

BACHELOR OF COMPUTER APPLICATIONS (BCA)
Three-Year Programme
Academic Curriculum (2019 – 22 onwards)
First Year
Curriculum Component

Component	Credit
1. University core (4 courses)	8
2. University Elective (2courses)	6
3. Basic Science (3 courses)	12
4. Program Core (25 courses)	64
5. Program Elective (4 courses)	12
6. Project/Summer Internship Project (2 courses)	17
7. Proficiency (Non Credit/Non Graded)	-
Total	119

Autumn Semester	Course Type	Course Title	Contact Hrs per Week			Credits	ETE Duration Hours	Weightage %			
			L	T	P			CW	MTE	PBL	ETE
			UC 19.101	Social and Professional Ethics	2			0	0	2	3
CA 19.101	Computer Fundamentals	3	-	-	3	3	10	40		50	
CA 19.103	C Programming	3	-	-	3	3	10	40		50	
CA 19.107	Foundation Course in Mathematics	3	1	-	4	3	10	40		50	
BS	<i>Environmental Studies (University Compulsory)</i>	3	1	-	4	4	10	40		50	
CA 19.133	Office Automation Laboratory	-	-	4	2	2	20	20	20	40	
CA 19.135	C Programming Laboratory	-	-	4	2	2	20	20	20	40	
	Sub Total		14	2	8	20					
	Proficiency (Non-Credit)					-				100	

Spring Semester	Course Type	Course Title	Contact Hrs per Week			Credits	ETE Duration Hour	Weightage %			
			L	T	P			CW	MTE	PBL	ETE
			UC 19.102	Communication Skill	2			0	0	2	3
UE 19.101	University Elective	3	-	-	3	3	10	40		50	
CA 19.102	Operating System	3	-	-	3	3	10	40		50	
CA 19.104	Data Structures	3	-	-	3	3	10	40		50	
CA 19.106	Systems Analysis and Design	3	-	-	3	3	10	40		50	
CA 19.108	Python Programming	3	1	-	4	3	10	40		50	
CA 19.134	Data Structures Laboratory	-	-	4	2	2	20	20	20	40	
CA 19.136	Python Programming Laboratory	-	-	4	2	2	20	20	20	40	
	Sub Total		17	1	8	22					
	Proficiency (Non-Credit)					1				100	

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Second Year

	Course Type	Course Title	Contact Hrs per Week			Credits	ETE Duration Hours	Weightage %			
			L	T	P			CW	MTE	PBL	ETE
			Autumn Semester	UC 19.201	Introduction to Management and Leadership			2	0	0	2
CA 19.201	Computer Organization	3		1	-	4	3	10	40		50
CA 19.203	Database Management System	3		-	-	3	3	10	40		50
PE	Program Elective-I	3		-	-	3	3	10	40		50
CA 19.207	C++ Programming	3		-	-	3	3	10	40		50
CA 19.209	Discrete Mathematics	3		1	-	4	3	10	40		50
CA 19.233	Database Management System Laboratory	-		-	4	2	4	20	20	20	40
CA 19.235	C++ Programming Laboratory	-		-	4	2	4	20	20	20	40
	Sub Total			17	2	8	23				
	Proficiency (Non-Credit) #						-				100

	Course Type	Course Title	Contact Hrs per Week			Credits	ETE Duration Hours	Weightage %			
			L	T	P			CW	MTE	PBL	ETE
			Spring Semester	UC 19.202	Business Environment			2	0	0	2
UE 19.202	<i>University Elective-2</i>	3		-	-	3	3	10	40		50
CA 19.204	Computer Networks	3		1	-	4	3	10	40		50
CA 19.206	Computer Graphics	3		1	-	4	3	10	40		50
CA 19.210	Java Programming	3		-	-	3	3	10	40		50
PE	Program Elective-2	3		-	-	3	3	10	40		50
CA 19.234	Internet Laboratory	-		-	4	2	4	20	20	20	40
CA 19.236	Java Programming Laboratory	-		-	4	2	4	20	20	20	40
	Sub Total			17	2	8	23				
	Proficiency (Non-Credit) #						-				100

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Third Year

	Course Type	Course Title	Contact Hrs per Week			Credits	ETE Duration Hours	Weightage %		
			L	T	P			CW	MTE	ETE
Autumn Semester	CA 19.301	Web Technology	3	-	-	3	3	10	40	50
	CA 19.303	Software Engineering	3	0	0	3	3	10	40	50
	PE	Program Elective – 3	3	0	0	3	3	10	40	50
	CA 19.333	Web Application Development Laboratory	-	-	4	2	2	20	40	40
		Program Elective – 4	3	-	-	3	-	20	40	40
	CA 19.337	Minor Project	-	-	-	2	-	20	40	40
		Sub Total	12		4	16				
		Proficiency (Non-Credit)				-				100

	Course Type	Course Title	Contact Hrs per Week			Credits	ETE Duration Hours	Weightage %		
			L	T	P			CW	MTE	ETE
Spring	CA 19.312	Major Project*	-	-	-	15	-			100
		Sub Total				15				
		Proficiency (Non-Credit) #	-	-	-	-				100

Total Credits = 42+46+31=119

Evaluation of proficiency will be based on the participation in co- curricular / extra curricular activities.

MTE : Mid Term Examination

ETE : End Term Examination

*Major Project: Spring Semester of third year will be exclusively for project training in an organization in which student shall be required to work on a project assigned by such organizations in consultation with the concerned Internal Supervisor allotted to her from the faculty members of the department. However, In exceptional conditions HOD may allow any student to undergo the project training in the campus under the supervision of faculty member assigned to her. At the end of the semester the student shall be required to submit a Project Report based on the project given to her. A committee of the Internal Supervisor & External Examiner will evaluate the report & conduct viva- voce.

Program Elective-1		
S. No.	Course Code	
1.	CA 19.231	Management Information System
2.	CA 19.232	Enterprise Resource Planning
3.	CA 19.237	Software Project Management
Program Elective-2		
S. No.	Course Code	Course Title
1.	CA 19.263	System Software
2.	CA 19.265	Internet Technologies
3.	CA 19.267	Network Security
4.	CA 19.208	Electronic Commerce
5.	ET 19.471	Cloud Computing (Infosys)
Program Elective 3		
1.	CA 19.373	Software and Case Study
2.	CA 19.375	Bioinformatics
3.	CA 19.377	Geographical Information System
4.	CA 19.369	E-Business
5.	ET 19.465	Agile Software Development (Infosys)
Program Elective 4		
1.	CA 19.362	Knowledge Management
2.	CA 19.364	Artificial Intelligence
3.	CA 19.366	Information Security
4.	CA 19.368	Cyber Laws
5.	ET 19.362	Mobile Apps Development (Infosys)

Credit Distribution across all Components									
Semester	UC	UE	BS	ES	PC	PE	SIP	Proj	Total
First	2	-	8	-	10	-	-		20
Second	2	3	-	-	17				22
Third	2		4		14	3			23
Fourth	2	3			15	3			23
Fifth					8	6	-	2	16
Sixth								15	15
Total	8	6	12		64	12	-	17	119

Objective: To create an awareness on professional ethics and human values, To instill moral and social values and loyalty and to appreciate the rights of others.

Pre-requisite:

1. **Basic Human Values:** Morals, Values and Ethics – Truth, Rights Conduct (Righteousness), Love, non-violence and peace, Humility and character. Core areas of ethics: Social ethics, Personal ethics Integrity and Trustworthiness, Honesty, Loyalty, Courage, Prudence, Confidence, Confidentiality. [5]
2. **Theories of Ethics:** Kohlberg and Gilligan’s analysis of moral development, - Deontology, Utilitarianism, Virtue Theory Rights Theory, Casuist Theory of Consequentialism – Robert Nozick’s Theory of Entitlement and Property Rights. [4]
3. **Professional Ethics:** Introduction, meaning of work ethics, professional ethics for Journalists, Physicians, Lawyers, Engineers and Accountants. Intellectual property Rights, scope of ethics, code of conduct, business values and inner consciousness, Ethics at the workplace cybercrime, plagiarism, misconduct, fraudulent use of institutional resources, etc. [7]
4. **Corporate Social Responsibility:** Evolution of Corporate Social Responsibility (CSR) in India, CSR models, CSR to different stakeholders, Corporate Social Responsibility Initiatives of Major Companies of India, Promoting value based governance in organization. Whistle blower policy. [6]
5. **Ethics and Environment:** Introduction to environmental Issues- Industry and Environmental Pollution, Ethics of Controlling environmental pollution – Impact of environmental pollution on human health – Rights, Duties and care in environmental protection - Sustainable development. [4]

Outcome: The students will understand the basic perception of profession, professional ethics, various moral issues and uses of ethical theories.

Text Books:

1. B.N Ghosh “Business Ethics and Corporate Governance”, McGraw Hill Education, Chennai, 2016
2. John R Boatright, “Ethics And The Conduct Of Business”, Pearson Education, New Delhi, 2013.

Reference Books:

1. Raju Ramachandran, “Professional Ethics: Changing Profession and Changing Ethics”, LexisNexis, Butterworths, 2nd Edition 2014.
2. Andrew Crane and Dirk Matten, “Business Ethics”, Oxford University Press, 2nd Edition, 2015.
3. S.K Mandal “Ethics in Business and Corporate Governance” McGraw Hill Education, New Delhi, 2013.
4. R. Subramanian “Professional Ethics”, Oxford University Press, 2015.

Prerequisite(s): NIL

Objective(s): To understand the fundamentals of computers like basic working and structure of computer, data representation, and office automation and networking.

- 1 **Introduction to Computers:** Definition, Block Diagram, characteristics, Applications in Modern Society, History, Classification of computers and Generation of computers. [6]
- 2 **Functional Units of Computer Processing System:** Hardware, CPU, Memory and secondary storage devices, Input devices, Output Devices, Information Concept and Processing: Data, Information, Knowledge and Wisdom. [8]
- 3 **Data representation:** Representation of Data, Bits and Bytes, Number System: Decimal, Binary, Octal, Hexadecimal, Conversions b/w number system, Arithmetic Operations in Binary Number, ASCII, EBCDIC and BCD Codes. [8]
- 4 **Software Concepts:** Types of Software, Generation of Programming Language: Machine Language, Assembly Language, High Level Language, Translator: Assembler, Interpreter, Compiler, Operating System: Functions, types of operating system: Batch Processing, Multiprogramming, Multiprocessing, Multitasking, Time Sharing and Real Time System, MS-DOS, MS-Windows. [9]
- 5 **Data Communication and Computer Networks:** The Basic Communication System, Data Transmission Modes, Network types, Network Topologies, Internet and its Applications: E-mail, World Wide Web, Intranet, Extranet, Computer Threats: Virus, Worm, Trojan horse, Malware. [9]

Outcome(s): After completion of the course, students would be able to:

- Understand the concept of input/output devices of Computers and how it works.
- Learn the working of computer network and web communication.

Text Books: [1]. P.K.Sinha ,P.Sinha, Computer Fundamentals, 6th ed., BPB Publications, 2015.
[2]. R. Thareja, Fundamentals of Computers, 2nd ed., Oxford University Press India, 2016.

Reference Books: [1]. IITL Education Solutions Limited, Introduction to Computer Science, 2nd ed., Pearson Education, 2011.
[2]. V. Rajaraman, Fundamentals of Computers, 6th ed., PHI, 2015

Prerequisite(s): NIL

Objective(s):

- To learn the basics of programming skills through C-Programming language.
- To understand the fundamentals concepts like syntax, and statements with essentials of efficient compiling, running and debugging processes.

- 1 **Introductory Concepts:** Introduction to computers, Computer characteristics, Types of programming languages, Introduction to C, identifiers and keywords, Data types: declaration and definition, Type conversion. [8]
- 2 **Operators:** Arithmetic, relational, logical, bitwise, unary, assignment, Increment and Decrement operators, conditional operators and their hierarchy, associativity, Data input/output. [6]
- 3 **Control Structure and Array:** Introduction, Conditional Statements; Simple If-Else; Nested Statements, switch, Loops- For, While, Do-While; Break, Continue, Go-To Statements, Labels, printf, scanf function. Defining an array, processing an array, passing arrays to functions, Multidimensional arrays, Arrays and strings. [13]
- 4 **Function and Pointer:** A brief overview, Defining a function, accessing a function, function prototypes, passing arguments to a function, recursion, Pointers: Declaration, operations on pointers, array of pointers, pointers to arrays. [7]
- 5 **Advance C Concepts:** Structure, Union, storage classes in C, Concept of files, file access in different modes, reading from and writing into a file, Library Functions. [6]

Outcome(s): At the end of the course student will be able to:

- Describe the process of problem solving through C.
- Write a justifiable C program for a given algorithm.
- Trace the certain C program manually.

Text Books: [1]. Y. Kanetkar, Let us C, 16th ed. BPB Publication, 2018.
[2]. B. W. Kernighan and D. M. Ritchie, The C Programming Language, 2nd ed., Pearson Education, 2013.

Reference Books: [1]. H. Schildt, C: The Complete Reference, Fourth edition, McGraw- Hill Education, 2000.
[2]. E. Balagurusamy, Programming in ANSI C, 4th ed., TMH Education, 2008.

Prerequisite(s): Nil

Objective(s):

- To acquire fundamental knowledge of (10+02) higher Mathematics and apply in science and engineering disciplines.

- 1 **Matrix:** Addition, Subtraction and Multiplication of matrices, column matrix, row matrix, unit matrix, diagonal matrix, zero matrixes. [6]
- 2 **Determinants:** Definition, Properties of Determinants, multiplication of Determinants, Value of Determinants up to third order, Minors and Co-factors. [8]
- 3 **Algebra:** Factorial Functions, Permutations and Combinations. [7]
- 4 **Calculus:** Differentiation, Integration of Standard functions, Definite Integrals. [11]
- 5 **Statistics:** Frequency Distribution, Mean, Median, Mode, and Standard Deviation and Variance. [8]

Outcome(s): After completion of the course, students would be able to apply fundamentals of (10+02) higher mathematical knowledge in science and engineering and also solve curriculum problems.

Text Books:

- [1].R.D. Sharma, 11th and 12th Mathematics, Dhanpatrai Publication, 2018.
- [2].Dass and Verma, Higher Engineering Mathematics, S.Chand, 2019.

Reference Books:

- [1].Majumder, Engineering Mathematics , Volume I, Central,1995.
- [2].Ramana B.V., Higher Engineering Mathematics, TMH, 2006.

CA 19. 133 Office Automation Laboratory

Total Hours: 26

0-0-4-2

Prerequisite(s): NIL

Objective(s): To familiarize the students in preparation of documents and presentations with office automation tools like, MS Word, MS Excel, MS PowerPoint and MS Access.

MS Word Exercise:

1. Working with Documents., Formatting Documents.
2. Setting Page style.
3. Creating Tables.
4. Drawing.
5. Mail Merging and Printing Documents.

MS Excel Exercise:

6. Spread Sheet & its Applications, Opening Spreadsheet, Menus.
7. Entering & Deleting Data.
8. Setting Formula.
9. Formatting Spreadsheets.
10. Working with sheets.
11. Creating Charts.
12. Using Tools.

MS Access Exercise:

13. Starting Access, Access Screen, Creating a New Database.
14. Creating Tables and Working with Forms.
15. Creating queries.
16. Finding Information in Databases.
17. Creating Reports.
18. Types of Reports.
19. Printing & Print Preview – Importing data from other databases viz. MS Excel etc.

MS Power Point Exercise:

20. Creating a presentation.
21. Formatting a Presentation.
22. Adding Effects to the Presentation.
23. Printing Handouts.

Outcome(s): By learning the course, the students will be able

- to perform documentation
- to perform accounting operations
- to perform presentation skills

Prerequisite(s): NIL

Objective(s):

- To make students familiar with syntax and structure of C-programming.
- To learn problem solving techniques using C programs implementation.

1. Implement the logic of Data Types & Operators.
2. Implement the logic of Type Conversions.
3. Implement the logic of Arithmetic, Relational, and logical operators.
4. Implementation of Bitwise, unary, assignment operators.
5. Implementation of Increment and Decrement operators.
6. Implementation of Conditional operators.
7. Implement the logic of Increment and Decrement operators.
8. Implement the 10 programs in order to cover Control Structure, If-Else statements, Nested If-Else statements, Switch-case statement, Loops- For, While, Do-While, Break Continue, Go-To Statements, and Labels.
9. Implement the 8 programs in order to cover processing an array, passing arrays to functions, Multidimensional arrays.
10. Implement the 5 programs to cover all possible String operations.
11. Implement the 4 programs in order to cover Function prototypes and passing arguments to a function, Recursion.
12. Implement the 5 programs in order to cover Pointers declaration, operations on pointers, Array of pointers, pointers to arrays.
13. Implementation of structure and union programs.
14. Implement the use of Storage classes in C programming.
15. Implement 4 programs for Reading and writing from/to a file.

Outcome(s): On completion of this course student will be able to:

- Apply learning and knowledge of C language analytically, critically and logically to solve mathematical, scientific and real-life problems in an efficient manner.

UC 19.102 Communication Skills**Total Lectures: 26
2-0-0-2**

Objective: This Course aims to develop and enhance the linguistic and communicative competence of the students. The students will be exposed to various forms of personal and professional communication. The self-learning tasks designed will facilitate to enhance effective communication skills.

Pre-requisite:

1. **Introduction to Communication:** Need for Effective Communication, The Process of Communication, Use of language in communication; Barriers to Communication: Types of barriers (Semantic, Intrapersonal, Interpersonal, And Organizational); Miscommunication; Noise; Overcoming measures. **Technology-based Communication:** Netiquettes: effective e-mail messages; power-point presentation; enhancing editing skills using computer software. [5]
2. **Listening and Reading Skills :** Listening as an active skill; Types of Listeners; Listening for general content; Listening to fill up information; Intensive Listening; Listening for specific information; Developing effective listening skills; Barriers to effective listening skills. **Reading Skills:** Previewing techniques; Skimming; Scanning; Understanding the gist of an argument; Identifying the topic sentence; recognizing coherence and sequencing of sentences; Improving comprehension skills. [6]
3. **Writing Skills:** Sentence formation; Use of appropriate diction; Paragraph and Essay Writing; Coherence and Cohesion. Common Errors. **Letter Writing:** Formal, informal and demi-official letters; **Job Application:** Cover letter, Differences between bio-data, CV and Resume. **Report Writing:** Basics of Report Writing; Structure of a report; Types of reports. [6]
4. **Non-verbal Communication and Body Language:** Forms of non-verbal communication; Interpreting body-language cues; Kinesics; Proxemics; Chronemics; Effective use of body language. [3]
5. **Interview Skills:** Types of Interviews; Ensuring success in job interviews; Appropriate use of non-verbal communication. **Group Discussion:** Differences between group discussion and debate; Ensuring success in group discussions. **Presentation Skills:** Oral presentation and public speaking skills. [6]

Outcome: The students would hone the skills of reading, writing, listening, and speaking and become adept at communicating in the current modern context.

Text Books: 3. Raman, M., & Singh, P. (2017). Business Communication (2nd edition.). New Delhi: Oxford University Press.
4. Lesikar, Raymond V and Marie E. Flatley. Basic Business Communication: Skills for Empowering the Internet Generation: Ninth Edition. New Delhi: Tata McGraw-Hill,

Reference Books: 1. Prasad, H. M. How to Prepare for Group Discussion and Interview. New Delhi: Tata McGraw-Hill Publishing Company Limited
2. Bonet, Diana. The Business of Listening: Third Edition. New Delhi: Viva Books, 2004.

CA 19. 102

Operating System

Total Lectures: 40

Credits: 3-0-0-3

Prerequisite(s):

NIL

Objective(s):

- Understand the fundamental operating system abstractions like processes, threads, files, semaphores, IPC and deadlocks.
- Understand operating system from user's perspective as well as from system's perspective.
- Understand the principles of concurrency and synchronization.
- Understand basic resource management techniques.
- Understand different theoretical principles in depth through hands on high level programming.

- 1 **Introduction:** Definition and types of operating systems, Batch Systems, multi programming, time sharing, distributed and real-time systems, Operating system structure, Operating System Components and Services, System calls, System Programs, Virtual Machines. [6]
- 2 **Process Management:** Process and Thread Concept, Process States, Process Control Block, Operations with examples from UNIX (fork, exec) and/or Windows, Inter-process communication (shared memory and message passing), Scheduling Algorithms, Performance Evaluation. [9]
- 3 **Process synchronization and Deadlocks:** critical section problems, semaphores, classical Inter process communication problems. [9]
Deadlocks-System model, Characterization, Deadlock prevention, Avoidance and Detection, Recovery from deadlock, Combined approach to deadlock handling.
- 4 **Memory Management:** Logical and Physical Address Space, Swapping, Contiguous Allocation, paging and segmentation, demand paging, virtual memory page replacement algorithms. [8]
- 5 **File and I/O Management:** Directory systems, File System Implementation issue, access methods, Allocation Methods, Free Space Management, Disk Structure, Disk Scheduling, Disk Management, Control of Various Devices, Device Drivers, Interrupt Driven and Poll Driven Data Transfer. [8]

Outcome(s):

By learning the course, the students will be able to,

- describe, contrast and compare differing structures for operating systems
- understand and analyse theory and implementation of: processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files

Text Books:

- [1].P. B. Galvin, A. Silberschatz, G. Gagne, Operating System Concepts, 9th ed., Wiley India, 2015.
- [2].Andrew S. Tanenbaum, Modern Operating Systems, 4th ed.,Prentice-Hall Inc., 2015.

Reference

Books:

- [1].Deitel, Operating Systems,3rd ed., Pearson Education,2012
- [2].Stallings, Operating Systems: Internals and Design Principles, 7th ed., Pearson education, 2013.

Prerequisite(s): CS-19.103 (C- Programming)

Objective(s):

- To provide knowledge of ways of structuring and operating on data, the nature of some fundamental problems, methods for addressing those problems,
- To promote an analytical and empirical appreciation of the behavior of algorithms using data structures

1. **Introduction:** Overview of data structure, types of data structures and operations. [4]
Applications of data structures.
2. **Pointer and dynamic memory allocation:** Pointer declaration and initialization, [9]
accessing a variable through its pointer, meaning and advantages of dynamic memory allocation, Memory allocation functions.
3. **Array, Sorting and Searching Techniques:** Representation of single and [9]
multidimensional array. Insertion Sort, Selection Sort, Merge Sort, quick sort, Linear Search, Binary Search.
4. **Stack & Queue:** Definition and representation of stack, operations on stack, Infix, [9]
Postfix, Prefix Expressions, Conversion from Infix to Postfix (Algorithms only).
Types of queues, Primitive Operations on Queues.
5. **Linked List & Tree:** Introduction to Linked List, implementation of Linked List, [9]
operations on linked list: creation, deletion, search and display, Tree introduction,
Traversal of Binary Trees.

Outcome(s): On the successful completion of the course, the student will be able to:

- be knowledgeable of certain abstract data types (ADT)
- be able to make a critical assessment of different implementations of an ADT
- be familiar with a number of fundamental computational problems, and be aware of real world instances of those problems

Text Books: [1].Lipschutz, Data Structures, Schaum's Outline Series, TMH, Revised ed. Feb. 2014.
[2].Horowitz and Sahani, Fundamentals of Data Structures, 2nd ed., University Press, 2008.

Reference Books: [1]. Langsam , Augenstein and Tannenbaum, Data Structure Using C and C++, 3rd ed., PHI, 1996.
[2].M. A. Weiss, Data Structures and Algorithm analysis in C++, 3rd ed., Addison Wesley,

CA 19. 106 System Analysis and Design

Total Lectures:40
Credits : 3-0-0-3

Prerequisite(s): NIL

Objective(s):

- To introduce the concept of system analysis for managing the projects
- To analyze and document systems, design new systems and implement their plans.

- 1 **Introduction to system:** Definition, characteristics and elements of system, types of system, System development life cycle, Role of system analyst. [6]
- 2 **System Planning and Initial Investigation:** Introduction, bases for planning in system analysis, initial investigation, fact finding, information gathering, information gathering tools, fact analysis, determination of feasibility. [7]
- 3 **Structured Analysis and Feasibility Study:** Tools of structured analysis: DFD, data dictionary, flow charts, Gantt charts, decision tree, decision table, structured English, pros and cons of each tool. Feasibility Study Objective, types, Steps in feasibility analysis, feasibility report, oral presentation, cost and benefit analysis, classification of costs and benefits. [10]
- 4 **Designing:** System Design Objective, logical and physical design, design methodologies, structured design, form-driven methodology (IPO charts), and structured walkthrough.
Input/ Output and Form Design: Objectives of input and output design, form design, classifications of forms, requirements of form design. [9]
- 5 **System Testing and Implementation:** Objectives of testing test plan, testing techniques/types of system tests, quality assurance goals in system life cycle, System implementation. [8]

Outcome(s): By learning the course, the students will be able to,

- Describe different approaches to systems analysis and design.
- Describe the five phases of the systems development life cycle (SDLC).
- Describe in detail the systems planning, systems analysis, systems design, systems implementation, and systems operation and support phases of the SDLC.

Text Books: [1].A wad Elias M, System Analysis and Design,,2nd ed., Galgotia Pub.(P) Ltd., 2008

Reference Books: [1].H. Igor, Introduction To System Analysis and Design, 5th ed., PHI, 2001
 [2].M. Lejk and D. David , An Introduction to System Analysis Techniques, 1st ed., PHI, 1998

Prerequisite(s): C Programming (CA 19.103)

Objective(s): Python is a general-purpose, versatile and popular programming language. It's great as a first language because it is concise and easy to read, and it is also a good language to have in any programmer's stack as it can be used for everything from web development to software development and scientific applications.

1. **Basics of Python Programming:** History of python, installation of python , execution of python program, python character set, token, data type, inbuilt functions in python, operators and expressions, translating mathematical formulae into equivalent python expressions. [7]
2. **Python Program Flow Control :** Conditional blocks using if, else and elif, simple for loops in python For loop using ranges, use of while loops in python Loop, nested loops, break and continue [8]
3. **Functions:** syntax and basics of a function, parameters and arguments in a function, local and global scope of a variable, return statement, recursive function and lambda function [8]
4. **Strings and Lists:** Basic inbuilt python functions for string, immutable strings, strings operators and operations, creating and accessing the elements of the list, python inbuilt functions for lists. [9]
5. **Tuples, sets and dictionary:** creating tuples, inbuilt functions for tuples, operations on tuples, creating sets and set operations, creating dictionary, simple program on dictionary [8]

Outcome(s): Upon completion of this course students will be

- Familiar with Python syntax.
- Able to use python to implement a given logic.

- Text Books:**
1. John V Guttag, Introduction to Computation and Programming using Python, Prentice Hall of India, 2nd Edition, 2013.
 2. Swaroop C H. , A Byte of Python, URL: <https://python.swaroopch.com>

- Reference Books:**
1. Zed A. Shaw ,Learn Python the hard way: a very simple introduction to the terrifyingly beautiful world of computers and code, Third edition, 2014.
 2. Richard L. Halterman, Learning to Program with python, 2011.
 3. Allen Downey ,Think Python How to Think Like a Computer Scientist, Version 2.0.17, Green Tea Press Needham, Massachusetts, 2012.

Prerequisite(s): CS-19.135 (C Programming Laboratory)

Objective(s):

- To develop skills to design and analyze simple linear and nonlinear data structures
- To Strengthen the ability to identify and apply the suitable data structure for the given real world problem
- To Gain knowledge in practical applications of data structures

1. Implement the logic of One Dimensional Array.
2. Implement the logic of Two Dimensional Array.
3. Implement the logic of Linked List and its various operations.
4. Implementation of stack using array and Link List.
5. Implement various stack operations.
6. Implementation the logic of Queue using array.
7. Implement various operations on queue.
8. Implement all the types searching algorithms (minimum 4 programs are desired)
9. Implement all types of sorting algorithms (minimum 5 programs are desired)

Outcome(s): At the end of this course, the student will

- Be able to design and analyze the time and space efficiency of the data structure.
- Be capable to identify the appropriate data structure for given problem.
- Have practical knowledge on the application of data structures.

CA-19.136
Hours:26

Python Programming Laboratory

Total

Credit:0-0-4-2

Prerequisite: (CS 19.135) C Programming Laboratory

Objectives: The objective of this course is to:

- Become comfortable with Python programming, starting from basics of data types to deep learning.
- Provide the foundation of to explore any expansions of Python whether it is machine learning, deep learning, web development or gaming. It will also put focus to learn various skills to design object-oriented software.

Contents:

- Code different data types and operations on list, dictionaries, sets, String etc
- Code basic programs like factorial, Fibonacci etc. to understand functions and recursions.
- Implement different built-in functions in Python like eval, exec, map, lambda etc.
- Implement the concept of class, objects, inheritance and polymorphism
- Implement constructor and self
- Code programs to implement exceptions and assertions
- Implement regular expressions

Objective: This Course, Management and leadership focus on understanding seminal and contemporary leadership theories and principles. To provide a basis of understanding to the students with reference to the working of the business organization through the process of management.

Pre-requisite:

1. **Introduction to Management :** Nature of Management, Meaning, Definition, it's nature purpose, importance & Functions, Management as Art, Science & Profession- Management as social System Concepts of management-Administration-Organization [4]
2. **Evolution of Management Thought:** Contribution of F.W.Taylor, Henri Fayol ,Elton Mayo , Chester Barhard & Peter Drucker to the management thought. Various approaches to management (i.e. Schools of management thought)Indian Management Thought. [5]
3. **Functions of Management:** Planning - Meaning - Need & Importance, types levels - advantages & limitations. Organizing - Elements of organizing & processes, Delegation of authority - difficulties in delegation – Decentralization, Staffing - Meaning & Importance, Controlling - Process & Techniques, Coordination - Need – Importance. [6]
4. **Introduction to Leadership:** Leadership styles, qualities of a good leader, role of a leader, trait approach to leadership, behaviour approaches to leadership; Situational theories; Transformational Leadership transactional leadership, Neutralizers and substitutes to leadership. [6]
5. **Emerging Challenges to Leadership:** Leadership in changing workplace, Leader's role in fostering teamwork, Overcoming traditional thinking Methods to enhance creative problem solving, Climate for creative thinking, Leadership practices for innovation, Ethical leadership development, Cultural sensitivity, intelligence, and global leadership skills. [5]

Outcome: On successful completion of the course, students will be able to Work effectively and collaboratively with others in diverse management contexts.

Text Books:

1. Dr. L.M.Parasad, "Principles & practice of management", Sultan Chand & Sons - New Delhi, 2015
2. Stephen P.Robbins "Organizational Behavior" Pearson Publisher, 16th Edition, 2014

Reference Books:

1. Principles of Management, By Tripathi, Reddy Tata McGraw Hill, 2012
2. Essential of Business Administration - K.Aswathapa Himalaya Publishing House, 2014
3. Hughes, R., Ginnett, R., & Curphy, G. Leadership: Enhancing the lessons of experience, McGraw Hill, 7th Edition, 2017
4. Northouse, P. G. "Leadership: Theory and Practice" Sage Publications, New Delhi, 7th Edition 2015.

Prerequisite(s): NIL

Objective(s):

- To understand the basics of combinational as well as sequential logic.
- To get familiar for analyzing the performance of digital circuits

- 1 **Boolean Algebra:** Laws and theorems of Boolean algebra. De-Morgan's theorem, [5]
XOR and XNOR gates, Half and Full Adder and Subtractor circuits.
- 2 **Fundamental Concepts:** Products, Sum of products and Product of sums, Form of [8]
Boolean expressions, Truth Tables and Karnaugh maps and Karnaugh simplification.
Multiplexers, decoders, characteristics of digital integrated digitals.
- 3 **Design of Simple Computer:** Micro Operation, Macro Operation, Bus and [8]
Memory Transfers, Arithmetic and Logic Micro Operations, Shift Micro Operation,
Instruction and Instruction Types
- 4 **Instruction Cycle:** Timing and Control Instruction Cycle, Memory Reference [8]
Instructions, Input Output and Interrupts, Machine Language Instructions
- 5 **I/O and Memory Organization:** Peripheral Devices, Input-Output Interface, [10]
Asynchronous Data Transfer, Modes of Transfer, Programmed I/O, Interrupt I/O
Direct Memory Access. Memory Hierarchy, Main Memory, Auxiliary Memory,
Associative, Cache Memory, Virtual Memory and Memory Management Hardware

Outcome(s): After successful completion of the course, student will be able to

- Develop a digital logic and apply it to solve real life problems.
- Analyze, design and implement combinational logic circuits.
- Classify different semiconductor memories.
- Analyze, design and implement sequential logic circuits.

Text Books:

- [1].M. Mano, Digital Design, 4th ed., Prentice Hall of India, 2008
- [2].R. P. Jain, Modern Digital Electronics, 3rd ed., TMH, 2003.
- [3].W. Stallings, Computer Organization and Architecture, 9th ed., Pearson,2013

Reference Books:

- [1].J. F.Wakerly, Digital Design, 4th ed, Pearson, 2008.
- [2].C.H.Roth. Fundamentals of Logic Design, 6th ed., Thomson Learning, 2013.

Prerequisite(s): Nill

Objective(s): The objective of this Course is to:

- Understand the fundamental concepts of database management.
- Design and Normalize databases.
- Understand transaction processing control.
- Understand basic of object concepts and object relations.
- Understand the role of the DBMS & RDBMS in the organization.

1. **Introduction:** An Overview of Database Management System, Comparison of Database System and File System, Characteristics of Database Approach, DBMS Architecture, Data Models, Schema and Instances, Data Independence. Data Modeling Using Entity Relationship Model: Entity, Entity Types, Entity Set, Notation for ER Diagram, Attributes and Keys, Concepts of Composite, Derived and Multivalued Attributes, Super Key, Candidate Key, Primary Key, Relationships, Relation Types, Weak Entities, Inheritance, Specialization and Generalization. [10]
2. **Relational Data Model:** Relational Model Terminology: Domains, Attributes, Tuples, Relations, Characteristics of Relations, Relational Constraints: Domain Constraints, Key Constraints, Relational Database Schema, Relational Database Design By ER To Relational Mapping. Introduction to SQL. [11]
3. **Normalization:** Functional Dependencies, Armstrong's Inference Rule, Normal Form up to Boyce Codd Normal Form. [4]
4. **Relational Algebra:** Selection, Projection, Set Theoretic Operations Union, Intersection, Set Difference And Division, Inner, Outer, Left Outer, Right Outer and Full Outer Join. [8]
5. **Transaction Processing And Concurrency Control:** Definition of Transaction, Desirable ACID Properties, Serializable And Non Serializable Transactions, Concurrency, Lost Update, Dirty Read, Concurrency Control Techniques: Locking, 2PL [7]

Outcome(s): After completion of the course, students will be able to:

- Analyze database models & entity relationship models. Understand architecture for database development.
- Design E-R diagram
- Use Structured Query Language (SQL) with complex queries.
- Design and normalize the relations for any organization.

Text Books: [1] R. Elmasri & S. B. Navathe, Fundamentals of Database Management Systems, 7th ed., Pearson Education, 2016.
[2] R. Ramakrishnan, Database Management Systems, 3rd ed., Tata McGraw Hill, 2008.

Reference Books: [1] Korth and Schilberschatz, Database System Concepts, 6th ed., Tata McGraw Hill, 2011.
[2] C.J. Date, Database Systems, Tata McGraw Hill, 2nd Edition, 2003.

Prerequisite(s): CS-19.103 (C Programming)

Objective(s):

- To get a basic knowledge of object-oriented concepts.
- To master in programming related to classes inheritance using C++.

- 1 **Introduction to Object Oriented Programming and C++:** Basic concepts of object-oriented programming, Structured versus object-oriented programming, merits and demerits of object oriented methodology. C++ Preprocessor directives, Variables, data types, constants, operators, scope resolution operator, memory management operators, decision and loop control structures, arrays, strings, functions. [8]
- 2 **Classes and Objects:** Class definition, Structure versus class, accessing member functions within a class, data hiding, arrays within a class, static data and member functions, objects, friend functions and friend classes, constant member functions, pointers to members, constructors and destructor. [9]
- 3 **Overloading and Exception Handling:** Definition, unary operator overloading, binary operators overloading, overloading of new and delete operators, manipulation of string using operators, type conversion, overloading with friend functions, function overloading, error and exception handling. [9]
- 4 **Inheritance and Overriding:** Derived and base classes, type of inheritance, derived class constructors and destructor, overriding member functions, public and private inheritance, virtual base classes, abstract classes, this pointer, virtual functions and pure virtual functions, static and dynamic bindings. [8]
- 5 **Introduction of I/O Streams and the Standard Library:** Header files, I/O stream library, stream I/O for objects, file I/O. [6]

Outcome(s): On the successful completion of the course, the student will be able to:

- To gain the basic knowledge on object oriented concepts.
- To understand the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code.

Text Books: [1].R. Lafore, Object-Oriented Programming in C++, 4th ed., Pearson Education, 1997.
[2].Balagurusamy E., Object Oriented Programming With C++, 6th ed., Tata McGraw Hill Publishing Co. Ltd., 2013.

Reference Books: [1].Stroustrup Bjarne, Programming -Principles and Practice Using C++, 4th ed. Addison-Wesley, 2013
[2].Schildt Herbert, "C++: The Complete Reference", 4th ed., Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2003.

Prerequisite(s): Nil

Objective(s):

- To Introduce fundamental concepts and applications of discrete structure in the field of computer science

- Set Theory:** Definition of Sets, Subsets, Cardinality of Sets, types of sets: Equal Sets, [10]
Universal Sets, Finite and Infinite Sets, proper set, power sets, Operations on Sets:
Union, Intersection, Complement of Sets, set difference, Cartesian Product, Venn
Diagrams, and Algebra of sets, duality, counting principle.
- Relations and Functions:** Definition, types of relation, Ordered Pairs, properties of [8]
relation, equivalence relations, partial ordering relation. Function: Domain and Range,
Onto, Into, and One to One Function, Composite and Inverse Functions.
- Algebraic Structures:** Definition of a group, properties of group, different types of [8]
group, subgroup, finite, infinitely, countable and Cyclic Groups.
- Propositional Calculus:** Propositions, Logical Connectives: conjunction, disjunction [8]
and negation, Truth Tables, Tautologies and Contradictions, Conditional and Bi-
conditional statements.
- Counting:** Basic principles, permutations, combinations, summations, principle of [6]
inclusion and exclusion, pigeon-hole principle.

Outcome(s): On the successful completion of the course, the student will be able to:

- Understand the theory and techniques of logic, graphs and trees, and algebraic systems.
- Apply the knowledge and skills obtained to investigate and solve a variety of discrete mathematical problems.

Text Book: [1]. B. Kolman, C. Robert , S. Busb, C. Ross, Discrete Mathematical Structures, 6th ed., PHI, 2009.
[2]. H. R. Kenneth, Discrete Mathematics and Its Applications, 7th ed., TMH, 2011.

Reference Book: [1]. Swapan Kumar Chakraborty, BikashKanti Sarkar, Discrete Mathematics, Oxford Higher
Education, 2011
[2]. C. L. Liu, D. P. Mohapatra, Elements of Discrete Mathematics A Computer Oriented
Approach, Tata Mcgraw-Hill, 3rd Edition, 2008.

CA-19.233

Data Base Management Systems Laboratory

Total Hours: 26

Credit: 0-0-4-2

Pre-requisites: CS14.111 (Programming Language Laboratory)

Objective: By the end of the practical sessions of this section, students will be able to:

- To learn Databases using a user interface and SQL command.
- To learn Integrity and constraints on databases.
- To understand the working of SQL queries.

Contents: Lab manual based upon the theory course CS 19.203 and to achieve the listed course objectives and outcomes

Outcomes: After undergoing this laboratory module, the students should be able to:

- Understand, appreciate and effectively explain the underlying concepts of database technologies.
- Design and implement a database schema for a given problem-domain.
- Populate and query a database using SQL DML/DDDL commands.
- Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS.

CA 19. 235

C++ Programming Laboratory

Total Hours: 26

0-0-4-2

Prerequisite(s): CS-19.135 (C Programming Laboratory)

Objective(s):

- To make students familiar with syntax and structure of C++-programming.
- To learn problem solving techniques using object oriented programming through C++ programs implementation.

1. Implement the logic of Data Types & Operators in C++.
2. Implement the logic of Control Statements in C++.
3. Implement the programs on arrays using C++.
4. Implement the basic logic of class with a function, displaying “Hello World” as output.
5. Implement the use of all types of constructors in object creation. Also covers the concept of destructor to reclaim the resources from object (minimum 3 programs).
6. Implementation of data constant and static keyword in all possible manners.
7. Implementation of all types of inheritance using C++ (min. 3 programs).
8. Implement the logic of Function and operator overloading (min. 2 programs).
9. Implement the logic of Function overriding.
10. Implement the use of access specifiers in C++ for creating class, function and data members (min. 2 programs).
11. Implement the logic of virtual function and virtual class.
12. Implement the use of this pointer to differentiate local data member to object data member.
13. Implement the 3 programs in order to cover all aspects of exception handling in C++.
14. Implementation of abstract class functionality.
15. Implementation of file handling concepts (min. 4 programs).

Outcome(s): On the successful completion of this lab course, the student will be able to:

- To implement features of object oriented programming to solve real world problems.

UC 19.202

Business Environment

Total Lectures: 26
2-0-0-2

Objective: To familiarize the students about the background of the spectrum of business and its environment (internal and external).

Pre-requisite: Good General knowledge.

1. **Dimensions of Business Environment:** Nature and characteristics of contemporary business; [5]
Types of business environment - general and task environment, Internal (Value system, Organization structure, Human Resource, Company image and brand value, Physical assets) and external Environment (micro and macro), Environmental analysis and strategic Management.
2. **Social Environment:** Concept and salient features of Indian culture and values, Impact of [5]
culture on business, Cultural resources, Ethics and social responsibility of business, Consumerism.
3. **Political and legal Environment:** Impact of competing political ideologies and role of [5]
government, Political Stability and Instability on Business Activities, Legal framework for establishing a business unit in India, Competitive Conditions, Foreign Direct Investment in India.
4. **Economic Environment:** Economic systems – Market, Planned and Mixed economy; Indian [6]
economy – overview; Economic reforms in India; Economic policies – Determinants of National Income, Privatization, Fiscal policy and Monetary policy.
5. **Technological Environment:** Features of technology; Impact of technology; Management of [5]
technology; status of technology in India; Policy for research and development in India.

Outcome: Understanding real life situations vis-à-vis economic, social, legal, political and technological systems in the country and analyzing the impact of changes on different industries and trends in different sectors of the economy and society.

Text Books: 3. Business Environment, Francis Cherunilam, 1st Edition, 2018.
4. Essentials of Business Environment, K Aswathappa, HPH, 12th Edition, 2014.

Reference Books: 5. Business Environment, BN Ghosh, OUP, 2015
6. Business Environment: Text & Cases (3rd Edition), Justin Paul, McGraw Hill, 2016.
7. Business Environment, AC Fernando, Pearson, 2016

CA 19. 204

Computer Networks

Total Lectures: 40

Credits: 3-1-0-4

Prerequisite(s): Nil

Objective(s):

- To become familiar with layered communication architectures (OSI and TCP/IP).
- To understand the client/server model and key application layer protocols.
- To understand fundamentals of computer networks and major routing protocols.

- 1 **Basic concepts of networks and Layered Architecture:** Computer networks [9]
introduction, network topologies, protocols and standards, Client-Server transactions, Network devices: repeaters, bridges, gateway, Routers; categories of networks- LAN, WAN and MAN. Layers and their function, OSI reference model, TCP/IP model, Comparison of models.
- 2 **Physical layer:** Transmission Media, guided and unguided; Attenuation, Distortion, [7]
Noise, Switching.
- 3 **Data Link Layer:** Functionality, Framing, Encoding Techniques, Design Issue, Error [7]
Detection & Correction Codes, MAC.
- 4 **Network & Transport Layer:** Routing Algorithms (Distance Vector & Link State), [8]
IPv4 and IPv6, Connection Oriented and Connection Less services, Sliding Window Protocols.
- 5 **Application Layer :** Network Security & Privacy, Data Compression & Cryptography, [9]
Electronic Mail (SMTP, POP3, IMAP), DNS, FTP, HTTP, telnet etc.

Outcome(s): On successful completion of this course, students will be able to

- Analyze computer network component and devices.
- Synthesize how communication works in a network and internet.
- Formulate the concept of topologies and their applications.
- Analyze protocol at different layers and how they play important role in network implementation.
- Enumerate the layers of OSI and TCP/IP models.

Text Book: [1]. B. A. Forouzan, Data Communications and Networking, 5th ed., Tata McGraw Hill, 2013.

Reference Book: [1]. A. S. Tanenbaum, Computer Networks, 4th ed., Prentice-Hall of India, 2002.

Prerequisite(s): CS-19.103 (C Programming)

Objective(s):

- To introduce the students with the graphics mode, with the help of basic algorithms and methodologies.
- The objective of the course is to equip students with fundamental knowledge and basic technical competence in the field of computer graphics.
- Provide an understanding of how a computer draws the fundamental graphics primitives.
- To learn Computer Graphics methodologies/Algorithms and techniques.

- 1 **Basic Concepts:** Application Areas of Computer Graphics, Graphical User Interface, [8]
RGB Color model, CMY color models, Advantages of Computer Graphics.
- 2 **Graphics Hardware:** Random Scan Displays, Raster Scan Display (with Introduction to [7]
Flickering, Interlacing, American Standard Video), Color CRT Monitors, Flat Panel
Display (Plasma Panel, Liquid Crystal Display, Electroluminescent Display).
- 3 **Raster Graphics Algorithms:** Line Drawing Algorithms-DDA, Bresenham's [12]
Algorithm, Circle and Ellipse Drawing Algorithms, Filling (Scan-Converting Polygon
Filling, Inside Outside Tests Boundary Fill and Area Fill Algorithm). Cohen- Sutherland
Algorithm of clipping.
- 4 **Transformations:** 2-D Transformations (Rotation, Reflection, Shearing, Scaling), [8]
Homogeneous Coordinate Representation, and Translation.
- 5 **Animation Introduction:** Conventional and Computer-Assisted Animation, Animation [5]
languages, methods of controlling Animation, basic rules of Animation.

Outcome(s): On successful completion of this course, students will be able to

- Understand basic concepts of computer graphics.
- Acquire knowledge about drawing basic shapes such as lines, circle ellipse, polygon.
- Perform processing of basic shapes by various processing algorithms /techniques.
- Implement two dimensional transformations.

Text Books: [1].D. D. Hearn and M. P. Baker, Computer Graphics, 3rd ed., Prentice Hall India, 2011.
[2].A. Kalbag, Computer graphics & animation, 1st ed., Usborne, 1999.

Reference Books: [1].J. D. Foley, A. V. Dam, S. K. Feiner, J. F. Hughes, Computer Graphics Principles and Practice, 2nd ed., Addison Wesley, 1995.
[2]. D. F. Rogers, Procedural Elements for Computer Graphics, 2nd ed., Tata McGraw Hill Publications, 2001.

CA 19. 210

Java Programming

Total Lectures: 40
3-1-0-4

Prerequisite(s): Nil

Objective(s): The objective of this course is to:

- Cover issues related to the definition, creation and usage of classes, objects and methods.
- Discuss the principles of inheritance and polymorphism.
- Provide the foundation of good programming skills by discussing key issues of the design of object-oriented software, including programming design and documentation.

- 1 **Basics of Java Programming:** Importance of Java, Java Byte code, Java and HTML, the Java buzzwords, using blocks of code, lexical issues, Java Class Libraries. Constants, Variables, Data Types, Operators, Type Conversion in Expression, Mathematical Functions, Decision Control Structure, Loop Control Structure, Arrays. [10]
- 2 **Class and Inheritance:** Class fundamentals, declaring objects, assigning object reference variables, introducing methods, constructors, the this keyword, garbage collection, the finalize () method, overloading methods, using objects as parameters, returning objects, recursion, introducing access control, understanding static, introducing final, arrays revisited, introducing nested and inner classes, Wrapper Classes. Inheritance: Multilevel hierarchy, method overriding, Abstract classes, Final classes, String Class. [10]
- 3 **I/O and String Handling:** I/O basics, reading console input, writing console output, the PrintWriter class, reading and writing files, String and StringBuffer class, Various Types of string operations related to both the classes. [6]
- 4 **Package, Interfaces and Exception Handling:** Packages, importing packages, interfaces, exception-handling fundamentals, exception types, uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws, finally, Java's built-in exceptions, creating your own exception subclasses, using exceptions. [7]
- 5 **Applet Programming:** Applet life cycle, creating executable application, Designing a web page, Applet Tag, Parameter passing in applets, Graphic Class, lines, rectangles, circle and ellipse, polygons. [7]

Outcome(s): Upon completion of this course, students are able to:

- Understand the concepts of OOP as well as the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.
- Identify classes, objects, members of a class and the relationships among them needed for a specific problem.
- Develop programs using the in-built Java API and the Java standard class library.
- Create Java application programs using sound OOP practices (e.g., interfaces and APIs) and proper program structuring (e.g., by using access control identifies, automatic documentation through comments, error exception handling).

Text Book: [1]. H. Schildt, Java The Complete Reference, 8th ed., Herbert Schildt, 2011.
[2]. J. Jukowski, Mastering Java J2SE 1.4, SYBEX, 2002.

Reference Book: [1]. A. B. Downey, Think Java: How to Think Like a Computer Scientist, 2011.
[2]. P. Deitel, H. Deitel, Java How To Program, 10th ed., Deitel publication, 2014.

Prerequisite(s): NIL

Objective(s):

- Understanding of working of internet enabled applications
- Understand the practical aspects of various application layer protocols of TCP/IP Model

1. Describe and demonstrate the use of Web-based e-mail services
2. Configure and use Outlook Express to send, receive, and print e-mail messages
3. Create and maintain an address book in Outlook Express
4. How to formulate an effective Web search strategy to answer research questions
5. Uses of Web search engines, Web directories, and Web meta search engines effectively
6. Use Boolean logic and filtering techniques to improve your Web searches
7. Use advanced search options in Web search engines
8. Demonstrate how to use an FTP client program and Web browser to transfer files
9. Demonstrate navigation of an FTP site using a Web browser
10. Demonstrate how to compress and decompress files and how to check them for viruses
11. Download an FTP client program using a Web browser
12. Install and use a compression program
13. Trace the connection between your computer and a remote computer
14. Demonstrate the working of e-commerce related online operations

Outcome(s): After completion of the course students will be

- Well versed in internet or online related browsing and other functionalities
- To configure FTP and WEB agents properly.
- To understand the working of Mail agent like outlook express.

CS-19.236

Java Programming Laboratory

Total Hours:26

0-0-4-2

Prerequisite: CS-19.135 (C Programming Laboratory)

Objectives: The objective of this course is to:

- Become comfortable with object-oriented programming and learn to think in terms of objects.
- Provide the foundation of good programming skills by discussing key issues to the design of object-oriented software, including programming design patterns, documentation.

Contents: Lab manual based upon the theory course CS 19.210 and to achieve the listed course objectives and outcomes.

Outcomes: Upon completion of this course, students are able to:

- Understand the concepts of OOP as well as the purpose and usage principles of
- Inheritance, polymorphism, encapsulation and method overloading.
- Create Java application programs
- Use of development environment like Eclipse for collaborative

CA 19.301

Web Technology

Total Lectures: 40
Credit:3-0-0-3

Prerequisite(s): Nil

Objective(s):

- Build Web applications. Semantics and syntax of the HTML, Java Scripts and VB Scripts, including discussion on the practical problems that HTML solves. Write server-side scripts to implement dynamic Web pages that interact with databases and files.

1. **Introduction:** Clients, Servers, and Communication, The Internet Basic Internet Protocols, The World Wide Web, HTTP request message, response message, Web Clients Web Servers. [5]
2. **HTML:** HTML Document, Markup Tags (HTML, HEAD, TITLE, BODY, PRE, LIST, HR, BR), Formatting Tags (MARQUEE, BOLD, ITALICS, SUBSCRIPT), Linking, URL, Relative Path Vs Absolute Path names, Images, Tables, Frames, Form Elements (Text, Buttons, List, Reset, Submit, Radio buttons, Checkbox); DHTML: Cascading Style sheets, Dragging, Dropping, Layers, Div tag. [8]
3. **JavaScript:** Declaration and Expressions, Control Structure and Functions, Variable scope Global Vs Local, Object in Java Script: Properties and Methods, Array Object, Date Object, Math Object, String Object, Events in java Script: Onblur, Onclick, on change, on focus, Design of Interactive forms. [9]
4. **VBScript:** Fundamentals, Variables, String, Constant, Date and Time, Arrays, control Structure, Design making, looping, Sub procedure, Object Methods and events, data validation. [7]
5. **XML:** Overview, Comparison of XML and html, components of XML, XML document, XML declaration, Root element, An empty element, attributes, Markup Delimiters, Element Mark Up, Attribute Mark Up, Naming Rules, Character References, Predefined Entities, Entity References, Cdata Sections, Processing Instructions, Document Type Declaration, Wellformed and Valid Document, DTD and Validation, Internal DTD Subset, External DTD, Developing DTD, Elements and Attributes Of DTDs:- Empty Element, Only Element, Mixed Elements, Any Element, Creating a valid document from a DTD [11]

Outcome(s): After Successful completion of this course student will be able to:

- Write Java and VB scripts to handle HTML forms
- Write regular expressions including modifiers, operators, and meta-characters.
- Create HTML web pages that use various Scripting functions, and that manipulate files and directories

Text Books:

1. Young M .L, "Internet Millenium Edition" TMH, New Delhi, 2007.
2. Jackson Jeffrey C., "Web Technologies -A Computer Science Perspective", Pearson Education, 2006.

Reference Books:

- (1) Noel Jerkr, " Techunedia VB Scrapper VB Script Interleave course", New Delhi 1998(2) Web Searching Technology and Search Engine Optimization[ISBN: 978 - 93 - 81786 - 92 - 5] by Bharat & Company
- (2) Marlin Webb, "Java Scrapper, Instant JavaScript", Tata McGraw-Hill, New Delhi.(4) SEO Warrior: Essential Techniques for Increasing Web Visibility By John I Jerkovic, O'Reilly Media, November, 2009
- (3) Eathier Kay and Houser Alan , "XML programming in 2 ½ days," IDG Books India (P) Ltd.

CA 19. 303

Software Engineering

Total Lectures: 40
Credit:3-0-0-3

Prerequisite(s): CA 19.103 (C Programming)

Objective(s):

- To know about software requirements specification, requirement elicitation, structured system analysis and introduction of object-oriented analysis and design, design techniques.
- To acquire knowledge on implementation issues such as modularity and coding standards

1. **Introduction:** Software Characteristics, Components and Applications, Software Engineering a layered Technology, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models. [8]
2. **Software Project Management:** Basic Concepts, Project Management: Core functions, support functions, Project Integration Management. [8]
3. **Software Project Planning:** Objectives, decomposition techniques: software sizing, problem based estimation, lines of code based estimation, and function point based estimation, process based estimation, Cost Estimation Models:-COCOMO, Risk Management. [8]
4. **Software Design:** Design Principles, Design Concepts:- abstraction, refinement, modularity, software architecture, structured partitioning, information hiding, effective Modular Design:- functional independence, cohesion and coupling, Object Oriented analysis and Design. [8]
5. **Software Testing:** Testing Fundamentals, Design of Test Cases, White box testing, Basis Path testing, Control structure Testing, Black box testing. [8]

Outcome(s):

- Demonstrate knowledge of the distinction between critical and non-critical systems and ability to manage a project including planning, scheduling and risk assessment/management.
- Author a software requirements document and understanding of the proper contents of a software requirements document.

Text Books:

1. Pressman R.S., “Software Engineering”, Tata McGraw Hill Publishing Company Ltd.,8th edition, 2014
1. Jalote Pankaj,“An Integrated Approach to Software Engineering”, NAROSA.3rdedition, 2005.

Reference Books:

2. Rajib Mall, Fundamentals of Software Engineering, Prentice-Hall, 2ndedition, 2004.

Develop Web Pages by use of following tags

- Markup Tags
- Formatting Tags
- Frames
- Form Elements

Programs:

- Design web pages based on above Tags.
- Design and formatting a form based on form elements

Develop Web Pages by use of following tags/Concepts

- Cascading Style sheets
- Dragging
- Dropping
- Div tag.

Programs:

- Based on above CSS formatting on HTML scripts.

Develop Web Pages by use of following tags/Concepts

- java Script Declaration and Expressions
- Control Structure and Functions
- Java Script: Properties and Methods
- Array Object
- Date Object
- Math Object
- String Object
- Events in java Script: Onblur, Onclick, on change, on focus.

Develop Web Pages by use of following tags/Concepts

- Form validation through JavaScript
- Program for Event handling
- Working with Date and Time Functions
- Program for calculator

Testing:

- XML components
- DTD
- Creating a Valid Document From a DTD

Programs:

- Basic XML Document
- Access XML document elements through programs

Program Electives

Program Elective-1		
S. No.	Course Code	
1.	CA 19.231	Management Information System
2.	CA 19.232	Enterprise Resource Planning
3.	CA 19.237	Software Project Management
Program Elective-2		
S. No.	CourseCode	CourseTitle
1.	CA 19.263	SystemSoftware
2.	CA 19.265	InternetTechnologies
3.	CA 19.267	NetworkSecurity
4.	CA 19.208	Electronic Commerce
5.	ET 19.471	Cloud Computing (Infosys)
Program Elective3		
1.	CA 19.373	Softwareand CASE Tools
2.	CA 19.375	Bioinformatics
3.	CA 19.377	Geographical Information System
4.	CA 19.369	E-Business
5.	ET 19.465	Agile Software Development (Infosys)
Program Elective4		
1.	CA 19.362	Knowledge Management
2.	CA 19.364	Artificial Intelligence
3.	CA 19.366	Information Security
4.	CA 19.368	CyberLaws
5.	ET 19.362	Mobile Apps Development (Infosys)

CA 19. 231

Management Information System

**Total Lectures: 40
3-0-0-3**

Prerequisite(s): Computer Fundamental

Objective(s): To understand how to leverage information systems to effectively operate and grow an enterprise. The course provides a foundation in the theory and practical application of information systems within an organization. Managing, analyzing, designing, and implementing an MIS will be the focus of the course

- 1 **Introduction:** Elements, characteristics, objectives and importance, relationship between MIS and Computer, role of MIS in the functions of management. [6]
- 2 **Information:** Classification of information, levels of information, techniques of data collection, quality aspect of information, value of Information [8]
- 3 **Decision Making:** Decision making concepts, rationality in decision making, decision support system, MIS as a technique for programmed decisions, structured v/s Un-structured decisions, formal vs. informal systems, model of decision making, methods, MIS and role of decision making. [8]
- 4 **Manager and Computers:** Database concept, database models, database design, RDBMS, MIS and RDBMS, network topology, LAN, MAN, WAN and data communication. [9]
- 5 **Development and Application of MIS:** Strategic and project planning for MIS, conceptual system design, detailed design, implementation, evaluation and maintenance of the MIS, pitfalls of MIS. MIS for marketing, financial, production management, human resource management. [9]

Outcome(s): After completion of the course, students would be able to:

- understand and articulate fundamental concepts of information technology management.
- assess and apply IT to solve common business problems.
- suggest and defend effective solutions to business problems, and design a database application to solve a business problem.
- discuss the ethical aspects of information technology use in the organization and its governance issues.

Text Books: [1]. Jawadekar, W. S. "Management Information System", Tata McGraw- Hill Publishing Co. Ltd., New Delhi, 2004

Reference Books: [1]. Murdick, R, G, Ross J E and Clagget, J, R, "Information Systems for Modern Management", PHI, New Delhi., 2003
[2]. Sadagopan, "Management Information System", PHI, New Delhi. 2010.
[3]. Parker, Case Thomas, "Management Information System: Strategies and Action", Tata McGraw- Hill Publishing Co. Ltd., New Delhi

Prerequisite(s): Computer Fundamental and Networking

Objective(s): This course will enable student understanding of issues and decisions that must be made when embarking upon a ERP selection and implementation journey. It will also lead to an understanding the challenges associated with managing extant ERP systems.

- 1 **Overview:** Definition, ERP & Business, Evolution of ERP, Need of ERP, Features of ERP, Motivation behind ERP, Technologies & Infrastructure required for ERP, Demerits of ERP, benefits & application, BPR & ERP,ERP Market. [6]
- 2 **Data Mining & Data Warehousing:** Foundation of Data Mining, scope of Data Mining, Mechanism, Data Mining methods & Algorithms, Relevance of Data Mining to BPR, Database marketing by Data mining. Data warehouse Management System, Business Intelligent system architecture, features, Application, Necessity of Data warehousing, critical factors for the failure of Data warehouse. [8]
- 3 **Implementation Issues:** Implementation Methodologies, Post Implementation Issue, Hidden Costs of ERP (Training, Testing, Dirty Data), Role of consultant [8]
- 4 **ERP Module :** BAAN, SAP, ORACLE, People soft, Comparison of major ERP packages [9]
- 5 **ERP & E-commerce:** Electronic Data Interchange, Advantage of EDI with respect to business, ERP fitness with E-commerce, Post ERP work with E-commerce, ERP & Internet. [9]

Outcome(s): After completion of the course, students would be able to:

- Understand and gain insight into process views of organizations and tools and techniques used to model both as-is and to-be models.
- Apply the process modeling techniques in one or more modeling environments.
- Know and be able to apply key technical terminology in enterprise information systems as they apply in different ERP products and development methods
- Understand key differences between the major ERP applications (such as SAP R/3, and Oracle/PeopleSoft/Sibel) and issues specific to these applications their configuration and management.
- Analyze a current architecture and perform an effective gap analysis before an ERP implementation
- Be able to map enterprise architectural resources to a contemporary Enterprise Architecture mapping tool.

Text Books: [1].Luvai F. Motiwalla, Jeff Thompson, Enterprise Systems For Management, Pearson Education., 2nd Ed., 2011
[2].Ravi Shankar, S.Jaiswal, Enterprise Resource Planning, Galgotia Publication Pvt. Ltd., 2nd Ed., 2005.

Reference Books: [1].Monk, E. F., Wagner, B. J., Concepts in Enterprise Resource Planning, Course Technology Cengage Learning, 3rd Ed. 2009.
[2].Chuck Munson, Supply Chain Management Casebook : The Comprehensive Coverage and Best Practices in SCM, Pearson FT Press 2013.
[3].Ferran, C., and Salim, R., Enterprise Resource Planning for Global Economics: Managerial Issues and Challenges, Information Science References, 2008.

CA 19.237

Software Project Management

Total Lectures: 40

Credit: 3-0-0-3

Prerequisite(s): (System Analysis and Design)

Objective(s):

- To introduce the concepts of Software Project Management to the students.
- To make the students understand the requirement for project evaluation.
- To make the students understand the requirement for Software quality assurance and project management along with its tools.

- 1 **Introduction to Software Project Management (SPM) :** Software Engineering problem and software product, software product attributes, definition of a Software Project (SP), SP vs. other types of projects activities covered by SPM, categorizing SPs, Project Management cycle, SPM framework, types of project plan [10]
- 2 **Project Evaluation:** Strategic assessment, technical assessment, cost benefit analysis, cash flow forecasting, cost benefit evaluation techniques, risk evaluation [8]
- 3 **Activity Planning:** Objectives, project schedule, sequencing and scheduling activities, network planning models, forward pass, backward pass, activity float, shortening project duration, activity on arrow networks. [8]
- 4 **Managing people and Organizing teams:** Introduction, understanding behaviour, organizational behavior, working in groups, becoming a team, decision making leadership, organizational structures. [7]
- 5 **Software Quality Assurance and Testing:** Testing principles and objectives, test plan, types and levels of testing, test strategies, program verification and validation, software quality, SEI-CMM,SQA activities, QA organization structure, SQA plan [7]

Outcome(s): After completion of the course, students would be able to:

- Identifying the essential skills required to be an excellent project manager
- Analyzing the main factors influencing project management outcome

Text Books:

- [1].Bob Hughes, Mikecoterrell, “Software Project Management”, Fourth Edition, Tata McGraw Hill, 2009.
- [2].AshfaqueAhmed,"Software Project Management: A Process-Driven Approach",CRC Press, 2016.

Reference Books:

- [1].Ramesh, Gopaldaswamy, "Managing Global Projects", Tata McGraw Hill,2nded. 2005.
- [2].Royce, “Software Project Management”, Pearson Education, 1999
- [3].Walker Royce Software Project Management,, Addison Wesley, 1998.

CA 19. 263

System Software

Total Lectures: 40

3-0-0-3

Prerequisite(s): Basic concepts of Unix-like systems. Shells and scripting. System-level programming in the C language. Software development tools and techniques.

Objective(s): This course provides an introduction to computer systems and explores the design and implementation issues of System programs that play an important role in program development.

1 **Overview:** Language processors, data structures for language processors, [6]
assemblers, macros and macroprocessors, compilers, interpreters, linkers and loaders.

2 **Operating System:** Functions of Operating System, Kernel, Shell, Process, Process state [8]
diagram, System Calls

3 **Assemblers:** Design of an assembler, one pass and two pass Assembler, Databases of [8]
Assemblers, table processing

4 **MacroProcessors:** Importance of Macro, Macro Definition, Macro call, Macro [9]
Expansion, Conditional Macro expansion, Nesting of Macros, Functions of Macro Processor.

5 **Loaders, Linkers and Compilers:** Function of Loaders, loader schemes-compile and go, [9]
general, absolute, subroutine linkages, relocating loaders, direct linking loaders, binders,
linking loaders, overlays, dynamic binders, Types of Compilers, Phases of
compiler design, recursion, call and return statements.

Outcome(s): After completion of the course, students would be able to:

- Apply knowledge of mathematics, science, and engineering
- Design a system, component, or process to meet desired needs within realistic constraints.
- Identify, formulate, and solve engineering problems Understand the concept of input/output devices of Computers and how it works.

Text Books: [1]. Donovan J.J., "Systems Programming", New York, Mc-Graw Hill, 3rd Ed 1993.

Reference Books: [1]. Leland L Beck, "System Software, An Introduction to System Programming",
Pearson Education, 13th Indian Reprint, New Delhi, 2003
[2]. Dhamdhere, D.M., "Introduction to Systems Software", Tata Mc-Graw Hill 1996.

Prerequisite(s): Computer Fundamental

Objective(s): Internet Technologies presents the student with an introduction to the Internet and its services, applications and tools

- 1 **Introduction:** Layering, TCP/IP Layering, Internet Addresses, The Domain Name System, Client Server Model, Port Numbers, Implementations and Application, Programming interfaces. [6]
- 2 **IP:** The Link Layer Ethernet and IEEE 802 Encapsulation Trailer Encapsulation, **SLIP:** Serial Line IP, Compressed SLIP, **PPP:** Point-to-Point Protocol. The Internet Protocol IP Header, IP Routing, Subnet Addressing, Subnet Mask, Special Case IP Addresses. [8]
- 3 **Introduction to ARP:** Address Resolution Protocol and RARP: Reverse Address Resolution Protocol, ARP Packet Format, Proxy ARP, RARP Packet Format. [8]
- 4 **ICMP:** Internet Control Message Protocol Introduction, ICMP, Message Types, ICMP Address, Mask Request and Reply, IP Routing Routing Principles, Introduction to Dynamic Routing; . **UDP:** User Datagram Protocol UDP Header, UDP Checksum; **DNS:** The Domain Name System DNS Basics, DNS Message Format, security [9]
- 5 **TCP:** Transmission Control Protocol TCP Services, TCP Header TCP Connection, Establishment and Termination, TCP Timeout and Retransmission, Repacketization; Telnet and Rlogin Remote Login Rlogin Protocol, SMTP Protocol; **FTP:** File Transfer Protocol and SMTP: Simple Mail Transfer Protocol. [9]

Outcome(s): After completion of the course, students would be able to:

- Understand different types of networks, various topologies and application of networks.
- Understand types of addresses, data communication.
- Understand the concept of networking models, protocols, functionality of each layer.
- Learn basic networking hardware and tools.

Text Books: [1]. Tannenbaum A. S., "Computer Networks", Prentice-Hall India., New Delhi
[2]. Forouzan Behrouz A, "Data Communication and Networking", TMH, New Delhi

Reference Books: [1]. Sybex, "Networking Complete", BPB Publication, New Delhi
[2]. Stallings William, "Data and Computer Communication", Pearson Education, New Delhi

Prerequisite(s): Computer Fundamental and Networking,
Basic Mathematics.

Objective(s): Students will learn the basic concepts in computer security including software vulnerability analysis and defense, networking and wireless security, applied cryptography, as well as ethical, legal, social and economic facets of security.

- 1 **Introduction:** Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, has algorithms [6]
- 2 **Secret Key Cryptography:** Block Encryption, DES rounds, S-Boxes IDEA: Overview comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography; ECB CBC, OFB, CFB, Multiple encryptions DES, Hash Functions and Message Digests: Length of hash, uses, algorithms (MD2, MD4, MD5, SHS) MD2: Algorithm (Padding, checksum, passes.) MD4 and 5: algorithm (padding, stages,digest computation.) SHS: Overview, padding, stages [8]
- 3 **Public key Cryptography:** Algorithms, examples, Modular arithmetic (addition,multiplication, inverse, and exponentiation) RSA: generating keys, encryption and decryption.Other Algorithms: PKCS, Diffie-Hellman, El-Gamal signatures, DSS, Zero-knowledge signatures [8]
- 4 **Authentication:** Password Based, Address Based, Cryptographic Authentication. Passwords in distributed systems, on-line vs offline guessing, storing. Cryptographic Authentication:passwords as keys, protocols, KDC's Certification Revocation, Interdomain, groups, delegation. Authentication of People: Verification techniques, passwords, length of passwords, password distribution, smart cards, biometrics, Kerberos: purpose, authentication, serer and ticket granting server, keys and tickets, use of AS and TGS, replicated servers. Kerberos V4: names, inter-realm authentication,Key version numbers. Kerberos V5: names, realms, delegation, forwarding and proxies, ticket lifetimes, revoking tickets, multiple Realms [9]
- 5 **Network Security:** Electronic mail security, IP security, Network management security.Security for electronic commerce: SSL, SET. System Security: Intruders and Viruses, Firewalls, Intrusion Detection [9]

Outcome(s): After completion of the course, students would be able to:

- Identify the security goals of an information system, point out contradictory goals and suggest compromises.
- Understand of the principles underlying cryptography and cryptanalysis and have a technical understanding of the main cryptographic concepts and technologies.
- Understand the purpose of security protocols and be witness to the difficulties of their verification.

Text Books: [1].AtulKahate,“ Cryptography and Network Security”, TMH, New Delhi
[2].Kaufman, C., Perlman, R., and Speciner, M., “Network Security, Private Communication in a public world” , PHI

Reference Books: [1].Stallings, W., “Cryptography and Network Security: Principles and Practice”, Prentice Hall.
[2].BehrouzAForouzan, “Cryptography and Network Security”; McGraw Hill.

Prerequisite(s): Computer Fundamental

Objective(s): A comprehensive overview of how firms compete in today's environment with a focus on strategic choices and the infrastructures affecting e-commerce including technology, capital, media, and public policy.

- 1 **Electronic Commerce:** Overview and Scope, Traditional Commerce vs. Electronic Commerce, Impact of E-Commerce, Electronic Markets, Internet Commerce, e-commerce in perspective, Application of E Commerce in Direct Marketing and Selling, advantages and disadvantages, and future of E-commerce [6]
- 2 **Business strategy in an Electronic Age:** Value Chains, Supply chain, Porter's value chain Model, Inter Organizational value chains, Strategic Business unit chains and industryvalue chains. [8]
- 3 **Business to Business E-Commerce:** Inter-organizational Transitions, Credit Transaction Trade Cycle, a variety of transactions. Electronic Data Interchange (EDI): Introduction, Benefits of EDI, EDI Technology, EDI standards, EDI Communication, EDI Implementation, EDI agreement, EDI security. [8]
- 4 **Electronic Payment System:** Introduction, Online Payment System, Prepaid Electronic Payment System, Post Paid Electronic System, E-Cheques, Credit Cards, Smart Cards, E-Purses, DebitCards, Legal Risk of E-Payment System. [9]
- 5 **Securing Network Transaction:** Security Policy, Procedures and Practices, Transaction Security, Cryptography Algorithm, Public Key Algorithm, Authentication Protocol, Digital Signature, E-Mail Security. Different case studies of E commerce [9]

Outcome(s): After completion of the course, students would be able to:

- Illustrate management's role in the networked economy.
- Identify strategies involved in running an e-commerce company.
- Identify factors of successful implementation of an online strategy.
- Compare metrics used to evaluate progress of an e-commerce strategy.
- Summarize the effect of laws and regulations on e-commerce and Internet business.

Text Books: [1]. Whitely David, "E-commerce Strategy, Technology and application", Tata McGraw Hill Publications, New Delhi, 2005.

Reference Books: [1]. Kalakota, R. and Whinston, A. B. "Readings in Electronic Commerce", Addison Wesley, 2006
 [2]. Schneider, Gary P. and Perry, Jame, "Electronic Commerce" Thomson Publication, 2003
 [3]. P.T. Joseph, S.J., "E-Commerce :An Indian Perspective", PHI.

ET 19.471

Cloud Computing (Infosys)

Total Lectures: 40
3-0-0-3

Prerequisite(s): Computer Fundamental and Networking
Object Oriented Design and Programming

Objective(s): This course covers a series of current cloud computing technologies, including technologies for Infrastructure as a Service, Platform as a Service, Software as a Service, and Physical Systems as a Service.

- 1 **Overview of Cloud Computing:** Brief history and evolution - History of Cloud Computing, Evolution of Cloud Computing, Traditional vs. Cloud Computing. Why Cloud Computing, Cloud service models (IaaS, PaaS&SaaS). Cloud deployment models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing. Introduction to AWS Public Cloud Vendor. Cost optimization in AWS. [6]
- 2 **Virtualization:** Basics of virtualization, Virtualization technologies, Server virtualization, VM migration techniques, Role of virtualization in Cloud Computing. Introduction to EC2 service of AWS. [8]
- 3 **WWoWorking with Private Cloud:** Private Cloud Definition, Characteristics of Private Cloud, Private Cloud deployment models, Private Cloud Vendors - CloudStack, OpenStack, Eucalyptus Microsoft, Private Cloud – Benefits and Challenges. Private Cloud implementation in Amazon EC2 service. [8]
- 4 **Working with Public Clouds:** What is Public Cloud, Why Public Cloud, When to opt for Public Cloud, Public Cloud Service Models, and Public Cloud Players. Infrastructure as a Service Offerings, IaaS Vendors, PaaS offerings, PaaS vendors, Software as a Service. Demonstrating public cloud with AWS – Storage and Database services. Private vs. Public Cloud – When to choose. [9]
- 5 **Overview of Cloud Security:** Explain the security concerns in Traditional IT, Introduce challenges in Cloud Computing in terms of Application Security, Server Security, and Network Security. Security reference model, Abuse and Nefarious Use of Cloud Computing, Insecure Interfaces and APIs, Malicious Insiders, Shared Technology Issues, Data Loss or Leakage, Account or Service Hijacking, Unknown Risk Profile, Shared security model between vendor and customer in IAAS/PAAS/SAAS, Implementing security in AWS. Migration paths for cloud, Selection criteria for cloud deployment, Issues/risks in cloud computing, Future technology trends in Cloud Computing. [9]

Outcome(s): After completion of the course, students would be able to:

- Understand the concepts of cloud computing
- Understand the advantages and limitations of different cloud architectures.
- Understand the enabling technologies for building cloud systems.
- Understand the concept of security in cloud computing.

Text Books: [1].Cloud Computing: Principles and paradigms By Raj Kumar Buyya, James Broberg, AndrezeiM. Goscinski, 2011
[2].Cloud Computing, By Michael Miller, 2008.
[3].Cloud Computing for dummies, By Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper, 2009.

Reference Books: [1].Rittinghouse, John, W. Cloud computing: Implementation, management and security
[2].Rhoton, John, Cloud Computing Architected: Solution Design Handbook.
[3].Krutz, Ronald L.; Vines, Russell DeanKalakota ,R. and Whinston, A. B.,“Cloud Security: A comprehensive Guide to Secure Cloud Computing”, Addison Wesley.

CA 19. 373

Software and CASE Tools

Total Lectures: 40

3-0-0-3

Prerequisite(s): Computer Fundamental, Computer programming

Objective(s):

- To introduce the concept of software crisis, managing complexity, requirements specification, architectural and detailed design, testing and analysis, software process, and tools and environments.
- Explores concepts and techniques for design and construction of reliable and maintainable software systems in modern high-level languages; program structure and design; program-correctness approaches, including testing; and event-driven programming

- 1 **Software Engineering Fundamentals :** Definition of software product and process, Software Characteristics, Components, Applications, Layered Technologies, Processes and Product, Methods and Tools, Generic View of Software Engineering, Software Crisis and Software development paradigms [6]
- 2 **Software Requirements Analysis & Specification:** System specification, Software requirements specification (SRS) standards, Analysis Modeling: Difference between Data and Information, ER Diagram, Dataflow Model, Control Flow Model, Control and Process Specification, Data Dictionary [8]
- 3 **Software Design:** Software architecture, Modular design - cohesion and coupling, Process-oriented design, Data-oriented design, User-interface design, Real-time software design, introduction to Object Oriented Design [8]
- 4 **CASE Tools, Coding and Testing:** Computer-aided software engineering, Introduction to CASE, Building Blocks of CASE, Integrated Case Environment, Characteristics of good Programming languages, Introduction to Testing Process, Testing Activities like Unit, Integration & System Testing. [9]
- 5 **Reengineering, Quality and Metrics:** Business Process Reengineering, Reverse Engineering, Software re-engineerin. SQA-Software Quality Assurance, Software Reliability, Software quality metrics, SQA plan, ISO 9000 and 9001 Quality Standards. [9]

Outcome(s): After completion of the course, students would be able to:

- Make independent and critical assessments,
- Identify, formulate and solve problems autonomously, and
- Deal with changes in working life.
- Stay abreast of the development of knowledge, and
- Communicate their knowledge to others, including those who lack specialist knowledge in the field.

Text Books: [1].Pressman R.S. , “Software Engineering”, TMH 7th Ed 2014.
[2]. PankajJalote,“An Integrated Approach to Software Engineering”, NAROSA, 2005.

Reference Books: [1].Designing Flexible Object Oriented systems with UML - Charles Ritcher
[2].Fairely, R.E., “Software Engineering Concepts”, McGraw-Hill
[3].Object-Oriented Analysis and Design: using UML Mike O'Docherty Wiley Publication

Prerequisite(s): Computer Networking

Some knowledge of genetics or molecular biology would be advantageous.

Objective(s): To deliver descriptions of this rapidly evolving field, and facilitate user access to and manipulation of the biological data. This will include descriptions of genetic and biological databases and relevant tools available to retrieve and analyse the information within these.

- 1 **Biological Information Resources:** Introduction to biological data and database management, Biological databases – Protein databanks (Primary and Secondary databank; Sequence and structuredatabank), Genomic databanks (Sequence and specialized databanks). [6]
- 2 **Sequence Alignment:** Introduction to biological sequence alignment, Database searching, Algorithm for sequence alignment, Pairwise alignment (Needleman and Wunsch algorithm, Smith-Waterman algorithm), Multiple Sequence Alignment, Concept of Gaps, Gap penalties and scoring matrices, FASTA, BLAST, Variations of BLAST, Alignment scores and statistical significance of database searches [8]
- 3 **Genomics:** Genome, Gene structure of prokaryotes and eukaryotes, Concept of ORFs, GC-content, Codon Usage, cDNAs and ESTs, Serial analysis of gene expression (Microarrays). [8]
- 4 **Proteomics:** Introduction to proteome and proteome analysis (2D electrophoresis, Mass spectrophotometry, Protein micro array and X-ray crystallography), Algorithm for modeling protein folding. [9]
- 5 **Phylogenetics:** Introduction to phylogenetics, Parsimony, Molecular phylogenetics, Methods of phylogenetic tree construction [9]

Outcome(s): After completion of the course, students would be able to:

- Explain the basic principles that underpin Bioinformatics analyses, and apply these principles when analysing biological data.
- critically analyse and solve problems in biotechnology.
- Interpret correctly the outputs from tools used to analyse biological data and make meaningful predictions from these outputs.

Text Books: [1]. Peruski and Peruski: The Internet and the new Biology: tools for Genomic and Molecular Research, ASM Publishing House, India.

Reference Books: [1]. Higgins and Taylor, Bioinformatics, Oxford University Press, US.

CA 19. 377

Geographical Information System

**Total Lectures: 40
3-0-0-3**

Prerequisite(s): Computer Fundamental
Data Representation
Computer Graphics

Objective(s): This is designed to provide the students with an understanding of the methods and theories of GIS Analysis that will allow students to apply GIS knowledge and skills to everyday life.

- 1 **Genesis and Progression:** Basic Concepts, Benefits of Computerization of Information, [6]
Users of GIS, Introduction to Real World and Data Model,
Geometric Representation of objects, Levels of Measurement, Applications of GIS.
- 2 **Vector Data Models:** Introduction, Spaghetti Model, Topology Model, Data [8]
Compression, Storing Vector Data, Compression, Storing Vector Data.
- 3 **Raster Data Models:** Necessity and Characteristics, Coding and Storage of Raster Data, [8]
Compression of Raster Data, Run Length Encoding, Chain Codes, Block Codes, Quad
Tree Model, Conversion and Contrast between Vector and Raster Models
- 4 **Hardware and Software Requirements for GIS:** Basic Hardware Devices viz [9]
Computer, VDU, Quantizers, Printers, Plotters, etc. DBMS, Structure of
Databases, Multimedia, WWW.
- 5 **Basics of Data Collection:** Digitizing Maps, Scanning, Manual Digitizing, Aerial Photographs, [9]
Photo Interpretation, Remote Sensing, Correction, Surveying

Outcome(s): After completion of the course, students would be able to:

- Summarize GPS elevations and the operating environment for GPS;
- Create spatial data with real time GPS data;
- Recognize discrepancies in data presentations;
- Import GPS data into GIS;
- Evaluate data before transformation for scale and accuracy;

Text Books: [1]. Bernhardsen Tor, "Geographic Information System: An Introduction", 3rd edition,
Wiley Publication

Reference Books: [1]. Longley Paul, "Geographic Information Systems and Science", 2nd Edition, Wiley
Publication

CA 19. 369

E-Business

Total Lectures: 40
3-0-0-3

Prerequisite(s): Computer Fundamental

Objective(s):

- To introduce the fundamental concepts in the use and application of telecommunications, systems and technology in the e-business environment.
- To introduce new opportunities and expectations created through the use of eBusiness processes enabled by integrating information systems, telecommunications and internet-based technologies.
- To provide hands-on training for designing e-business applications and web sites using the market software packages, web authoring and development tools.

- 1 **Internet as a Business Driver:** Internet, WWW, Benefits of Internet and WWW, Difference between e-Commerce and e-Business, Mobile Internet, Internet Consumers. [6]
- 2 **Introduction to e-Business Trends:** Trends Driving e-Business, Customer Oriented Trends, e-Service Trends, Organizational Trends, Enterprise Technology Trends and General Technology Trends [8]
- 3 **E-Business Models:** Disruptive Technology, e-Business Models, Internet Pricing, e-Cash, Online Retailing, Constructing e-Business ICT Framework. [8]
- 4 **Leveraging the Web for Marketing:** Business Enhancement, Framework for Web Marketing, Web Usability, Content Management, and Impact of Internet on Marketing [9]
- 5 **Online Resources and Deployment:** Meta Search Engines, Boolean, Searching on Internet, Best Practice Web Searching, The Invisible Web [9]

Outcome(s): After completion of the course, students would be able to:

- Apply the functions of the various types of hardware, software, telecommunications, security and their uses to enable and support integrated, e-Business processes in any organisation;
- Understand the strategies and approaches for the e-business processes engineering;
- Understand the basic methods and procedures involved in planning and controlling the development and modification of an e-Business system in an organisation; Understand the concept of input/output devices of Computers and how it works.

Text Books: [1]. Ravi Kalakota, Marcia Robinsion, "E-Business 2.0: Roadmap For Success", 2nd Edition, Pearson.
[2]. Paul Phillips, "E-Business Strategy", 1st edition, TMH.

Reference Books: [1]. Colin Combe, "Introduction to e-Business", 1st Edition, Routledge
[2]. Azhar Kozami, "Business Policy and Strategic Management", 2nd Edition, Tata McGrawHill.

Prerequisite(s): Software Engineering

Objective(s):

- To learn the fundamental principles and practices associated with each of the agile development methods.
- To learn how agile methods scale to large and distributed projects.
- To perform in-depth explorations into aspects of agile development that are particularly relevant to each student through detailed discussion sessions.

- 1 **Fundamentals of Agile:** The genesis of Agile, introduction and background, Agile manifesto and principles, overview of Scrum, extreme programming, feature driven development, lean software development, Agile project management, design and development practices in Agile projects, test driven development, continuous integration, refactoring, pair programming, simple design, user stories, Agile testing, Agile tools. [7]
- 2 **Agile Scrum Framework:** Introduction to Scrum, project phases, Agile estimation, planning game, product backlog, sprint backlog, iteration planning, user story definition, characteristics and content of user stories, acceptance tests and verifying stories, project velocity, burn down chart, sprint planning and retrospective, daily scrum, Scrum roles – product owner, Scrum master, Scrum team, Scrum case study, tools for Agile project management. [9]
- 3 **Agile Testing:** The Agile lifecycle and its impact on testing, test driven development (TDD), unit framework and tools for TDD, testing user stories – acceptance tests and scenarios, planning and managing testing cycle, exploratory testing, risk based testing, regression tests, test automation, tools to support the Agile tester, securing Agile software. [10]
- 4 **Agile Software Design and Development:** Agile design practices, role of design principles including single responsibility principle, open closed principle, Liskov substitution principle, interface segregation principles, dependency inversion principle, Agile design, need and significance of refactoring, refactoring techniques, continuous integration, automated build tools, version control. [10]
- 5 **Industry Trends:** Market scenario and adoption of Agile, Agile ALM, roles in an Agile project, Agile applicability, Agile in distributed teams, business benefits, challenges in Agile, risks and mitigation, Agile project on cloud, balancing Agility with discipline, Agile rapid development technologies. [4]

Outcome(s): On successful completion of this course, students will be able to

- Understand concept of agile software engineering and its advantages in software development. Recognize various agile methods.
- Design and manage a project using Agile.
- Write user stories for project requirements.

Text Books:

- [1].Ken Schawber, Mike Beedle, Agile Software Development with Scrum, Pearson, 2008.
- [2].Robert C. Martin, Agile Software Development Principles, Patterns and Practices, Prentice Hall
- [3].Lisa Crispin, Janet Gregory, Agile Testing: A Practical Guide for Testers and Agile Teams, Addison Wesley.

Reference Books:

- [1].Alistair Cockburn, Agile Software Development: The Cooperative Game, Addison Wesley, 2006
- [2].Mike Cohn, User Stories Applied for Agile Software, Addison Wesley, 2004

CA 19. 362

Knowledge Management

Total Lectures: 40

3-0-0-3

Prerequisite(s): Management Information System
Software Engineering
Data Mining and warehousing

Objective(s): To enable students to learn about this practice in the context of managing the design, development and operation of information technologies that can facilitate KM.

- 1 **Introduction:** Definition, Evolution, Types, Implication for Knowledge Management [6]
- 2 **LifeCycle:** Challenges, Difference, Knowledge management system Life Cycle, Comparative Studies Between SDLC and Knowledge Management System Development, Role of Knowledge Developer. [8]
- 3 **Knowledge Creation and Architecture:** Knowledge Codification, Need of Codification, and Knowledge Tools for Codification, Developer Skills Set. [8]
- 4 **Knowledge Transfer and Internet:** Internet and Knowledge, E-Business, Ethical and Legal Issues in Knowledge Management. [9]
- 5 **Executive Information and Support Systems:** Business Expert System and AI, OLTO & OLAP; Data Warehousing; Data Marts, Data Warehouse architecture; Tools for data warehousing. [9]

Outcome(s): After completion of the course, students would be able to:

- Analyze the role of knowledge management in attainment of financial objectives, quality and process improvement, and innovation.
- Apply knowledge management models and technologies to business situations.
- Use a knowledge management system for an organization.
- Create a knowledge management plan to leverage opportunities to create, capture, represent and share knowledge within an organization. Understand the concept of input/output devices of Computers and how it works.

Text Books: [1]. Awad, Elias M., "Knowledge Management", TMH, New Delhi
[2]. Kimiz Dalkir, Knowledge Management in Theory and Practice - 2nd Ed. MIT Press 2011

Reference Books: [1]. Inmon, W. H., "Building Data Warehousing", Wiley, New Delhi.
[2]. Han, Jiawei, Kamber, Michelinal, "Data Mining Concepts & Techniques", Harcourt India, New Delhi

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Artificial Intelligence

Total Lectures: 40

3-0-0-3

- Prerequisite(s):**
- fundamental concepts in calculus, linear algebra and probability theory, for example, vector, matrix, Bayes' rule, differential
 - Programming language

Objective(s): Presentation of artificial intelligence as a coherent body of ideas and methods to acquaint the student with the basic programs in the field and their underlying theory. Students will explore this through problem-solving paradigms, logic and theorem proving, language and image understanding, search and control methods and learning.

- 1 **Overview of A.I.:** Introduction to AI, Importance of AI, AI and its related field, AI techniques. [6]
- 2 **Problem space and search:** Defining the problem as a state space search, Production system and its characteristics, Issues in the design of the search problem. [8]
- 3 **Heuristic search techniques :** Generate and test, hill climbing, best first search technique, problem reduction, constraint satisfaction [8]
- 4 **Game Playing:** Minimax, alpha-beta pruning, Predicate logic, representation of simple facts in logic, well formed formula, resolution. [9]
- 5 **Knowledge representation and Learning :** Definition and importance of knowledge, Knowledge representation, Various approaches used in knowledge representation, Issues in knowledge representation, Introduction learning, Types of learning, Introduction to neural networks. [9]

- Outcome(s):** After completion of the course, students would be able to:
- Know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)
 - Demonstrate working knowledge in Lisp in order to write simple Lisp programs and explore more sophisticated Lisp code on their own.
 - Ability to apply knowledge representation, reasoning, and machine learning techniques to real-world problems.

Text Books: [1]. Rich Elaine and Knight Kevin , Artificial Intelligence, Tata McGraw – Hill, 3rd edition, 2012

Reference Books: [1]. Russell Stuart and Norvig Peter, Artificial Intelligence: A Modern Approach, Prentice Hall; 3 edition, 2009.
[2]. Patterson D.W., "Introduction to AI and Expert Systems", PHI, 1999

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Information Security

**Total Lectures: 40
3-0-0-3**

Prerequisite(s): Computer Fundamental and Networking,
Basic Mathematics.

Objective(s): Students will learn the basic concepts in computer security including software vulnerability analysis and defense, networking and wireless security, applied cryptography, as well as ethical, legal, social and economic facets of security. Students will also learn the fundamental methodology for how to design and analyze security critical systems.

- 1 **Introduction:** Information, Characteristics of Information, Security Attacks, security model, Concepts of Policies; procedures; Guidelines and Standards NSTISSC [6]
- 2 **Cryptography:** Conventional Encryption Principles, Conventional encryption algorithms, cipher block modes of operation, location of encryption devices, Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates. [8]
- 3 **IP Security:** IP Security Overview, Architecture, Authentication Header, Encapsulation Security Payload, Combining Security Association, Key Management, Pretty Good Privacy, S/Mime and Types. [8]
- 4 **Web Security and E-Commerce:** Web Security Requirement, SSL and Transport Layer Security, Secure Electronic Transactions, Introduction to E-Commerce, Transaction on E-Commerce, Requirement of Security on E-Commerce. [9]
- 5 **System Security:** Recognized Security Threats, Virus, Trojan horse, Worm, Spyware, Adware, Key Logger, Denial of Services, Firewall Design Principles, Trusted Systems, Common criteria for information technology security and evaluation. [9]

Outcome(s): After completion of the course, students would be able to:

- Identify the security goals of an information system, point out contradictory goals and suggest compromises.
- Understand of the principles underlying cryptography and cryptanalysis and have a technical understanding of the main cryptographic concepts and technologies available today, including symmetric and asymmetric encryption, hashing, and digital signatures.

Text Books: [1]. William Stallings, "Cryptography and Network Principles and Practice", Fourth Edition, Pearson.
[2]. William Stallings, "Network Security Essentials (Applications and Standards)" Pearson.

Reference Books: [1]. Forouzan, Mukhopadhyay, "Cryptography & Network Security", , McGraw Hill
[2]. Godbole "Information Systems Security", , Wiley-India
[3]. Shah Deven "Information Security Principles and Practice", , Wiley-India

Prerequisite(s): Computer Fundamental
Information Security Concept

Objective(s): To give the Students a general knowledge of cyber technology and cyber security. Students will clarify issues of jurisdiction and sovereignty of the internet and be introduced to the basic principles of digital intellectual property, online privacy, and the basic elements of software copyright.

- 1 **Fundamentals of Cyber Law:** Jurisprudence of Cyber Law- Overview of Computer and WebTechnology-IntroductiontoIndian CyberLaw- Overview of GeneralLaws andProcedures inIndia; Freedomof Expression on theInternet. [6]
- 2 **E-commerce-LegalIssues:**ElectronicCommerce–DigitalSignature-Meaning; CreationofDigitalSignature;Understanding howdigitalsignatureswork,Rolein InformationTechnology;technicalissues;legalissues;Crimesrelating todigital signature certificates [8]
- 3 **CyberCrimes:**MeaningofCyberCrimes– CybercrimesunderIPC,Cr.P.CandIndianEvidenceLaw- CybercrimesundertheInformationTechnologyAct,2000 [8]
- 4 **CybercrimesunderInternationalLaw** -HackingChildPornography,Cyber Stalking,Denialofservice Attack,VirusDissemination, Software Piracy,Internet Relay Chat(IRC)Crime,CreditCardFraud,NetExtortion,Phishingetc-Cyber Terrorism - Violation of Privacy on Internet - Data Protection and Privacy [9]
- 5 **Intellectual Property Issues and Cyberspace : The Indian Perspective;** Overview of Intellectual Property related Legislation-Copyright law &Cyberspace; Trademark law &Cyberspace; Law relating to Semiconductor Layout&Design. [9]

Outcome(s): After completion of the course, students would be able to:

- Identify cyber laws and regulatory tools
- Understand the role of government and jurisdiction in technology
- Reflect on cyber laws regarding the internet and IP
- Judge case studies and court outcomes regarding online privacy and cyber security
- Classify cyber privacy, copyright, and software IP

Text Books: [1].Rodney D. Ryder, Guide to Cyber Laws, 2nd Edit, Wadhwa and Company, Nagpur,2007
[2].Sharma,Vakul. Information Technology law and Practice. Universal law Publishing,2011
[3].Rattan, Jyoti. Cyber law. New Delhi: Bharat law House,2011.

Reference Books: [1].Seth,Kanika. Cyber Law in the Information Technology Act. Nagpur : Lexis Nexis Butterworth Wadhwa,2009
[2].Rodney D.Ryder,Guide of Cyber Law,2nd Edition.
[3].FaruqAhmed,Cyber law in India

ET 19.362

Mobile Apps Development

Total Lectures: 40
Credit: 3-1-0-4

Prerequisite(s): CA 19.210 (Java Programming)

Objective(s):

- To learn how mobile apps are different from others traditional apps by learning those aspects of mobile programming that make it unique from other platforms
- Program mobile applications for the Android operating system that use basic and advanced phone features
- Deploy applications to the Android marketplace for distribution.

- 1 **Getting started with Mobility:** Mobility landscape, mobile platform, mobile apps development, overview of android platform, setting up the mobile app development environment along with an emulator, a case study on mobile app development. [8]
- 2 **Building blocks of mobile apps: Apps user:** Interface designing-mobile UI resources (Layout,UI elements, Draw-able,Menu), activity-states and life-cycle, interaction amongst activities. app-functionality beyond user interface- threads, async task, service –state and life cycle, notification, broad cast receivers, telephony and smsapis native data handling-on device file I/O, shared preferences, mobile database such as SQLite, and enterprise data access(via Internet/Intranet) [15]
- 3 **Sprucing up mobile apps:** Graphics and animation- custom views, canvas, animation APIs, multimedia-audio/video playback and record, location awareness, and native hardware access (sensor such as accelerometer and gyroscope). [8]
- 4 **Testing mobile apps:** Debugging mobile apps, white box testing, black box testing, and test automation of mobile app, JUnit for Android, Robotium, Monkey Talk. [6]
- 5 **Taking apps to market:** Versioning signing and packaging mobileapps, distributing apps on mobile market place. [3]

Outcome(s): On successful completion of this course, students will be able to

- Understand the android operating system in details
- Create mobile application for various screens
- Deploy on play store market
- Use various sensors available in mobile

Text Books: [1].Barry Burd, Android Application Development All in One for Dummies, John Wiley & Sons Inc., Edition I , 2011.
[2].AnubhavPradhan ,Anil V Deshpandy, Mobile App Development, Edition

Reference Books: [1].Lauren Darcey, Shane Conder,“Teach Yourself Android Application Development in 24 Hours”,Sams Publishing, 2012, 2ndEdition , 2012.