazy, Decision Trees, clustering: K-Means, Partitioning Method, Implement classification using K nearest neighbour classification, Hierarchical Method.

References:

1. J.Han, M. Kamber, *Data Mining Concepts and Techniques*, (3e), Elsevier, 2011.
2. M. Berry, G. Linoff, *Data Mining Techniques*, (3e), Wiley, 2011.
3. T.H. Davenport, J.G.Shankar, *Competing on Analytics*, (1e), Harvard Business Review, 2007.
4. R.N Prasad, S. Acharya, *Fundamentals of Business Analytics*, (2e), Wiley, 2011.

CA3131: MOBILE APPLICATION DEVELOPMENT LAB [0 0 2 1]

Develop an application that uses GUI components, Font and Colors. Develop an application that uses layout managers and event listeners. Develop a native calculator application to calculate the arithmetic operations. Write an application that draws basic graphical primitives on the screen. Develop an application that makes use of database for add the info, and show the search result. Implement an application that implements multi-threading. Develop a native application that uses GPS location information. Implement an application that writes data to the SD card. Implement an application that creates an alert upon receiving a message. Write a mobile application that creates alarm clock.

References:

1. B. Phillip , C. Stewart, B. Hardy, K. Marsicano, *Android Programming*, The Big Nerd Ranch Guide, (3e), Big Nerd Ranch LLC, 2017.
2. R. Meier, *Professional Android 4 Application Development*, (3e), Wiley India (Wrox), 2012.
3. J. C. Sheusi, *Android Application Development for Java Programmers*, (1e), Cengage Learning, 2013.
4. W.M.Lee, *Beginning Android 4 Application Development*, (1e), Wiley India (Wrox), 2013.

PROGRAM ELECTIVE- I

CA3140: ENTERPRISE RESOURCE PLANNING [3 0 0 3]

Business function and Business process: Functional areas and Business Process - functional area of operations - Business process - Marketing Sales – supply chain management – Accounting and finance – Human Resource – Functional areas of information system – The development of ERP system SAP R/3 – New directions in ERP – significance and benefits of ERP software and systems, Marketing information system and sales order process in ERP: sales and Distribution in ERP, Pre sales activities, sales order processing, inventory Sourcing, Delivery, Billing, payment, Customer relationship Management, benefits of CRM, Production and supply chain management information system: Production overview, The production planning process, The SAP ERP Approach to production planning, Sales forecasting, sales and operation Planning, Demand management, Material requirement planning in SAP ERP, ERP and supplier, supply chain, Accounting in ERP : Accounting activities, using ERP for accounting Information, operational decision making problem, credit management, Industrial credit management in SAP ERP, product profitability analysis Management reporting with ERP system, Document flow for customer Service, Human resource process in ERP: HR with ERP, Advance HR features, Time management, Payroll, Travel management, Training and Development, Management by objectives, ERP process modeling.

References:

1. A.Leon, *ERP demystified*, (2e), McGraw Hill Education, 2008.
2. A.Shtub, R.Karni, *ERP: The Dynamics of Supply Chain and Process Management*, (2e), Springer , 2010.
3. K.Kumar ,*ERP experiences and evolution*, Communications of the ACM, 2008.

CA3141: MANAGEMENT INFORMATION SYSTEM [3 0 0 3]

Introduction to MIS: The Technical and Business Perspective, Organization Structure, Evaluation of MIS through Information System, MIS Organization within the Company. Information Systems for Decision Making: Evolution of an Information System, Basic Information Systems, Decision Making and MIS,

Decision Assisting Information System, Concepts of Balanced MIS Effectiveness and Efficiency Criteria. Development of MIS: Methodology and Tools/Techniques for Systematic Identification, Evaluation and Modification of MIS. Advanced MIS: Concepts, Needs and Problems in Achieving Advanced MIS, DSS. Pitfalls in MIS Development: Fundamental Weakness, Soft Spots in Planning and Design Problems.

References:

1. Murdic, J.Rose, Clagett, *Information Systems for Modern Management*,(3e), PHI, 1985
2. K.C.Laudon, J.P.Laudon, *Management Information Systems*,(12e), Pearson, 2012.

CA3142: SAP [3 0 0 3]

Introduction: Evolution of SAP, Different versions of SAP, New dimensional components of SAP, modules of each SAP component. SAP Net weaver Architecture: Net weaver Introduction, Components of Net Weaver, Core Architecture, Application servers, Central Instance, Dialog instance.ABAP and Java Stacks, Message servers, Dispatchers, WPs and the types, System Landscape. SAP Components: Core Component and functionality, New Dimensional components and basis introduction of these functionality. Modules of SAP: components, Roles in SAP application, basis introduction to ABAP and T-Codes. Basis introduction to SAP technical work flow.

References:

1. A.Leon, *ERP demystified*, (2e), McGraw Hill Education, 2008.
2. A.Shtub, R.Karni, *ERP: The Dynamics of Supply Chain and Process Management*, (2e), Springer, 2010.

**III Year
Sixth Semester**

CA3201: CRYPTOGRAPHY FUNDAMENTALS [3 1 0 4]

Elements of Number Theory : Euclid Algorithm, Prime Number Theorem, Euler's, Fermat's Little theorems, Entropy ; Classical Cipher Techniques: Caesar, Affine, Mono-alphabetic, Transposition, Polyalphabetic Ciphers; Security Attacks: Active V/S Passive, Security Services; Symmetric Encryption: Fiestel Cipher, Confusion and Diffusion, DES Algorithm; Asymmetric Encryption: Principles of Public Key Cryptosystems, RSA Algorithm; Message Authentication & Hashing; Digital Signatures: RSA Based, ElGamal Signatures; Key distribution; User Authentication Protocols; E-Mail Security: PGP, S/MIME; IPsec: AH & ESP; SSL; TLS.

References:

1. S. Williams, *Cryptography and Network Security: Principles and Practices*, (7e) Pearson Education, 2017.
2. A. Kahate, *Cryptography and Network Security*, (2e),Tata Mc-Graw Hill, 2009.
3. C.kaufmen, R.Perlman,M.Speciner, *Network Security: Private Communication in a Public World*, (2e), prentice Hall, 2008.
4. V.S.Bagad, I.A.Dhotre, *Cryptography and Network Security*, (1e) Technical Publications, 2008.
5. B.A. Forouzan,D.Mukhopadhyay, *Network Security*, (3e) Tata Mc-Graw Hill, 2015.

CA3202: FUNDAMENTALS TO MACHINE LEARNING [3 1 0 4]

Introduction to Machine Learning: Basics of Machine Learning, Supervised Machine Learning, K-NearestNeighbors, Naïve Bayes, Decision tree, Support Vector Machines, Unsupervised Machine Learning: Cluster analysis, K means, Association Rule Mining, Apriori algorithms, Regression Analysis: Linear Regression, Nonlinear Regression, Problem Solving: State Space Search, Production System, Depth First Search, Breadth First Search, Heuristic Search (Hill Climbing, Best First Search and Problem Reduction).

References:

1. T.M.Mitchell, *Machine Learning*, (1e), McGraw- Hill Education, 2017.
2. E.Alpaydin, *Introduction to Machine Learning*, (3e), PHI, 2015.

CA3203: FUNDAMENTALS TO MOBILE COMPUTING [3 1 0 4]

Introduction: Mobile Communication and Overall View of the Syllabus and Lesson Plan, Introduction to Wireless Communication: Evolution of Mobile communications, Wireless and Mobile Radio-The First 150+ Years, Transmission fundamentals: Basics of Propagation, Propagation Models, Free-Space Propagation Model, Large-Scale Path Loss, Small Scale Multipath Propagation, Modulation Techniques for Mobile Radio: Modulation Criteria, Modulation Techniques, Linear Modulation Techniques - ASK, PSK, FSK, MSK, Spread spectrum modulation Cellular concepts: Frequency reuse, Channel assignment strategies, Handoff strategies; Mobile Computing: Mobile IP, ubiquitous and nomadic computing WWW & Mobile Agent wireless world wide web; Mobile agent technology and standards.

References:

1. T.S. Rappaport, *Wireless Communications - Principle and Practice*,(2e), PHI, 2005.
2. W. Stallings, *Wireless Communication and Network*, (2e), PHI, 2004.
3. K. Garg, *Mobile Computing*, (1e), Pearson Education India, 2010.

CA3230: MACHINE LEARNING LAB [3 0 0 3]

Introduction to R Programming, History of R, and R packages, CRAN, R community, R-bloggers, StackOverflow, Coursera, DataCamp.R Syntax Basics: Constants, operators, functions, variables .Random numbers, Vectors and vector indexing, simple descriptive stats, Loops, Conditional expressions. Data Types: Levels of measurement (nominal, ordinal, interval, ratio scale) Vector types, data. Frame objects, rows and columns, indexing, Characteristics of tidy data. Basic Data Transformations: Create new variables in a data. Frame, Filter rows and columns, merging datasets. Introduction to Complex Data Transformations: Filtering and ordering data ,Summaries and aggregates ,New variables ,Relational data, Joins on Keys ,Introduction into fuzzy joins ,Transforming wide and long tables, Converting Numeric Variables into Factors, Date Operations ,String Parsing ,Geocoding. Data Visualization using R. Dirty Data Problems, Data Sources: sqlite examples for relational databases, Loading SPSS and SAS files, Reading from Excel and Google Spreadsheets, API and web scraping examples.

References:

1. G.Grolemund, *Handbook of programming with R*, (1e), O'REILLY, 2014.

CA3260: PROJECT [0 0 4 2]

The duration of BCA final year project is one Semester of 6th semester. Students are required to undertake innovative and research oriented projects, which not only reflect their knowledge gained in the earlier semesters but also additional knowledge gained from their own effort. They must show the phase wise development of their project submitting the appropriate documents at the end of each phase. The student must put in effort to find answers to questions about the applications, which will also enhance the value of the project report. There will be one interim and one final seminar for evaluation of the project.