ACADEMIC PROGRAMME GUIDE

of

BACHELOR OF COMPUTER APPLICATIONS

(BCA)

Based on Choice Based Credit System (CBCS)/Elective Course System

CHITKARA UNIVERSITY
HIMACHAL PRADESH
NAAC ACCREDITED

w.e.f.
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Department of Computer Applications

Chitkara University, Himachal Pradesh, India

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1. GENERAL INFORMATION

Bachelor of Computer Applications is a three-year undergraduate course which deals with information technology and computer applications. The course includes subjects such as core programming languages Java and C++, data structure, networking and others. BCA graduates have good job prospects both in the government and private sector companies. After successfully passing their BCA course, students can easily find lucrative job opportunities in leading IT companies across the world.

2. ELIGIBILITY FOR ADMISSION

The candidate must have passed his/her 10+2 from recognized board of central or state government with minimum 50% marks. The candidate should have good moral character and must be in good mental and physical condition.

3. PROGRAM OVERVIEW

The Indian economy is on an extremely positive note; growth is across sectors, both in traditional industries and non IT sectors. In such an environment, corporate India will need young and talented youths to actively participate, manage, design, develop and lead several IT initiatives. It has not been better than this for aspirants of Bachelor of Computer Applications. The program imparts comprehensive knowledge with equal emphasis on theory and practice in the field of information technology. A BCA graduate would be able to demonstrate advanced skills in the effective analysis, design and realization of business systems utilizing contemporary information technology. The broad objective of the program is to provide sound academic base from which an advanced career in Computer Applications can be developed. Conceptual grounding in computer usage as well as its practical business application will be provided making candidates suitable for IT sector entry-level jobs.

3.1 Program Objectives

1. To equip graduate with the skills, knowledge and attitude necessary to work as a responsible software professional.
2. To develop appropriate intellectual, professional and personal attributes to succeed in a competitive environment.

3. Train future ready IT/Software industry professionals.
4. Impart comprehensive knowledge with equal emphasis on theory and practice.
5. To prepare tomorrow's responsible and sensible human beings.

3.2 Programme Educational Objectives (PEO)

PEO1: To be able to attain and exhibit a good command over interpersonal communication skills, team work and leadership traits and follow the ethical practices in their professional life.

PEO2: To be a able to analyze the given problem/set of requirements and develop good quality software applications through application of the software development paradigms and choice of appropriate technology which may require learning the emerging technologies from time to time.

PEO3: To be able to make a choice to opt for professional career in IT and IT-enabled services or to pursue higher studies in the field of Computer Science and Applications and succeed in their academic, professional or entrepreneurial pursuits.

PEO4: To be aware of the emerging needs of the society and would be able to provide appropriate solutions to cater to those needs through life-long learning.

3.3 Programme Outcomes (PO)

The Programme is designed to provide the knowledge and skills. The precise aim of this course is to develop and transfer the right talent to meet the demand of corporate India and to bridge the gap between industry and academics. In such an environment, corporate India will need young and talented youth to actively participate, manage, design, develop and lead several IT initiatives. It has not been better than this for aspirants of Bachelor of Computer Applications. The students shall be further groomed to work in a variety of organizational settings. The Programme Outcomes of BCA are summarized as below:

PO1: Application of Knowledge: Apply knowledge of software development paradigms in a systematic manner to solve real-time problems.

PO2: Employability: Build skills, knowledge and attitude necessary to work as responsible software professional.

PO3: Societal & Environmental Concern: Design solution for software application problems with appropriate consideration for societal and environmental issues.

PO4: Modern Tool Usage: Create, select and apply appropriate techniques, resources and modern IT tools.

PO5: Professional Ethics: Apply ethical principles and practices towards the use of technology and commit to professional ethics and responsibilities.

PO6: Individual & Team Work: Function effectively as an individual, and as a member or a leader in diverse teams and multi-disciplinary fields.

PO7: Communication Efficacy: Communicate effectively and write effective reports and Design documents, make effective presentations and give and receive clear instructions.

PO8:Life-long Learning: Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PO9:Problem Analysis: Prepare plan, design and develop solutions for the real-world problems of the industry.

PO10:Innovation and Entrepreneurship: Identify opportunities; develop entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.

3.4 University Vision and Mission

Vision:

To be a globally recognized organization promoting academic excellence through interdisciplinary applied research and to expand realms of knowledge through innovation.

Mission:

M1: To carry out the academic processes in accordance with global standards through active teacher-student-industry participation.

M2: To promote research, innovation and entrepreneurship in collaboration with industry, research laboratories and academic institutions of global repute.

M3: To inculcate high moral, ethical and professional values amongst our students, faculty & staff.

M4: To contribute in building skillful society.

4. DURATION AND STAGES

An academic year shall be divided into regular semesters (known as term) for all the programs. The program of studies leading to the award of degree consists of 6 terms as approved by the Academic Council. The maximum permissible duration for completion of degree is 5 years, after the day of first registration.

Normal duration of the degree program	Maximum time allowed for completion of program
3 years	5 years

5. RULES FOR ATTENDANCE

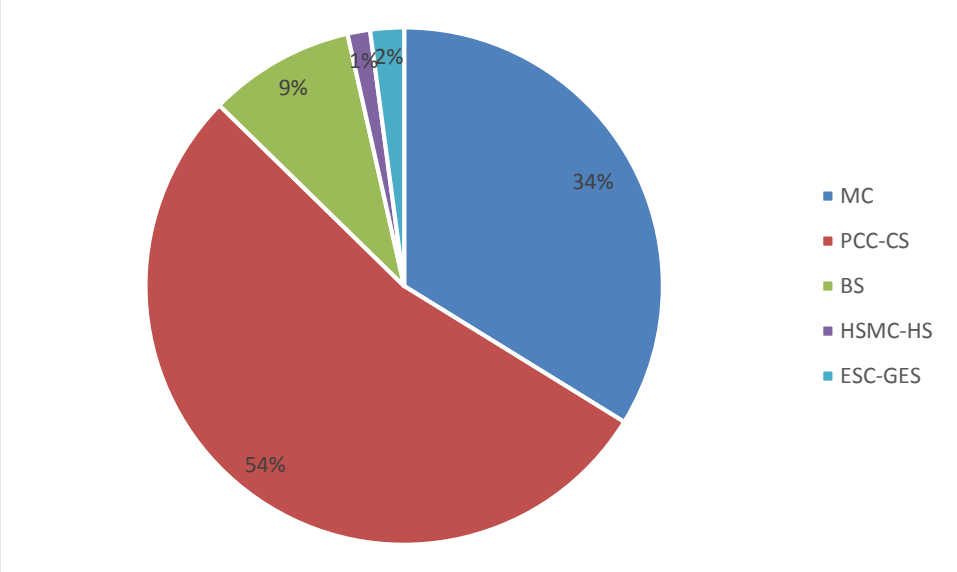
The program being highly rigorous, all the students are expected to show utmost regularity in attendance. Even a day's absence is detrimental to student's interest. The university expects its students to be regular in attending the classes. 75% attendance is compulsory in a course in order to be eligible to appear for end term examination. The students are also encouraged for participating in co-curricular activities conducted by prestigious institutions at national/International level. Such students would be eligible for grant of special duty leaves (limited by a cap decided by the Vice Chancellor) to make up for the attendance, in case any class work is missed during this period. This privilege extended to students, will not be termed as right and is limited to the attendance benefit only 10% concession in attendance requirements is possible only in case of extreme circumstances and at the sole discretion of the Vice Chancellor.

6. CREDIT ALLOCATION

Course Credit Distribution

Year/Category	MC	PCC-CS	BS	HSMC-HS	ESC-GES	PROJ	TOTAL
Semester - I	10	6	5				21
Semester - II	15	6	4	2			27
Semester - III	5	15	4				24
Semester - IV		26					26
Semester - V	10	9			3		22
Semester - VI	8	14					22
Total	48	76	13	2	3		142

Course Category-wise Credit Distribution



Course Category and Definition

Course Category	Definition
BS	Basic Science Courses
HSMC-HS	Humanities, Social Sciences, Management
ESC-GES	Engineering Science course
PCC-CS	Professional Core Courses
MC	Mandatory Course
Proj	Project

Credit Allocation (Semester Wise)

SEMESTER	CREDITS
Semester I	21
Semester II	27
Semester III	24
Semester IV	26
Semester V	22
Semester VI	22
Total	**142**

7. COURSE STRUCTURE

The various courses prescribed for a program may be categorized in terms of their academic affinity or their functional objectives as Core Courses and Elective courses.

Core Courses: Core courses are compulsory set of papers which also include those offered for specialization in the branch/discipline.

Electives Courses: The category called "Electives" is conceptually different and operationally wider. For each program there may be a specified number of electives classified as Program Electives or Open Electives.

A faculty advisor may be appointed to guide the students to opt for the elective courses those are relevant to the subject in which student is registered for the program.

A credit is a convenient device to anticipate the number of hours per week of total effort including the class work of a student. The system recognizes only the formal contact hours in the class room /studio and laboratory apart from self-study.

BCA Course Scheme

The term-wise program consists of a prescribed set of courses described in the course scheme, adding to a certain total number of credits in each term. For each program, the term-wise pattern presented in the course scheme conveys a sense of what comes first and what comes later.

Year – I				
Semester – I				
Course Category	**Course Code**	**Course Name**	**(L-T-P)**	**Credits**
MC	CA101	Introduction to Information Technology	4-0-0	4
MC	CA104	PC Assembly and Troubleshooting Lab	0-0-4	2
MC	CA146	Web Technologies I	0-0-4	2
PCC-CS	CA147	Programming with C-I	4-0-0	4
PCC-CS	CA148	Programming with C-I Lab	0-0-4	2
MC	CA150	Integrated Project -I	0-0-2	1
MC	EL101	Functional English	1-0-0	1
BS	AM111	Foundation of Algebra and Calculus	5-0-0	5
Total Semester Credits				**21**

Semester II				
Course Category	**Course Code**	**Course Name**	**(L-T-P)**	**Credits**
PCC-CS	CA142	Networking Fundamentals	4-0-0	4
PCC-CS	CA143	Networking Fundamentals-Lab	0-0-4	2
MC	CA155	Programming in C-II	4-0-0	4
MC	CA156	Programming in C-II Lab	0-0-4	2
MC	CA159	Computer System Architecture	3-0-0	3
MC	CA160	Integrated Project II	0-0-2	2
MC	CA161	Web Technologies-II	0-0-4	2
MC	CL102	Communicative English	2-0-0	2
HSMC-HS	ES101	Environmental Sciences	2-0-0	2
BS	AM108	Basics of Statistical Mathematics	4-0-0	4
Total Semester Credits				**27**

Year – II				
Semester III				
Course Category	**Course Code**	**Course Name**	**(L-T-P)**	**Credits**
MC	CA112	Software Engineering	4-0-0	4
PCC-CS	CA113	Fundamentals of Object Oriented Programming	4-0-0	4
PCC-CS	CA114	Fundamentals of Object Oriented Programming Lab	0-0-4	2
PCC-CS	CA115	Relational Database Management System	4-0-0	4
PCC-CS	CA116	Relational Database Management System Lab	0-0-4	2
PCC-CS	CA162	Web Technologies III	0-0-4	2
PCC-CS	CA165	Integrated Project -III	0-0-2	1
MC	CL203	Business English	0-0-2	1
BS	AM109	Discrete Mathematics	4-0-0	4
	HR101	Human Rights and Professional Ethics	0-0-0	0
Total Semester Credits				**24**

Semester IV				
Course Category	**Course Code**	**Course Name**	**(L-T-P)**	**Credits**
PCC-CS	CA121	Data Structures	4-0-0	4
PCC-CS	CA122	Data Structures Lab	0-0-4	2
PCC-CS	CA117	Web Programming using PHP	4-0-0	4
PCC-CS	CA118	Web Programming using PHP Lab	0-0-4	2
PCC-CS	CA125	Introduction to Java Programming	4-0-0	4
PCC-CS	CA126	Introduction to Java Programming Lab	0-0-4	2
PCC-CS	CA119	Operating System Concepts	4-0-0	4
PCC-CS	CA145	Operating System –Lab	0-0-4	2
PCC-CS	CL204	Soft Skills	2-0-0	2
Total Semester Credits				**26**

Year – III				
Semester V				
Course Category	**Course Code**	**Course Name**	**(L-T-P)**	**Credits**
PCC-CS	CA129	Data Warehousing & ETL Technologies	4-0-0	4
PCC-CS	CA130	Data Warehousing & ETL Technologies-Lab	0-0-2	1
MC	CA131	Digital Marketing	4-0-0	4
MC	CA132	Programming in Python	0-0-4	2
ESC-GES	CS501	Cyber Security	3-0-0	3
		Electives Set I (Students to opt for any one of the elective sets)		
MC	CA127	Software Testing	4-0-0	4
	CA127A	Object Oriented Software Engineering		
	CA127B	Business Analytics		
		Electives Set II (Students to opt for any one of the elective sets)		
PCC-CS	CA133	Major Project	4-0-0	4
PCC-CS	CA133A	Software Project Management (Based on PMI Guidelines)		
Total Semester Credits				**22**

(a) For Students opting for Regular Semester

Semester VI				
Course Category	**Course Code**	**Course Name**	**(L-T-P)**	**Credits**
PCC-CS	CA135	Advanced Java	4-0-0	4
PCC-CS	CA136	Advanced Java Lab	0-0-4	2
MC	CA157	Basics of Data Sciences	4-0-0	4
MC	CA150	Data Sciences-Lab	0-0-4	2

PCC-CS	CA138	Programming Practicum	4-0-0	4
MC	CA140	Logical Reasoning	0-0-4	2
		Electives Set III (Students to opt for any one of the elective sets)		
PCC-CS	CA139	Basics of Cloud & IoT	4-0-0	4
	CA139A	Introduction to Internet of Things		
	CA139B	Dynamic Programming		
Total Semester Credits				**22**

(b) For Students opting for Industrial Training (6 Month Duration)

Semester VI			
Course Category	**Course Code**	**Course Name**	**Credits**
PROJ	CA141	Industrial Training	22

List of Courses:

Basic Science Courses (BS)			**13**
Course Code	**Course Name**	**L-T-P**	**Credits**
AM111	Foundation of Algebra and Calculus	5-0-0	5
AM108	Basics of Statistical Mathematics	4-0-0	4
AM109	Discrete Mathematics	4-0-0	4

Humanities, Social Science and Management Courses (HSMC-HS)			**2**
Course Code	**Course Name**	**L-T-P**	**Credits**
ES101	Environmental Sciences	2-0-0	2

Mandatory Course (MC)			**48**
Course Code	**Course Name**	**L-T-P**	**Credits**
CA101	Introduction to Information Technology	4-0-0	4
CA104	PC Assembly and Troubleshooting Lab	0-0-4	2
CA146	Web Technologies I	0-0-4	2
CA150	Integrated Project -I	0-0-2	1
EL101	Functional English	1-0-0	1
CA155	Programming in C-II	4-0-0	4

CA156	Programming in C-II Lab	0-0-4	2
CA159	Computer System Architecture	3-0-0	3
CA160	Integrated Project II	0-0-2	2
CA161	Web Technologies-II	0-0-4	2
CL102	Communicative English	2-0-0	2
CA112	Software Engineering	4-0-0	4
CL203	Business English	0-0-2	1
HR101	Human Rights and Professional Ethics	0-0-0	0
CA131	Digital Marketing	4-0-0	4
CA132	Programming in Python	0-0-4	2
CA127	Software Testing	4-0-0	4
CA127A	Object Oriented Software Engineering	4-0-0	4
CA127B	Business Analytics	4-0-0	4
CA157	Basics of Data Sciences	4-0-0	4
CA150	Data Sciences-Lab	0-0-4	2
CA140	Logical Reasoning	0-0-4	2

Professional Core Courses (PCC-CS)			**76**
Course Code	**Course Name**	**L-T-P**	**Credits**
CA147	Programming with C-I	4-0-0	4
CA148	Programming with C-I Lab	0-0-4	2
CA142	Networking Fundamentals	4-0-0	4
CA143	Networking Fundamentals-Lab	0-0-4	2
CA113	Fundamentals of Object Oriented Programming	4-0-0	4
CA114	Fundamentals of Object Oriented Programming Lab	0-0-4	2
CA115	Relational Database Management System	4-0-0	4
CA116	Relational Database Management System Lab	0-0-4	2
CA162	Web Technologies III	0-0-4	2
CA165	Integrated Project -III	0-0-2	1
CA121	Data Structures	4-0-0	4
CA122	Data Structures Lab	0-0-4	2
CA117	Web Programming using PHP	4-0-0	4
CA118	Web Programming using PHP Lab	0-0-4	2
CA125	Introduction to Java Programming	4-0-0	4
CA126	Introduction to Java Programming Lab	0-0-4	2

CA119	Operating System Concepts	4-0-0	4
CA145	Operating System –Lab	0-0-4	2
CL204	Soft Skills	2-0-0	2
CA129	Data Warehousing & ETL Technologies	4-0-0	4
CA130	Data Warehousing & ETL Technologies-Lab	0-0-2	1
CA133	Major Project	4-0-0	4
CA133A	Software Project Management (Based on PMI Guidelines)	4-0-0	4
CA135	Advanced Java	4-0-0	4
CA136	Advanced Java Lab	0-0-4	2
CA138	Programming Practicum	4-0-0	4
CA139	Basics of Cloud & IoT	4-0-0	4
CA139A	Introduction to Internet of Things	4-0-0	4
CA139B	Dynamic Programming	4-0-0	4

Engineering Science course (ESC-GS)			**3**
Course Code	**Course Name**	**L-T-P**	**Credits**
CS501	Cyber Security	3-0-0	3

YEAR –I (SEMESTER I)

CA101	Introduction to Information Technology	4-0-0	4

Course Learning Outcomes:

CLO 1. Understand the computing basics, network applications, human computer interactions. Evaluate the fundamentals of computers, IT and the various related technologies to enhance IT related skills.

CLO 2. Appreciate the benefits of different number systems and be able to perform appropriate computations on different number systems as well as able to understand computer codes.

CLO 3. Enhance calculation skills using binary arithmetic. Evaluate the Boolean expressions and reduce those to simplified forms.

CLO 4. Learn Skills of designing digital circuits using the logic gates. Comprehend the need, benefits and functions of operating systems in computers.

CLO 5. Realize the significance of open source movement and the various licenses available under open source paradigm. To understand basic concepts of Microprocessors.

Syllabus:

Basics of Computer System: Evolution/Generations/Types of computer systems, Block diagram of computer, Application Areas of Computers. Memory and Storage, Need, Types of computer memory. Data storage devices. Number System: need, types, conversions from one number system to another number system. Arithmetic Operations (addition, subtraction, multiplication and division) on numbers of different number systems. Computer Codes. Boolean algebra: Concepts, Postulates, Principles, forms of Boolean expressions. Logic Gates and Logic Circuits

Computer Software: Introduction, types and categories. Programming languages: Need, categories. Outline view of translators I/O devices. Computer Networking: basics, types, topologies, devices employed in networking, Devices employed in networking of computers, networking software and use of network. Introduction to Internet, cloud and cloud-based services, effects of cloud-based services on business. What is www, http,https, ftp, email, Uses of Internet. Brief introduction to networking protocols (http, https, ftp, telnet and DNS) Operating System: Need, functions, basic operations. Types of Operating Systems, Introduction to working of Linux and Windows OS, Applications of Operating System. Open source Software: History, principles, success, methodologies, various open-source licensing options. Software Tools, Development

Tools, Designing Tools .Viruses: introduction to different kind of viruses and their anti-dots. Introduction to net etiquettes.

Suggested Books:

1. Sinha, P. K. & Sinha P., 2010, "Computer Fundamentals", 4th Ed., BPB Publications.
2. Norton P., 2012, "Introduction to Computers", 9th Ed., Tata McGraw-Hill
3. V. Rajaramna,"Introduction to Information Technology", 3rd Edition (2018), PHI

CA104	PC Assembly and Troubleshooting-Lab	0+0+2	1

Course Learning Outcomes(CLO):

CLO1: Working on various the basic hardware components of computer systems required for entrepreneurship .

CLO2: Working on PC memories such as RAM and ROM devices. This includes RAM types, RAM upgrading, ROM BIOS, and the CMOS chip.

CLO3: Analyze about power supplies and the skills to trouble-shoot various power-related problems.

CLO4: Recall the various tools available in Windows or provided by third-party companies that helps in PC troubleshooting and maintenance.

CLO5: Implement about Video technologies directly connected to PCs such as CRT monitors and VGA cards.

Syllabus

Understand various tools required to Assemble/ Dissemble a PC with safety precautions. Demonstrate the brief overview of motherboards, expansion slots, system buses (Control, address and data buses), various kinds of ports, cabinets and power supplies.
Introduction to BIOS, BIOS features, BIOS and Boot sequence, BIOS troubleshooting and BIOS upgrade.Perform disk partitioning and formatting of a hard disk, Create an Image of an Operating System Introduction to Operating System. Brief introduction and comparisons of Windows10, Linux and Apple operating system. Install Windows Operating System on a computer & concept of DUAL booting. Installation sequence of Windows10 and Linux. Name of software drivers requirement for running computers (Sound, Camera, Chipset, and Keyboard and display driver). Windows diagnostic tools (Defrag, clean up etc.). Troubleshooting problems related to memory. Installation/Uninstall/Updating Ubuntu Software Center, Synaptic Package Manager, Unity Dash, Introduction to different kind of web browsers (Internet edge, Chrome, Firefox and safari) and their configuration settings (like privacy setting, parental control etc.) Printers: Introduction to printer technologies. How to attach and install printers on respective operating system. Sharing: Introduction to sharing, Networks Utilization of Resources, Troubleshooting: Trouble shooting procedure (Fault location, fault finding aids, test and measuring tools).

Suggested Book(s):

1. Minasi, M., &Petroutsos, E. (2016). The complete PC upgrade and maintenance guide (No. 1). San Francisco, CA:Sybex.
2. Mueller, S. (2003). Upgrading and repairing PCs. QuePublishing.
3. Sinha, P. K. & Sinha P., 2010, “Computer Fundamentals”, 4th Ed., BPB Publications.

CA146	Web Technologies I	0+0+4	2

Course Learning Outcomes(CLO):

CLO1: Understand the paradigms and objects used in web development process.

CLO2: Differentiate between client and server side programming

CLO3: Apply the HTML and CSS concepts to create and design webpages and enhance web designing skills.

CLO4: Understand the principles of creating an effective web page that confirm to web standards by employing cascading style sheets.

CLO5: Apply Critical thinking and problem solving skills required to successfully design and implement a website.

Syllabus

Introduction to web programming, client server architecture, DNS, latest trends, static and dynamic content, WWW3C standards, difference between HTML & HTML5. Formatting tags e.g. font, Bold, italic, super script, subscript, delete, mark etc. HTML5 Quotations: q tag, blockquote, Code, abbreviation, address, cite, bi-directional override tag, header, footer and output Tag, meta data and meta tag. Ordered, Unordered, Definition List. anchor element, internal linking and external linking, attribute of anchor tag. image basics, image tag, Image alignment, image map and attributes of image and map. Table tag with attributes like width, alignment, cell spacing, cell padding, cell alignment, borders rules, rows, cells, rowspan, colspan, header, footer, body sections, captions and background images. Introduction to frameset tag, frame tag, iframes and respective attributes. Creating form, add labels, text box, check box, radio buttons, password, pull down menus and button to a form , Use of clickable image as a submit button, pass information between forms (action ,method). Introduction to DHTML, introduction to CSS3, ways to Insert CSS in HTML document (External Style Sheet, Internal Style Sheet, Inline Styles), CSS id and class, div and span tag. CSS background: background color, background image (repeat horizontally or vertically, set position and no-repeat) CSS Text: text color, text alignment, text decoration CSS Font: style, family, Size CSS lists, CSS Links CSS Tables: Table borders, collapse borders, table width and height ,table text alignment, table padding, table color CSS border: style, width, color. CSS margin: margin, padding Flex : Flex Intro,Flex direction ,Flex

Wrap ,Flex Grow and Flex Shrink,Flex justify content ,Align content, Overflow-Wrap ,Gradients . Resume Project : Resume Project Intro ,HTML Structure ,Adding Header Background image ,Navigation ,Adding Social Icons ,About Section. Gradient Functions Resume Project Intro ,HTML Structure ,Adding Header Background image ,Navigation ,Adding Social Icons ,About Section.

Suggested Book(s):

1. The Complete Reference HTML & XHTML by Thomas A. Powell, 4th Edition, Tata McGraw-Hill Company Limited.
2. Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML And PERL , Ivan Bayross, Edition 2018, BPB Publication
3. Dynamic HTML: The Definitive Reference, Danny Goodman, O'Reilly Publisher
4. HTML 4.0 by E. Stephen Mack, Janan Platt, Anaya Multimedia publication.

CA147	Programming with C-I	4-0-0	4

Course Learning Outcomes:

CLO 1. Develop the logic by understanding the semantics and syntax of C to enhance employability

CLO 2. Use break, continue and go to in looping constructs.

CLO 3. Manipulate tabular data (i.e. Arrays)

CLO 4. Use the user defined data types (structures and unions).

CLO 5. Able to write C programs, increasing coding skills to gain employability.

Syllabus:

Functions: Concept, Types, Library and User Defined Functions, Function calls- Call by Value, Call by Reference. Introduction to Arrays: Definition, Their Need and Importance, Types of Arrays, Initialization. Single and Multidimensional Arrays and functions. Strings: Definition, Reading and Writing Strings. String Manipulation, String Manipulations using Functions. Pointers: Concept and Usage, Pointers and Arrays, Pointer Arithmetic, String manipulation using pointers. Pointer to functions, Pointers and Strings, Array of pointers.

Suggested Books:

1. Kanetkar, Y., 2017, "Let Us C", 16th Edition BPB Publication New, Delhi.
2. Gottfried, B. S., 2017, "Theory and Problems of Programming with C", Schaum's outline series.
3. Reema Thareja , 2016, "Introduction to C programming ",3rd Edition Oxford Publication

CA148	Programming with C-I Lab	0-0-4	2

Course Learning Outcomes:

CLO 1. Develop the logic by understanding the semantics and syntax of C to enhance employability

CLO 2. Use break, continue and go to in looping constructs.

CLO 3. Manipulate tabular data (i.e. Arrays)

CLO 4. Use the user defined data types (structures and unions).

CLO 5. Modularize their complex problems using derived and user defined data types (data structures).

CLO 6. Able to write C programs, increasing coding skills to gain employability.

Syllabus:

Functions: Concept, Types, Library and User Defined Functions, Function calls- Call by Value, Call by Reference. Introduction to Arrays: Definition, Their Need and Importance, Types of Arrays, Initialization. Single and Multidimensional Arrays and functions. Strings: Definition, Reading and Writing Strings. String Manipulation, String Manipulations using Functions. Pointers: Concept and Usage, Pointers and Arrays, Pointer Arithmetic, String manipulation using pointers. Pointer to functions, Pointers and Strings, Array of pointers.

Suggested Books:

1. Gottfried, B. S., 2017, "Theory and Problems of Programming with C", Schaum's outline series.
2. Reema Thareja , 2016, "Introduction to C programming ",3rd Edition Oxford Publication

EL101	Functional English	1-0-0	1

Course Learning Outcomes:

CLO01: To develop confidence to respond in English during situation where the use of English is imperative

CLO02: To develop fluency in actual conversation in the English language and give students the confidence to talk efficiently and effortlessly in English.

CLO03 : To develop the speech skills necessary for confident and intelligent participation in group discussion

CLO04: To make formal and extempore speeches and presentations in English. Students will be able to increase efficiency in communication using it as an essential tool in influencing clients and effectively disseminating ideas.

CLO05: To develop the skills related to teamwork and to take up team leader roles in society as well as in future workplace.

CLO06: Learn comprehension skills including comprehension of the grammar, writing, speaking, listening, & reading parts of the English Language

Syllabus:

Phonetics: Phonetics Symbols and Transcription of Words,Translation: Translation of Simple sentences from Hindi to English, From English and Hindi,Translation of words from Hindi to English, From English to Hindi, Elements of a Sentence, Transformation of Sentences, Direct and Indirect Narration, Active and Passive Voice, Modals,Tense, Punctuation of a Short Passage with 10 Punctuation, Introduction to Reading Comprehension.

Suggested Books:

1. DiGiacomo, Michael. The English Grammar Workbook for Adults - A Self-Study Guide to Improve Functional Writing. Rockridge Press, 2020.
2. Mishra, Abhijeet Kumar. Spoken English Speak English Fluently & Confidently - I (Spoken English And Functional Grammar Book 1). A University Appproved Book on Spoken English, 2020.

3. Carley, Paul and Inger M. Mees. American English Phonetics and Pronunciation Practice. Routledge (Taylor & Francis Group), 2020.
4. Wells,J.C. and Lhinton Davidson. Sounds fascinating: further observations on English phonetics and phonology. Cambridge University Press, 2016.

AM111	Foundations of Algebra and Calculus	5-0-0	5

Course Learning Outcomes:

CLO1: Construct and analyze the graphs of trigonometry functions and will apply the concepts of trigonometry to any angle in a rectangular co-ordinate plane.
CLO2: Describe how circle, parabola, ellipse and hyperbola form the sections of cone and drive the standard equations of conics.
CLO3: Understand the respective application areas such as maxima-minima and area of a plane region through an overview of differentiation and integration respectively.
CLO4: Understand the Mathematical concepts and their applications in computational problems using the acquired board based knowledge to enhance calculation skills.

Syllabus:

Polynomials in one variable: Introduction to polynomials in one variable, zeroes of a polynomial, factorization of polynomials Algebraic identities. 2D Coordinate Geometry: Point Representation, Distance formula, Section formula, Equation of Straight Lines, Triangle, , Circle, Conics: Parabola Ellipse, Hyperbola, Area of conics, Complex numbers: complex numbers and their representation in a plane. Argand diagram, algebra of complex numbers, modulus and arguments of a complex number. Trigonometry: Introduction to six trigonometric functions, Simple Problems, Differentiation: Definition of Derivatives, Derivatives of Sum and Differences, Product and Quotients of Derivatives, Logrithmic differentiation, Chain rule, Tangent and Normal, Maxima-Minima, Integration: Fundamental Theorem of Calculus (statement only), Indefinite Integrals (Simple problems), Substitution method, Partial fraction method, By parts method.

Suggested Books:

1. Foundation Mathematics by K. F. Riley and M. P. Hobson, Cambridge University Press.
2. Applied Mathematics (Vol. II) by Dr. J. S. Bindra and K.S. Gill, 5th revised edition.
3. Engineering Mathematics - I, Chitkara University Publications
4. Calculus by Apostol, Tom M, J. Wiley.
5. Objective Mathematics by R. D. Sharma, Dhanpat Rai Publications.

YEAR I – (SEMESTER II)

CA142	Networking Fundamentals	4-0-0	4

Course Learning Outcomes:

CLO 1. Describe and analyses the hardware, software, components of a network and the interrelations required for employability.

CLO 2. Explain networking protocols and their hierarchical relationship hardware and software. Compare protocol models and select appropriate protocols for a particular design.

CLO 3. Manage multiple operating systems, systems software, network services and security. Evaluate and compare systems software and emerging industry technologies.

CLO 4. Explain concepts and theories of networking and apply them to various situations, classifying networks, analyzing performance and implementing new technologies.

CLO 5. Identify infrastructure components and the roles they serve, and design infrastructure including devices, topologies, protocols, systems software, management and security. Analyze performance of enterprise network systems.

CLO 6. Effectively communicate technical information verbally, in writing, and in presentations to improve employability.

Syllabus:

Introduction to Networks : Describe network and its usage. Basics Of Network, LANs, WANs, and the Internet ,Network Trends And Security Overview, Introduction to OSI,TCP/IP models, UDP protocols, Describe the impact of infrastructure components in an enterprise network : Firewall, access points, wireless controllers. Difference in OSI and TCP/IP model Network protocols: Network protocols and standards, moving data in the network, network Access: Physical layer overview, network media, data link protocols and media access control, Ethernet, network Layer, transport layer, Cisco IOS,IP Addressing, subnetting, application layer, ideal network. Routing and switching essentials: Switched network overview, VLAN, Routing basics, static routing dynamic routing, access control list, DHCP.Connectionless and best effort service. Example of connection oriented protocol Scaling Networks: Overview, LAN redundancy, link aggregation, wireless LAN,EIGRP overview and basic configuration. Connecting Networks: WAN, Point to point, broadband, site to site connectivity security, network monitoring, troubleshooting, quality of services.

Suggested Books:

1. Behrouz A Forouzan,,2009, Data communications and Networking, fifth edition, TMH.
2. Andrew S. Tanenbaum,,2011, Computer Networks, Seventh edition, Prentice Hall.
3. Kuross and Ross " Computer Networking : A top Down Approach", Sixth Edition , 2012 , published by Addison-Wesley

CA143	Networking Fundamentals Lab	0-0-4	2

Course Learning Outcomes :

CLO1: Identify the role of network devices.

CLO2: Construct straight through cable, cross cable and roll over cable

CLO3: Learn skill to employ IP addressing and understand the concept of subnetting

CLO4: Establish a peer to peer network and confirm the communication between the devices using ping command

CLO5: Establish small network topologies using simulator

CLO6: Connect two or more different networks.

Syllabus:

Introduction to Network & Network Devices. Network Cabling and Connecters. Internet Protocol and IPv4 Subnetting:Various classes of IPv4, Public and Private Address types. Introduction to Peer-to-Peer network. Creation of P2P network, File sharing. Packet Tracer simulator. Working of various routing protocol. Router IOS, H/W of router, Ports of Router, Static Routing, Routing Information Protocol. various troubleshooting Commands such as Ping, Trace Route, Netstat, Ipconfig, Nslookup. DNS, DHCP, Telnet.

Suggested Books:

1. Behrouz. A Forouzan; "Data communication and Networking" third edition;TMH, 1993.
2. Andrew S. Tanenbaum; "Computer Networks"; seventh edition, Prentice Hall,2000

CA155	Programming with C-II	4-0-0	4

Course Learning Outcomes:

CLO 1. Develop the logic by understanding the semantics and syntax of C to enhance employability

CLO 2. Use break, continue and go to in looping constructs.

CLO 3. Manipulate tabular data (i.e. Arrays)

CLO 4. Use the user defined data types (structures and unions).

CLO 5. Modularize their complex problems using derived and user defined data types (data structures).

CLO 6. Able to write C programs, increasing coding skills to gain employability.

Syllabus:

String Manipulation, String Manipulations using Functions. Pointers: Concept and Usage, Pointers and Arrays, Pointer Arithmetic, String manipulation using pointers. Pointer to functions, Pointers and Strings, Array of pointers. Recursion, Storage classes, User Defined Data Types - typedef, enumerated data types, Structures: Declaring & initializing structures, Array of structures, Nested Structures, Pointers and structures. Self referential structures. Unions: Declaration, Accessing union members, Difference between Structures and union Types of memory allocations: Static and dynamic memory allocation. C support: Library Functions malloc () and calloc () and realloc(). File Handling: Introduction to Files, Their Importance and Need, Steps in processing a file. File opening modes, Input and output operations of files, Direct/Random Access operations on functions.

Suggested Books:

1. Kanetkar, Y., 2017, "Let Us C", 16th Edition BPB Publication New, Delhi.
2. Gottfried, B. S., 2017, "Theory and Problems of Programming with C", Schaum's outline series.
3. Reema Thareja , 2016, "Introduction to C programming ",3rd Edition Oxford Publication

CA156	Programming with C-II Lab	0-0-4	2

Course Learning Outcomes:

CLO 1. Develop the logic by understanding the semantics and syntax of C to enhance employability

CLO 2. Use break, continue and go to in looping constructs.

CLO 3. Manipulate tabular data (i.e. Arrays)

CLO 4. Use the user defined data types (structures and unions).

CLO 5. Modularize their complex problems using derived and user defined data types (data structures).

CLO 6. Able to write C programs, increasing coding skills to gain employability.

Syllabus:

String Manipulation, String Manipulations using Functions. Pointers: Concept and Usage, Pointers and Arrays, Pointer Arithmetic, String manipulation using pointers. Pointer to functions, Pointers and Strings, Array of pointers. Recursion, Storage classes, User Defined Data Types - typedef, enumerated data types, Structures: Declaring & initializing structures, Array of structures, Nested Structures, Pointers and structures. Self referential structures. Unions: Declaration, Accessing union members, Difference between Structures and union Types of memory allocations: Static and dynamic memory allocation. C support: Library Functions malloc () and calloc () and realloc(). File Handling: Introduction to Files, Their Importance and Need, Steps in processing a file. File opening modes, Input and output operations of files, Direct/Random Access operations on functions

Suggested Books:

1. Gottfried, B. S., 2017, "Theory and Problems of Programming with C", Schaum's outline series.
2. Reema Thareja , 2016, "Introduction to C programming ",3rd Edition Oxford Publication

CA159	Computer System Architecture	3-0-0	3

Course Learning Outcomes:

CLO1: Design trade-offs Basic fundamentals in digital logic & structure of a digital computer.

CLO2: Identify performance issues in processor and memory design of a digital computer.

CLO3: To Develop independent learning skills and be able to learn more about different computer architectures and hardware.

CLO4: To articulate design issues in the development of Multiprocessor organization & architecture.

Syllabus:

Digital Logic Design: Axioms and laws of Boolean algebra, Reduction of Boolean expressions, conversion between canonical forms, Karnaugh map (4 variable), Half Adder, full adder, 4-bit parallel parity bit generator, checker circuit, Decoder, Encoder, Multiplexer, IC RAM, ROM, Memory Organization, Sequential Circuits, State transistors, Flip-flop, RS, JK, D-Latch, Master slave. INSTRUCTION SET ARCHITECTURE Memory Locations and Addresses: Byte Addressability, Big-Endian and Little-Endian Assignments, Word Alignment, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Subroutines, Additional Instructions, dealing with 32-Bit Immediate Values. BASIC PROCESSING UNIT & PIPELINING Basic Processing Unit: Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control, CISC Style Processors. Pipelining: Basic Concept, Pipeline Organization, Pipelining Issues, Data Dependencies, Memory Delays, Branch Delays, Pipeline Performance Evaluation. MEMORY ORGANIZATION Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, Memory Hierarchy, Cache Memories, Performance Considerations, Virtual Memory, Memory Management Requirements, Secondary Storage INPUT OUTPUT & PARALLEL PROCESSING Basic Input Output: Accessing I/O Devices, Interrupts, Input Output Organization: Bus Structure, Bus Operation, Arbitration, Interface, Interconnection Standards. Parallel Processing: Hardware Multithreading, Vector (SIMD) Processing, Shared-

Memory Multiprocessors, Cache Coherence, Message-Passing Multicomputers, Parallel Programming for Multiprocessors, Performance Modeling.

Suggested Reading(s):

1. M. Morris Mano, Computer System Architecture (3rd ed.), Prentice –Hall of India, 2007.
2. W. Stallings, Computer Organization and Architecture: Designing for Performance (7th ed.),Pearson Education, 2006
3. A.S. Tanenbaum, Structured Computer Organization (4th ed.), Prentice–Hall of India, 1999. 4. J.P.Hayes, Computer Architecture and Organization (2nd ed.), McGraw-Hill Book Company, 1988.

CA161	Web Technologies II	0-0-4	2

Course Learning Outcomes:

CLO01: Develop familiarity with the JavaScript language.
CLO02: Learn to use best-practice idioms and patterns.
CLO03: Understand and implement how to deal with various DOM elements to enhance web development skills.
CLO04: Understand concepts commonly used in dynamic language programming, such as introspection, higher-order functions, and closures.
CLO05: Understand advanced language features such as prototypical inheritance.
CLO06: Become adept at implementing client-side interfaces through the use of the DOM, jQuery and AJAX**.**

Syllabus:

Traversing the DOM – Why Javascript, Reference versus Value variables and Data Types, Events and Event Handling, Conditional statements, Functions and Function Calls, Scope, Dev Tool Debugging, Loops, Loops, Loops, Loops, Dom creation and modification, Asynchronous Communication.

Suggested Book(s):

1. The Complete Reference HTML & XHTML by Thomas A. Powell, 4th Edition, Tata McGraw-Hill Company Limited.
2. Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML And PERL , Ivan Bayross, Edition 2018, BPB Publication
3. Dynamic HTML: The Definitive Reference, Danny Goodman, O'Reilly Publisher
4. HTML 4.0 by E. Stephen Mack, Janan Platt, Anaya Multimedia publication.

CL102	Communicative English	2-0-0	2

Course Learning Outcomes:

CLO01: To learn effective interpersonal and team communication skills that are useful for engineers in the practice of their profession
CLO02: To learn micro-skills of communication
CLO03: To discuss professional and technical written communication along with the creative aspects of writing slogans, paragraphs, dialogues and developing outlines
CLO04: To develop the skills of reading, note making, note taking and summarizing
CLO05: To ensure students can communicate effectively.
CLO06: To gain proficiency in group discussions, interviews, and professional presentations.

Syllabus:

Effective Communication: What do We Mean by Communication?,Process of Communication, Communication Cycle, Channels and Media of Communication,Barriers to Communication, Learning Strategies for Effective Communication, Use of Technology in Developing Communication Skills, Introduction, Computer Assisted Language Learning (CALL), Self-learning Through the Use of Technology, Integrated Group Learning Using a Multimedia Language Laboratory, Effectiveness of CALL for Developing English Language Skills, Use of Internet, Word Elements, Introduction, Root/Base: The Core of a Word, Affi xes, Prefi x: The Frontal Element, Suffi x: The Tail to Modify Meaning, Vocabulary Building: Introduction, Synonyms, Antonyms, Homophones, Homonyms, Words Often Confused, One-Word Substitution, Idioms and Phrasal Verbs, Technical Terms, Professional Interaction: Introduction, Group Discussion, Job Interviews, Professional Presentation, Reading and Study Skills: Introduction, Reading Comprehension, Note Taking and Note Making, Précis Writing, Written Communication: Introduction, Paragraph Writing, Developing Outlines, Key Expressions and, Situation, Slogan Writing, Dialogue Writing, Interpreting Pictures and Cartoons, Professional and Technical Communication: Introduction, Letter Writing, Job Applications, Letter to the Editor, Business Letters, Reports, News Reports, E-mail Writing, Revision and Doubt Clearance Class

Suggested Book(s):

1. Bhatnagar,Nitin & Mamta Bhatnagar. Communicative English for Engineers and Professionals. Longman, Pearson, 2010.
2. Fast, Julius. English for Work: Everyday Technical English.General Professional English: Longman, 2003.
3. Anderson, John. Effective Interpersonal And Team Communication Skills For Engineers. IEEE Press, 2012.

4. Dunlap, Carmen Zuniga and Evelyn Marino Weisman. Helping English Language Learners Succeed. Professional Development for Successful Classrooms: Shell Education, 2007.
5. Ibbotson, Mark. Cambridge English for Engineering Student's Book with Audio CDs (2). Cambridge Professional English, Cambridge University Press, 2008.
6. Swales, John M. and Christine B. Feak. Academic Writing for Graduate Students: Essential Tasks and Skills.Michigan Series in English for Academic & Professional Purposes.University of Michigan Press, 2012.

ES101	Environmental Sciences	2-0-0	2

Course Learning Outcomes:

CLO 1. Describe about all the natural resources, various ecosystems and energy resources, environmental pollution, waste management, biodiversity and human population.

CLO 2. Design, identify and analyze both natural (disasters such as floods and earthquakes) and man-made (industrial pollution and global warming) environmental problems.

CLO 3. Analyze the societal and environmental impacts of energy with respect to meet the growing energy needs for sustainable growth.

CLO 4. Apply the above knowledge, as an activity to do various Case studies, required to understand the interrelationships of the natural world

CLO 5. Understand the real world issues to improve skills related to pollution.

Syllabus:

Introduction to environmental studies: Multidisciplinary nature of environmental studies;Scope and importance; Concept of sustainability and sustainable development. Ecosystems: Structure and function of an ecosystem. Producers, consumers and decomposers, energy flow in the ecosystem, food chains, food webs and ecological succession Introduction, types, characteristic features, and case study of the following ecosystems: Forest ecosystem Grassland ecosystemDesert ecosystem Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Natural Resources: Renewable and non-renewable resourcesLand resources and Landuse change; land degradation, soil erosion anddesertificationDeforestation: Causes and Impacts due to mining, dams building on environment, on forest , biodiversity and tribal populations.Water resources: Use and over exploitation of surface and ground water, floods, drought, conflicts over water (international and inter-state).Energy resources:, renewable and non-renewable energy sources use of alternate energy sources, Growing energy needs, Case studies. Biodiversity and Conservation DefinitionLevels of biological diversity : genetic, species and ecosystem diversity. Bio-geographical classification of India; biodiversity patterns and global biodiversity Hot-sports. India as a mega-biodiversity nation; Endangered and endemic species of India.Threats to biodiversity: Habitat loss, poaching of wildlife, man wildlife conflicts, biological invasions; Conservation of biodiversity: Insitu and Ex-situ conservation of

biodiversity. Ecosystem and biodiversity services :Ecological,economic, social, ethical, aesthetic and informational values. Environmental Pollution: Definition :types, Causes, effects and control measures of Air ,Water, Soil, and Noise pollution. Nuclear hazards and human health risks. Solid waste Management: control measures of urban and industrial wastes, Pollution case studies. Environmental Policies & PracticesClimate change, global warming, ozone layer depletion , acid rain and impacts on human communities and agriculture. Environment Laws; Environment Protection Act; Air(Prevention and control of Pollution)Act;Water (Prevention and control of Pollution)Act;Wildlife Protection Act ; Forest Conservation Act.International agreements; Montreal and Kyoto protocols and Conservation on Biological Diversity (CBD).Nature reserves,Tribal Populations and rights, and human wildlife conflicts in Indian context.Human Communities and the Environment: Human Population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disaster management; floods, earthquake, cyclones and landslides. Environmental movements; Chipko, silent valley, Bishnois of Rajasthan. Environmentalethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (CNG vehicles in Delhi).

Suggested Books:

1. Erach Bharucha, "Environmental Studies", 1st Ed., 2011, UGC Press India Ltd., New Delhi.
2. Shashi Chawla, A Text Book of Environmental Studies, Mc Graw Hill Education, 4th Ed. 2014. Mc Graw Hill.
3. The Basics of Environmental Sciences' by Manish Randhawa, First edition, 2016. Chitkara University publications.

AM108	Basics of Statistical Mathematics	4-0-0	4

Course Learning Outcomes:

CLO 1. Possess an ability to solve the problems of data interpretation using measures of central tendency, measures of Variation and concepts of correlation and regression.

CLO 2. Introduce and form matrices for present mathematical solutions in a concise and informative manner. Use matrices to solve the problems of system of linear equations and solve various live problems using matrices.

CLO 3. To analyze and correlate many real life problems mathematically and thus find the appropriate solution for them using theory of probability.

CLO 4. To improve skills on calculating standard measures such as mean , median mode

CLO 5. Able to gain skills to correlate Programming with Mathematics

Syllabus:

Statistics : : Classification of Data, Measures of Central Tendency : Arithmetic Mean, Weighted Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean,Measures of Variation : Range and its coefficient, Mean Deviation, Quartile Deviation and its coefficient, Standard Deviation,Coefficient of Variation and Variance, Correlation Analysis,karlpearson's cofficient of correlation. Regression Analysis,Matrices :Definition and Types Of Matrices with their examples Addition, Subtraction, Scalar Multiplication, Transpose, Conjugate, Matrix Multiplication and Properties.Determinants: Expansion of determinants, Properties Of determinants, Minor, Co-factors, Adjoint and Inverse of Matrices.Solution of linear system of equations using Cramer's Rule and using Gauss Elimination method Rank of a matrix (Determinant Form), Consistency of linear system of equations, Probability : Elementary events, Sample Space, Compound events Types of events : Mutually exclusive, Independent Events, Addition Law of probability, Conditional Probability Multiplication Theorem of probability, Baye's Theorem.

Suggested Books:

1. K.F.Riley and M.P.Hobson, Foundation Mathematics, 3rded 2011Cambridge University Press.
2. Dr.J.S.Bindra and K.S. Gill , "Applied Mathematics (Vol. II)", 5th revised edition, 5th Ed., 2016, Khanna Publications.
3. Bindra J S &; Gill K S, "Applied Mathematics – II", 2nd Ed., 2015, Bindra PublicationsS.P.Gupta, M.P.Gupta, Business Statistics, Sultan Chand & Sons

YEAR - II (SEMESTER III)

CA112	Software Engineering	4-0-0	4

Course Learning Outcomes:

CLO 1. How to apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment.

CLO 2. To develop skills in one or more significant application domains.

CLO 3. Work as an individual and as part of a multidisciplinary team to develop and deliver quality software.

CLO 4. Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle.

CLO 5. Demonstrate the skill to use the techniques and tools necessary for engineering practice

Syllabus:

Introduction to Software Engineering/Software Development, Requirement Analysis Concepts and Principles , Design Concepts : The Design Process, Design Principles, The Design Model , Design Documentation, Coding, Top Down And Bottom Up Approach Of Programming, Structure, Level Of Testing, Test Cases, Test Criteria, white box and black box testing, Software Testing Strategies, Maintenances Characteristics, Software Project Scheduling And Designing, Software Project Management, Cost Estimation, Project Scheduling, Project Staffing, Risk Management, Quality Assurance, Project Monitoring, Overview of Component based development.

Suggested Book:

1. Pressman, R. S. (2015). Software engineering: a practitioner's approach. McGraw Hill.
2. Ian Sommerville Software Engineering (2017), Sixth Edition, Adison-Wesley Pub. Co.
3. Pankaj Jalote (2016)An Integrated Approach to Software Engineering by, Third Edition Wiley.

CA113	Fundamentals of Object Oriented Programming	4-0-0	4

Course Learning Outcomes:

CLO 1. Develop the logic by understanding the semantics and syntax of C++

CLO 2. Modularize their complex problems using derived and user defined data types (data structures).

CLO 3. Declare constructor to initialize variables.

CLO 4. Understand the concept of reusability of a code using inheritance and improve employability skills.

CLO 5. Use the overloading of functions and operators in program domain.

CLO 6. To be able to convert a real life problem in C++ code and enhance employability probability.

Syllabus:

What is object oriented programming,Discuss OOPs, Structure Of C++ program Keyword, Basic data type Derived data type Declaration of variables, Scope of variables, Operators in C++, arithmetic, logical, bitwise, conditional,Control Structure, Function, Storage class specifier, Recursive function, Arrays , Structures, Union, Pointers, Pointers And Function, Pointers And Arrays, This Pointer, Classes, Arrays within class, storing data into array.Friend Functions, Constructor, Copy Constructor, constructor overloading , Destructor, Operator Overloading, Function Overloading, Inheritance, Virtual Base class, Abstract Class, Intro to Virtual Functions .String: Creation and manipulation of strings, storing data in strings

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Suggested Books:

1. E Balaguruswamy (2017), Object Oriented programming with C++ McGraw Hill
2. K. R. VenuGopal (2015)Mastering C++, by Published By l ,Tata Mcgraw-Hill Edition
3. Robert Lafore (2017)Object Oriented Programming in C++ by, Techmedia Publication

CA114	Fundamentals of Object Oriented Programming Lab	0-0-4	2

Course Learning Outcomes :

CLO1: Partition the problems in the form of classes (data and methods).

CLO2: Apply the concept of reusability using various flavours of inheritance.

CLO3: Use the variants of polymorphism via function overloading, operator overloading and virtual functions.

CLO4: Participate in the development process (using OOPS Paradigm) of technological world.

CLO5: Handling of problems in real time for employability.

Syllabus:

Introduction to basic input output statements with format specifiers. Decision control statements: Simple if, if else, nested if else, looping construction: While, for, do while, break, continue, nesting of loops. Populating array, Writing array, Initialization of array, processing of different types of arrays. Introduction to strings and user defined functions. Declaration and initialization of pointer, Pointer Arithmetic, Association of pointers with arrays, Passing by value, passing by address, passing by reference. Dynamic Memory Allocations and Storage classes. Creation of structure and union function. Create, open, close files. Comparison between two files.

Suggested Book(s):

1. E Balaguruswamy (2017), Object Oriented programming with C++ McGraw Hill
2. K. R. VenuGopal (2015)Mastering C++, by Published By l ,Tata Mcgraw-Hill Edition
3. Robert Lafore (2017)Object Oriented Programming in C++ by, Techmedia Publication

CA115	Relational Database Management System	4-0-0	4

Course Learning Outcomes:

CLO 1. Understand the concept of Relational models, architecture for DBMS, EF Codd's rules, normalization, managing concurrent transactions, recovery and security of database.

CLO 2. Implement ER model to identify the entities and attributes involved in the database to improve employability chances.

CLO 3. Implement normalization to have a non-redundant anomaly free database to improve employability.

CLO 4. Develop a normalized and secured database having backup (Implementation of the recovery techniques) and enhance employability.

CLO 5. Analyze the difference between RDBMS and other database storing techniques.

Syllabus:

Database System Application and Purpose, Comparison between File based and Database System, Advantages and Disadvantages of DBMS, Database System Architecture: Data Independence and Mapping among Views. Components of DBMS, Responsibilities of Database Administrator, Structure of DBMS. Recent Advances in Database Technology, Database System Architecture Entity Relationship Model: Entity and Relationships, ER Diagram Cardinality and Participation, Weak and Strong Entity. Representation of ER Diagram. Data Models: Hierarchical and Network Model, Relational Data model and Comparison of all the Models, Integrity Rules Relational Algebra: Union, Intersection, Division, Product Relational Calculus: Tuple Calculus, Domain Calculus. SQL: Introduction to SQL (DDL, DML, DCL), Query Representation, Constraints, Dependencies, Anomalies, Normal Forms.Database Transaction and its states, properties of database transaction concurrency Management, Concurrency Related Problems, Dirty Read Concurrency Control, Deadlock Prevention, Deadlock Detection and Recovery, Granularity of Locking, Timestamp-Based Locking. Database Reliability and Recovery: Types of Failures, Detection Scheme, Checkpoints, Recovery Techniques, Shadow Paging Database Security and Integrity: Security and Integrity Threats, Defense Mechanisms., Security Policies, Authorization, Data Encryption, Data Integrity: Integrity Constraint. Introduction to Big Data, Big Data Management & NoSQL Databases, Column-oriented Databases, Graph Databases, Key-value pair Databases, Document Databases

Suggested Books:

1. Rob Coronel (2017), “Database Systems”, Seventh Edition, Gex Publications.

2. Bipin C Dessi (2017) ,"Introduction to Database System" ,Seventh Edition, Galgotia Publication
3. Gerald V.Post (2015) "Database Management Systems", Second Edition,Tata Mc Graw Hill

CA116	Relational Database Management System Lab	0-0-4	2

Course Learning Outcomes:

CLO1: To use some basic commands/instructions using MySQL Terminal

CLO2:Use some advanced commands in MySQL interface, such as inserting the data, updating, and selecting the particular records according to the user queries.

CLO3: Perform various select operations on the table.

CLO4: Learn various relational Algebra Skills.

Syllabus:

Introduction To DDL Commands, DML Commands, DCL Commands, Introduction To Logical Operators, miscellaneous Operators, various Set Operators, various Data Constraints used in MySQL, Implementation of various keys in SQL.Learn various Aggregate Functions and performs mathematical functions with it. Date and Numeric Functions, String Functions, Clause, Subqueries, joins, create views of the tables for particular users, create a particular sequence in a table.

Suggested Books

1. Rob Coronel (2017), “Database Systems”, Seventh Edition, Gex Publications.
2. Bipin C Dessi (2017) ,“Introduction to Database System” ,Seventh Edition, Galgotia Publication
3. Gerald V.Post (2015) “Database Management Systems”, Second Edition,Tata Mc Graw Hill

CA162	Web Technologies III	0-0-4	2

Course Learning Outcomes:

CLO01: Understand the purpose of client side scripting.

CLO02: Decide when to use offline and hosted jQuery and DOM.

CLO03: Utilize the full strength of jQuery using chaining.

CLO04: Implement different filters on wrapper set will be achievable by the students.

CLO05: Explore core jQuery features which would help in designing GUI to enhance web development skills.

CLO06: Apply event routines and regular expressions to execute complex queries.

Syllabus:

Base concept behind jQuery, The concept behind the concept behind jQuery, jQuery & standards mode, Waiting on the DOM to be ready, Executing jQuery code when the browser window is completely loaded. Using a hosted version of jQuery, Executing jQuery code when DOM is parsed without using ready(), Grokking jQuery chaining. Breaking the chain with destructive methods, Using destructive jQuery methods and exiting destruction using end(), Aspects of the jQuery function, Grokking when the keyword this refers to DOM elements. Wrapper Set Handling & Basic Library Functions:

Extracting elements from a wrapper set, using them directly without jQuery, Checking to see if the wrapper set is empty, Using .each() when implicit iteration is not enough, Elements in jQuery wrapper set returned in document order. Wrapper Set Handling & Basic Library Functions:Custom jQuery filters can select elements when used alone, Grokking the :hidden and :visible filter, Using the is() method to return a Boolean value, You can pass jQuery more than one selector expression, Checking wrapper set .length to determine selection. Event Handling Mechanism: Not limited to a single ready() event, Attaching/removing events using bind() and unbind(), Programmatically invoke a specific handler via short event methods , jQuery normalizes the event object, Event object

attributes. Event Propagation Mechanism:Event object methods, Adding a function to several event handlers, Cancel default browser behaviour with preventDefault(), Cancel event propagation with stopPropagation(), Cancelling default behaviour and event propagation via return false.

Suggested Books:

1. jQuery Succintly, Cody Lindley, 2017, Syncfusion
2. JavaScript & jQuery, The Missing Manual, David Sawyer, 2016, O'REILLY
3. jQuery in Action, Bear Bibeault, 2019, Manning Publication
4. jQuery Pocket Reference,David Flanagan, 2017 O'REILLY

CL203	Business English	0-0-2	1

Course Learning Outcomes:

CLO01: Apply business communication strategies and principles to prepare effective communication for domestic and international business situations.

CLO02: Identify ethical, legal, cultural, and global issues affecting business communication and deliver an effective oral business presentation.

CLO03: Utilize analytical and problem solving skills appropriate to business communication.

CLO04: Participate in team activities that lead to the development of collaborative work skills.

CLO05: Select appropriate organizational formats and channels used in developing and presenting business messages.

CLO06: Compose and revise accurate business documents using computer technology and communicate via electronic mail, Internet, and other technologies.

Syllabus:

Biographical Presentation: How to present oneself? Integrity, professionalism, improving communications, and communications barriers Continuous business vocabulary practice. Presentations, including a professional bio, and will practice effective communication. Continuous business vocabulary practice. Presentations, including a professional bio, and will practice effective communication. Presentation on Effective Communications (Team) using media tools, fundamentals of team collaboration Nonverbal communications and time management Cover Letter and C.V. Resume, College pplication/College Essay, and C.V. Operational Manual (Team), Write a great college application and essay, , and write operational instructions. Professional Electronic Portfolio : Digital Portfolio, Linked In Profile Business Card, Professional Network Development Business Letters Memo proposal Multimedia Presentation and Develop business vocabulary. Proposal Components, Advertisement, Memo/Letter Proposal (Team) Analytical Research Essay (2), Market Research Report (Team): Write a business report for evaluating business proposals, telecommunications methods and marketing campaigns, and brand ethics. Essay writing, writing with precision, research and cited sources, multimedia support, and review of sentence structure. Business Plan Proposal (Team), Business Pitch Develop a concise and effective Executive Summary, discern a business plan from a business pitch and presentation. Presentation (Team): Presentation of

completed telecommunications business reports orally as proposals in a simulated business/workplace situation.

Suggested Books:

1. Mishra, Abhijeet Kumar. Spoken English Speak English Fluently & Confidently - I (Spoken English And Functional Grammar Book 1). A University Appproved Book on Spoken English, 2020
2. Pickett, Nell Ann. Technical English: Writing, Reading and Speaking.Longman, 2000.
3. Woolever, Kristin R. Writing for the Technical Professions.Longman, 2008.

AM109	Discrete Mathematics	4-0-0	4

Course Learning Outcomes:

CLO 1. To investigate and solve a variety of live problems related to sets, Relations and Functions.

CLO 2. To understand and apply the theory and techniques of Lattice, Logic and Boolean algebra

CLO 3. To gain skills related to Graph Theory and its relevance within the context of computer science and

CLO 4. Enhance skills to find solutions of live problems related to shortest path etc.

CLO 5. Gain skills to solve real life problems using combinatory.

Syllabus:

Set Theory: Sets and Elements, Types, Venn Diagrams, Set Operations, Duality, The Inclusion – Exclusion principle, Partitions. Relations: Representation, Composition, Types, Properties, Equivalence& Partial Ordering relations. Boolean Algebra, Laws of Boolean Algebra, Basic Therorams, Functions: Types, Domain, Co-domain and Range, Into Functions, One-to-One, Onto & Invertible Functions, Cardinality, Composition, Function as a relation. Lattices: Laws, Types : Bounded, Distributive, Complemented Lattices. Modular lattice. Adjacency Matrix, Incidence Matrix for directed and undirected graphs Boolean Algebra : Duality, Basic Theorems Boolean Algebras as Lattices, SOP form of Sets, SOP form of Boolean Algebras, Logic Gates, Boolean Functions, Truth Tables, Circuits, Karnaugh's map.Graph Theory: Types, Eulerian Paths and Circuits, Hamiltonian graphs, Bipartite Graphs, Weighted graphs, Cut vertices and Cut Edges, Matrix representation, Multi graph, Planar and Non-planar graph, Graph coloring, Isomorphism of graphs, Homeomorphic graphs , Shortest Path Problems: Dijkstra's Permutation, Kruskal's Algorithm, , Prim's Algorithm The Pigeonhole principle, Combination.

Suggested Books:

1. S. Lipschutz, M. Lipson, 2009,Schaum's Outline: Discrete Mathematics, Second Edition, Adapted by VarshaPati.
2. Andrew Simpson ,2011, Discrete Mathematics with example -Tata Macgraw Hill
3. Kenneth H. Rosen ,2014,Discrete Mathematics and its applications, 5th Edition, , Tata Mc Graw Hill

HR101	Human Values & Professional Ethics	0-0-0	0

Course Learning Outcomes

CLO 1. Understand basic concepts of human values and value education.

CLO 2. Understand importance of personal development and creation of a positive personality.

CLO 3. Understand importance of value education towards national and global development.

CLO 4. Identify constitutional or national values, social, professional, religious and aesthetic values.

CLO 5. Understand about national Integration and international cooperation necessary employability.

CLO 6. Acquire basic working knowledge of human rights and institutions engaged in protection of these rights.

Syllabus:

General Concepts Introduction about human rights and value education, aim of education, concept of human values and its type, development: Self -analysis, gender equality, respect to age, experience, maturity, family member, coworker. Personality development and its importance in professional world Character formation through human values: Truthfulness, sacrifice, sincerity ,self-control, tolerance, positive attitude, dignity, ethicsNational values :Democracy, socialism, secularism , equality, justice, liberty, freedomSocial values : sympathy, universal brother-hood, duty towards our society Professional Values: Knowledge thirst ,sincerity towards responsibility, ethics, regularity, punctuality, and faithReligious values: Accept and respect others believes, tolerance, understanding, faithFundamental rights: Introduction and importance of fundamental rights of Indian constitutionRight to Equality: Introduction and its importance, types of rights of equality, equality before law, abolition of untouchability, abolition of titles Rights to freedom: Introduction and its importance, types of rights, freedom of speech ,freedom to reside and settle , freedom to practice any professionRights against exploitation and right to freedom of religion: Introduction and its importance and its effect on human life Cultural and educational rights and rights to constitutional remediesRight to property and right to education : Introduction and its importance, importance of education on our life Human rights-general: Concepts of human rights and its Indian and international perspective, evolution of human rights, Universal Declaration of

Human Rights, significance of the UDHR, analysis of the declarationTherapeutic Measures : Control of mind through physical exercise, meditation and Yoga: Introduction and its effects on human mind, types of yoga, how to control our thought through yoga and meditationHuman rights of women and children :Social practice and constitutional safeguards, gender discrimination in workplaceFemale feticide , physical assault and harassment, domestic violence, condition of working of women, child labor, violation by individuals, nuclear weapons and terrorism safeguard

Suggested Books:

1. Freeman and Michael, 2002, "Human rights: An interdisciplinary approach", Cambridge: Polity Press.
2. Dr. Satish Memoria &S.V. Gankar, 2011, Dynamics of Human Relations - Dr. C.B. Memoria,2nd Ed. Himalaya Publishing House.
3. Grose, D. N., 2005, "A text book of value education", Dominant Publishers and Distributors, New Delhi.

YEAR II (SEMESTER IV)

CA121	Data Structures	4-0-0	4

Course Learning Outcomes:

CLO 1. Define basic static and dynamic data structures and relevant standard algorithms for them: arrays, stack, queue, dynamically linked lists, trees.

CLO 2. Handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures

CLO 3. Select basic data structures and algorithms for autonomous realization of simple programs or program parts required to work in industry.

CLO 4. Know the importance of memory management through dynamic memory allocation and make use of memory efficient data structure like linked list.

CLO 5. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.

CLO 6. Ability to sensibly select appropriate data structures and algorithms for problems enhance employability.

Syllabus:

Data structures: Types of Data Structures, Need and application, Brief concept of Complexity analysis with various notations. Various Algorithm Conventions. Pointers : Introduction To pointers, addressing using pointer Introduction to array as first data structure. Linear and non-linear data structure. Types of arrays Operations on Arrays, Significance of sorting an array. Sorting techniques. Insertion Sort Advanced sorting techniques. Introduction to linked list as another data structure, linked list versus array, types of linked lists, importance of algorithm, Operations of linear linked list, Applications of linear and circular linked list: Introduction to two-way list: Operations on two way list, Stack, Operations and Application of stack, Queue, Operations on Queue, Tree, binary search tree. Recursive and non recursive algorithms for pre order and post order traversals, inorder traversal, Quick Sort, Merge Sort algorithm and example

Suggested Book:

1. Salaria, R. S. (2017). Data Structures & Algorithms Using C++. KHANNA 4th Ed. ,PUBLISHING HOUSE.

2. “Data Structures”, Nineteenth Reprint, Seymour Lipschutz,Tata McGraw Hill, 2016
3. Thareja, R. (2014). Data structures using C. 4th Ed. Oxford University Press

CA122	Data Structures lab	0-0-4	2

Course Learning Outcomes :

CLO1: The use of various insertion and deletion operations on array.

CLO2: Recognize and implement Linear and binary search method according to employability need.

CLO3:Implementation ways of various sorting like Bubble, selection, insertion, Quick and merge sort.

CLO4: Learn Skills of merging of arrays.

Syllabus

Differentiate between logical deletion and physical deletion, manipulation of Array. Apply the application of nested loops and arrange the elements in ascending/descending order. Apply the application of nested loops. Implement the working of insertion sort. find any given element in a given array. Differentiate between linear search and binary search and will be able to understand the fastest searching algorithm implementation. Implement merging of arrays using two different approaches. Understand the usage of structure data type and pointers and understand difference between static and dynamic data structure. Insertion of node at various given position in link list. Implement singly and doubly list. Work on stack using array.Implement the working of simple queue and circular queue. Use stack for pre order traversing. Understand the divide and conquer policy. Implement the working of merge sort.

Suggested Book(s):

1. Salaria, R. S. (2017). Data Structures & Algorithms Using C++. KHANNA 4th Ed. ,PUBLISHING HOUSE.
2. “Data Structures”, Nineteenth Reprint, Seymour Lipschutz,Tata McGraw Hill, 2016
3. Thareja, R. (2014). Data structures using C. 4th Ed. Oxford University Press

CA117	Web programming Using PHP	4-0-0	4

Course Learning Outcomes:

CLO 1. Understand how server-side programming works on the web. PHP Basic syntax for variable types and calculations. Creating conditional structure. Storing data into various types of arrays.

CLO 2. Using PHP built in function and creating custom functions Understanding Global variables in form submission.

CLO 3. How to receive and process form submission data. Reading and writing cookies.

CLO 4. Manage state of web application using session management. Creating a database in phpMyAdmin. Reading and process data in MySQL database.

CLO5. Be able to develop websites and can work on live projects essential for entrepreneurship

Syllabus:

Introduction to LAMP/XAMPP, Apache Web Server: Installation and Configuration,MySQL: Installation and Administration, PHP Installation and Configuration, Testing and troubleshooting. XAMPP Installation, Manipulating Data, Identifiers, Constants and Variables, Conditional Structures and iteration, Functions and Constructs, PHP and the Web, Arrays, Strings and Regular Expressions, File Manipulation, Managing Date and Time, Managing E- mail, PHP and Database Connections, Stream and Network Programming, Security Issues.

Suggested Book(s):

1. Giarratano& Riley,2012 'Expert Systems Principles and Programming', 2nd Ed. Course Technology INC
2. Raj K. Bansal, Goel, Sharma,2016, "MATLAB and its applications in Engineering", 2nd Ed.,Pearson Education
3. Lynn Beighley and Michael Morrison, 2017, "Head First PHP & MySQL,, 6nd Ed.OReilly Media Publications

CA118	Web programming Using PHP lab	0-0-4	2

Course Learning Outcomes:

CLO1: Develop, understand and write basic use of PHP for designing web pages.

CLO2: Describe the use of WAMP/XAMPP/LAMP server.

CLO3: Design webpages and forms in PHP for employability.

CLO4: Apply GET and POST methods for data transmission from client to the server.

CLO5: Examine to control the display of webpages in specific frames

Syllabus:

XAMPP Setup, Variables and Operators, Adding Controls and Implementation PHP Forms and User Input, Control Statements, Functions, Arrays, String Handling, PHP Advance, PHP State Management, Emails using PHP, Database Connectivity with MySQL

Suggested Book(s):

1. Giarratano& Riley,2012 'Expert Systems Principles and Programming', 2nd Ed. Course Technology INC
2. Raj K. Bansal, Goel, Sharma,2016, "MATLAB and its applications in Engineering", 2nd Ed.,Pearson Education
3. Lynn Beighley and Michael Morrison, 2017, "Head First PHP & MySQL,, 6nd Ed.OReilly Media Publications

CA125	Introduction to Java Programming	4-0-0	4

Course Learning Outcomes:

CLO 1. Create Java applications that leverage the object- oriented features of the java language, such as encapsulation, inheritance and polymorphism

CLO 2. Enable the students to understand about interface and its uses to achieve the multiple inheritances.

CLO 3. Create user exception and handle using exception handling techniques required for industry employability.

CLO 4. Create an applet which can be executed on web browser through which student can gain insight of interactive web development.

CLO 5. Enable the student to understand the concept of window based programming by making use of AWT components.

Syllabus:

History and Goals of Java, Java Virtual Machine, Garbage Collection, JAVA BASICS, Identifiers and Keywords, Primitive Data Types, Integral, Operators, Branching and Looping, OO Programming, Creating a Data Type, Arrays: Declaring, Creating, and Accessing Arrays, Initializing Array , Multidimensional Arrays, Copying Arrays, Advanced Class Concepts, Multithreading in Java, Life cycle of Thread, Thread Priority, exceptions, stream I/O, Servlets, Web Sphere Studio Application Developer Integration Edition, WebSphere Studio Enterprise Developer, Basic Operations with RAD Views and Perspectives, Searching, Setup Compiler Class Path, JRE Switching, Refactoring, Changing Class, Method, and Variable Name, Moving a Class to a Different Package, Extracting Code to a Method, Pull-up Method, Migrating Workspace from WSAD v5.x ,Project Interchange Feature, Migrating J2EE.

Suggested Books:

1. David Flanagan (2011) Java in a Nutshell", , 4th edition, Reilly Media Publications
2. Patrick Naughton, Herbert Schildt(2017) The Java: Complete Reference", , (3rd edition.), Osborne/McGraw-Hill.
3. E.Balagurusamy (2016) "Programming with Java", , 3rd edition, TATA McGraw-Hill Publishing

CA126	Introduction to Java Programming Lab	0-0-4	2

Course Learning Outcomes:

CLO1: Understanding about the basic compilation and execution of the java program for employability .

CLO2: Applying various control statements like if, if else and looping statement like for, while, do-while, nesting of loops for drawing various patterns in java.

CLO3: Applying Labeled break and continue statements, scanner class to give input to a program from keyboard in java.

CLO4: Understanding about the 1-D array, 2-D arrays, String class and various operations performed on it.

CLO5: Creating classes, creating multiple objects, various arguments passing techniques, returning values to a method and concept of method overloading.

Syllabus

Installation of JDK, JRE. Start programming with java, implement java keywords usage, data types available, and use of various operators in programming applications. Use various control statements like if, switch, looping statement like for, while, do-while in java and declaring and using arrays. Devlop a code to create classes, define constructor for object initializing. Use the concept of reusability in java and apply Various visibility controls to hide the data. Multiple inheritance with interfaces and abstract classes.
Use various in built packages in programming concept and also can declare their own package as well. Identify the usage of multithreading in java. Know the use of various Exception classes and their respective application to handle the errors. Apply Window and graphic programming in java using Frame class etc. Use various AWT controls and can place them in any respective layout. Apply the power of java in web based applications using Applets. Create their own Applet application and can run it on web browser using HTML applet tags. Use the concept of Event classes in java and can handle Key and Mouse events. Use the concept of Event classes using event listener's interfaces and adapter classes in java.

Suggested Book(s):

1. David Flanagan (2011) Java in a Nutshell", , 4th edition, Reilly Media Publications
2. Patrick Naughton, Herbert Schildt(2017) The Java: Complete Reference", , (3rd edition.), Osborne/McGraw-Hill.

3. E.Balagurusamy (2016) “Programming with Java”, , 3rd edition, TATA McGraw-Hill Publishing

CA119	Operating System Concepts	4-0-0	4

Course Learning Outcomes:

CLO 1. Student should be able to identify the different types of Operating System and their components.

CLO 2. Design and implementation of new system calls and gain skills to work in open source operating system.

CLO 3. Implementation of existing resource management algorithms in Linux operating system .

CLO 4. To identify various system security and protection issues and gain necessary skills.

CLO 5. To completely administer the system using various Operating systems (Windows and Ubuntu) for managing its resources.

Syllabus:

Types of computer systems, System Components, Operating System Services, System Calls/API, System Programs, Applications and operations of operating systems Process Concept – Process Scheduling – Operations on Processes – Cooperating Processes – Inter-process Communication. Examples of IPC Systems, Multithreading, Threads Multithreading Models. CPU Scheduling, Scheduling Criteria Scheduling Algorithms Multiple-Processor, Scheduling Real Time Scheduling. Process Synchronization - The Critical-Section Problem. Synchronization Hardware, Introduction to Semaphores, System Model, Process Scheduling, Process Priority, Examples of Process,Deadlock Characterization, Methods for handling Deadlocks, Deadlock Prevention , Deadlock avoidance, Deadlock detectionMemory Management: Swapping, paging, Segmentation, Segmentation with paging, Virtual Memory, Demand Paging, Process creation, Page Replacement Algorithms, Allocation of frames, Thrashing. File Concept Access Methods Directory Structure File System Mounting – File Sharing – Protection, File System Structure, File System Implementation Directory Implementation Allocation Methods Free-space Management. Kernel I/O Subsystems. Disk Structure – Disk Scheduling. Security Problem, User Authentication Problem, Program Threats, System Threats,Starvation aging

Suggested Book:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", Sixth Edition, John Wiley & Sons (ASIA) Pvt. Ltd.
2. Tanenbaum, A. (2016). Modern operating systems. 7th Ed.Pearson Education, Inc.,
3. Stallings, W. (2018). Operating Systems 10th Edition. Pearson Education India..

CA145	Operating System Concepts lab	0-0-4	2

Course Learning Outcomes :

CLO1: Know first-hand experience of interaction with Ubuntu OS, and would be able to use some basic general purpose commands/instructions using Ubuntu Terminal

CLO2: Realize the need of File Commands navigating through file system using terminals and would be able to use those commands

CLO3: Familiarize the various attributes of the file, inode,hard links, soft links and understand the security feature of Linux.

CLO4: Learn skill to grant ownership and permissions of the files and directories and how to set permissions for files/directories.

CLO5: Demonstrate the proper use of meta characters and redirection in LINUX commands.

Syllabus

Introduction to Ubuntu Interface – Ubuntu Launcher using Terminal, understanding features of Linux, history of Linux, architecture of Linux, Terminal commands: System Information Commands:login, date,cal, clear, who, echo,man,bc, passwd, tty, uname. Introduction to File and disk system: Appreciate the file structure of Linux O.S , knowing absolute pathname. relative pathnames Terminal commands: File Commands: ls, pwd,touch, cat, cd, cp, mv, rm, rmdir, mkdir,mv,file, lp, df, du, ulimit, File permissions,Terminal commands:chmod, od,umask, chown, chgrp, zip, gzip,unzip,tar. The Shell: wildcard characters- *, ? , [], [!], [x-z],\(escaping), ‘ ‘(quoting) Redirection: std input(<), >(std output),|(pipes),tee, cmd substitution, Terminal commands: more, wc,pr, cmp,diff,comm., head, tail, cut, paste, sort, uniq, nl, Terminal commands: ps, &, nohup, nice, kill, bg, fg, at ,batch, cron, Terminal commands: talk, mesg, finger, telnet, rlogin, mail, Advanced Filters using grep: grep, all options, regular expressions (full character set), egrep, fgrep, Vi –editor: all three modes: Input mode, command mode, last line mode commands (various command for positioning cursor in windows by character, byline, byword, commands for inserting and deleting text in file), Shell programming: Shell scripts based on :Introduction to shell script, keywords, variables, positional parameters. Use of operators: Writing shell scripts based on various operators used by shell like arithmetic operators ,relational, logical, string operators and usage of “expr”, Use of conditional statements: Shell scripts based on: Writing shell scripts based on if –else decision based statements and case esac statement.

Suggested Book(s):

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", Sixth Edition, John Wiley & Sons (ASIA) Pvt. Ltd.
2. Tanenbaum, A. (2016). Modern operating systems. 7th Ed.Pearson Education, Inc.,
3. Stallings, W. (2018). Operating Systems 10th Edition. Pearson Education India.

CL204	Soft Skills	2-0-0	2

Course Learning Outcomes:

CLO01. Personality Development training

CLO02. Enabling to interact efficiently and eff ectively

CLO03. Acquire career skills and fully pursue to partake in a successful career path

CLO04. Enabling students to develop a cooperative mindset

CLO05. Prepare good resume, prepare for interviews and towards working in teams

CLO06. Explore desired career opportunities in the employment market in consideration of individual interest.

Syllabus

Soft Skills: An Overview, Emotional Intelligence, Self-Image Management, Team Building and Cooperation, Time Management and Goal Setting, Leadership skills, Courtesy & Habits, Resume Writing & Job Applications, The Art of Promoting Yourself, Personal Interview and Interactions.

Suggested Book(s):

1. Johnson, Steven. The IT Professional's Business and Communications Guide : a Real-World Approach to CompTIA A+ Soft Skills. John Wiley & Sons, 2007.
2. b.
3. Klaus, Peggy. The Hard Truth About Soft Skills: Workplace Lessons Smart People Wish They'd Learned Sooner. Harper Collins, 2008.
4. c.
5. Gardenswartz, Lee. Jorge Cherbosque, Anita Rowe. Emotional Intelligence for Managing Results in a Diverse World: The Hard Truth about Soft Skills in the Workplace. Nicholas Brealey Boston, 2008.
6. d.
7. Wushow “Bill” Chou(eds.).Fast-Tracking Your Career: Soft Skills for Engineering and IT Professionals. Wiley-IEEE Press, 2013.

YEAR III (SEMESTER V)

CA129	Data Warehousing & ETL Technologies	4-0-0	4

Course Learning Outcomes:

CLO 1. Differentiate between the types of data and learn about historical reasons and goals for development of data warehouse technology

CLO 2. Identify the major frameworks of data warehousing required as per industry requirements.

CLO 3. Understand how to start-small and think-big using ETL technologies

CLO 4. Realize the potential use of multidimensional model and OLAP in data analysis

CLO 5. Be able to work on various ETL tools required for employability

Syllabus:

Introduction to Data, Structured, Semi-Structured and Unstructured Data. Data Warehousing: Need, characteristics, Ralph Kimball's Approach vs. W.H. Inmon's Approach, Goals of Data warehousing, Data Sources, Extract, Transform, Load, Data Integration, Technologies, Data Quality and Data Profiling, Data Warehousing Components : Sourcing, Acquisition, Cleanup and Transformation Tools. Access Tools. Warehouse Architecture, Data Warehouse and Data Marts, Multidimensional Data Modeling: Basics, Introduction to Meta Data: Repository, Management, Trends, Categorization of OLAP Tools: ROLAP and MOLAP Introduction to Business Intelligence, Business Intelligence Users and Applications, Business Intelligence Roles and Responsibilities. ETL architecture ,importance of ETL testing ,,ETL Testing Work flow activities involved, Challenges in DWH ETL Testing compare to other testing. Types of ETL Testing :Data completeness, Data transformation, Data quality, Performance and scalability, Integration testing, Incremental load testing ,Initial Load / Full load testing ,Different ETL tools available in the market : Informatica , Ab Initio , IBM Data stage

Suggested Books:

1. Berson, A., & Smith, S. J. (2017). Data warehousing, data mining, and OLAP. 7th Ed. McGraw-Hill, Inc..
2. Inmon, W. H. (2016). Building the data warehouse. 4th Ed.John wiley & sons.
3. Jiawei, H., Micheline, K., & Jian, P. (2016). Data mining concepts and techniques. 5th Ed. PHI Publications

CA130	Data Warehousing & ETL Technologies Lab	0-0-2	1

Course Learning Outcomes :

CLO1:Perform data analysis using pivot Tables.
CLO2: Learn Skills of slicing and dicing operation in MS Excel.
CLO3: Perform Vlook operation on MS Excel.
C LO4: Install Pentaho Data Integration Tool.

Syllabus

Illustrating Data Analysis using Pivot Table and Charts, Slicing and Dicing operations in MS Excel, Implementation of VLook Up, Install and Run Pentaho Data Integration IDE. Transformation, Transformation on Multiple Files, Creating Database Connection, Performing Database to files Transformation, Performing Files to database Transformation, Filtration of records.

Suggested Book(s):

1. Berson, A., & Smith, S. J. (2017). Data warehousing, data mining, and OLAP. 7th Ed. McGraw-Hill, Inc..
2. Inmon, W. H. (2016). Building the data warehouse. 4th Ed.John wiley & sons.
3. Jiawei, H., Micheline, K., & Jian, P. (2016). Data mining concepts and techniques. 5th Ed. PHI Publications

CA131	Digital Marketing	4-0-0	4

Course Learning Outcomes:

CLO 1. Understanding of the key concepts and trends associated with Digital Marketing necessary for entrepreneurship

CLO 2. Understand the key concepts required for e-marketing & Internet Technologies.

CLO 3. Hands-on familiarity with the leading tools and techniques used in the customer–facing aspects of Digital Marketing & Internet Technologies.

CLO 4. Conceptual and practical education in the best practices used by industry leaders to produce superior business results in the management of Digital Marketing & Internet Technologies.

CLO 5. E-business is booming and so are the opportunities for graduates to start their own e-business, consult existing e-businesses, work at e-business giants ranging from Airbnb.com to Amazon.com

Syllabus:

Digital Marketing Strategy: Introduction, Key terms and concepts, Understanding marketing strategy, Building blocks of marketing strategy; Crafting a digital marketing strategy. Content Marketing Strategy: Introduction, Key terms and concepts, Defining content marketing, Strategic building blocks, Content creation, Content channel distribution, Tools of the trade, Advantages and challenges. Web Presence: How to increase online presence and drive more traffic for a website, Search result visibility in Google for chosen keyword and phrases, Using e-mail marketing to drive traffic for a website, Posting social media content for lead generation, Tools to create and manage content, Use of Blogging as content strategy. Content Management: Writing and posting content on the web and in social networks, creating content: info graphics, the perfect blog and video; create lead and sales funnels; Create, manage and implement a content marketing strategy; Monitoring and recording results to improve content marketing campaigns; Successful content marketing examples, strategies and case studies.

Suggested Books:

1. Venakataramana Rolla (2009), “Digital Marketing Practice guide for SMB: SEO, SEM and SMM”, CreateSpace Independent Publishing Platform, 1 st edition.

2. Damian Ryan Kogan (2017) "Understanding Digital Marketing: Marketing strategies for Engaging the Digital Generation", 3 rd edition.
3. Shivani Karwal,(2014) "Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing", Create Space Independent Publishing Platform, 1st edition.

CA132	Programming in Python	0-0-4	2

Course Learning Outcomes :

CLO1: Learn Python fundamentals and its general purpose behavior.

CLO2: Learn skills to perform operations on numbers and strings.

CLO3: Learn skills Internal data structures like list, sets, tuples and dictionaries.

CLO4:Professional way of writing code using modular approach.

CLO5:The way of developing applications using object oriented approach.

Syllabus:

Introduction to Objects & Python's Math Library: Understanding variables and basic operations on number and string data, dealing with basics of math library (pow, sqrt, round, exp, pi, ceil, floor), displaying strings and numbers, while statement. Exploring String Object Methods: understanding string methods like upper(), lower(), isdigit(), isallnum(), isalpha(), isnumeric(), split(), endswith(), startswith(), join(), count(), strip() and exploring string iterations, basic if statement. Exploring Number Object Operations: working with number literals, dealing with hexadecimal, octal and binary numbers, basic arithmetic operations, mix type conversion, integer to float and float to integer conversion, formatting numbers. Introduction to List Object: creating empty list, initializing list, list indexing and slicing operations, input method, single and multidimensional arrays. Introduction to List Objects-II: Concatenating multiple lists, generating range based lists, list based methods like append (), extend (), insert (), index (), count (), sort (), reverse (), pop () and nested lists. Introduction to Dictionaries: creating empty dictionaries, initializing dictionaries, Accessing dictionary items, merging, and deletion. Introduction to Dictionaries-II: understanding dictionary specific methods, keys (), values (), items (), copy (), update (), pop () and dictionary comprehension. Exploring Statements and Syntax: Iterations, branching, assignment statement and expression statement and exploring print method. Introduction to python Modular Programming: declaring and calling user defined methods, recursive calls and returning multiple values via return statement. Introduction to python Modular Programming-II: Understanding local and global scopes, argument passing techniques (normal arguments: matched by position, keyword arguments: matched by name, default arguments, Using * and ** during calling time and receiving time. Exploring Object- Oriented Programming In Python: Creating classes, objects, attributes. classes v/s dictionaries, constructors and idea of inheritance. Understanding and Installing PyQT4 and QT Designer Interface. Using GUI controls like push-buttons, text-boxes, radio buttons, checkboxes, labels, managing resource files, combo boxes, list boxes, menu's and sub menu's, calendar control and other controls. Understanding signal and slots, Dealing with PyQt4 event handling mechanism. Push button events, checkbox and radio button events, menu events, combo box and list box events etc.

Suggested Book(s):

1. Lutz, Mark. Learning python. " O'Reilly Media, Inc.", 2013.

2. Barry, Paul. Head first python. " O'Reilly Media, Inc.", 2010.

3.Swaroop, C. H. "A Byte of Python." Enllaç web (2013).

CS501	Cyber Security	3-0-0	3

Course Learning Outcomes:

CLO 1. Understand the Information Technology Act of India (ITA).

CLO 2. Protect themselves from various Cybercrimes.

CLO 3. Understand the various kind of vulnerabilities.

CLO 4. Defend the personal data from botnets.

CLO 5. Understand the frauds used through handheld devices such as mobile phone and PDA.

CLO 6. Importance of ACI (Authentication, Confidentiality and Integrity) in Cyber.

CLO 7. Explore the importance of IPR and apply it for entrepreneurship.

CLO 8. Discover the various cons and pros of the social media.

Syllabus:

Introduction to Cyber Crime: Definition and origins of the world, cyber crime and information security, cyber criminals, classification of cyber crimes, cybercrime and ITA. Cyber Offense: Categories of Cybercrime, How criminals plans the attack, social engineering, cyber stalking, cybercafé and cybercriminals, Botnet, cloud computing. Cloud Computing Cyber Crime: Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and wireless computing era, Security challenges posed by mobile devices, Registry setting for Mobile Devices, Authentication service security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations. Tools and Methods used in Cybercrime: Proxy Server and anonymizers, Phishing, Password cracking, Keyloggers and spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, Minor and Majore types of attacks, Dos and Dos AMittacks, SQL Injection, Buffer Overflow, Attacks on wireless network Cyber security Organizational Implications : Cost of cyber crimes and IPR issues, Web Threats for Organizations, Security and Privacy Implications from cloud computing, Social Media Marketing, Social Computing and the Associated Challenges for Organizations ,Organizational guidelines for Internet Usage, Safe Computing, Guidelines and Computer Usage Policy, Incident Handling: An essential component of cyber security, Forensic Best Practices for Organizations, Cybercrime and Cyber terrorism: Social Political, Ethical and Psychological Dimensions: Intellectual Property in the Cyberspace, The ethical dimension of cybercrime, The psychology, mindset and skills of

hackers and other cybercriminals, Ethical Hackers Cybercrime: Illustrations, examples and mini-cases: Real Life examples, mini cases

Suggested Book:

1. Singer P.W. and Friedman A., 2014, "Cyber Security and Cyber War ", First Edition, Oxford Publication.
2. Godbole N. and Belapur S., 2014, "Cyber Security", First Edition, Wiley-India
3. Singer, P. W., & Friedman, A. (2014). Cybersecurity: What everyone needs to know. oup 2nd Ed. USA.

CA127	Software Testing	4-0-0	4

Course Learning Outcomes:

CLO 1. Apply software testing knowledge and engineering methods as per industry requirements.

CLO 2. Design and conduct a software test process for a software testing project.

CLO 3. Identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods to gain employable skills.

CLO 4. Use various communication methods and skills to communicate with their teammates to conduct their practice-oriented software testing projects.

CLO 5. Apply various testing techniques on real life projects.

CLO 6. Differentiate static testing methods with dynamic testing.

CLO 7. Write test case and report the bugs at various levels.

Syllabus:

A perspective of Testing, Examples: Basic Testing Vocabulary, Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing. Examples: Generalized pseudo code, The triangle problem, Defects and identification of defects, The Multiple Roles of the Software Tester (People Relationships), Scope of Testing, Testing Constraints, Levels of Testing, The "V" Concept of Testing.Test Administration and Test Plan: Test Planning, Customization of the Test Process, Prerequisites to test planning, understand the Characteristics of the Software Being Developed, Build the Test Plan, Write the Test Plan.Testing Techniques: Structural versus Functional Technique Categories, Verification versus Validation, Static versus Dynamic Testing. Path Testing, Data Flow Testing, Boundary value analysis, Robustness testing, Worst-case testing, Special value testing, Examples, Random testing, Equivalence classes, Equivalence test cases for the triangle problem, System Testing.Test Cases: Test case Design, Building test cases, Test data mining, Test execution, Test Reporting, Defect Management, Test Coverage – Traceability matrix.Test reporting: Guidelines for writing test reports, Test Tools used to Build Test Reports. Bug reporting using Excel Sheets.Automation

Testing Basics: Basics of automation testing, Factors for choosing a particular tool, an overview for the major functional testing tools, Overview of Test management and bug tracking tools.

Suggested Books:

1. Naresh Chauhan (2016) , Software Testing Principles and Practices, Second Edition, OXFORD University Press
2. Kshirasagar Naik (2017) , Software Testing and Quality Assurance Theory and Practive, Student Edition, Wiley Publications
3. Myers, G. J., Sandler, C., & Badgett, T. (2011). The art of software testing.2nd Ed. John Wiley & Sons.

CA127A	Object Oriented Software Engineering	4-0-0	4

Course Learning Outcomes:

CLO 1. Acquire strong fundamental knowledge in science, mathematics, fundamentals of computer science, software engineering and multidisciplinary engineering to begin in practice as a software engineer.

CLO 2. Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.

CLO 3. Deliver quality software products by possessing the leadership skills as an individual or contributing to the team development and demonstrating effective and modern working strategies by applying both communication and negotiation management skill.

CLO 4. Apply new software models, techniques and technologies to bring out innovative and novelistic solutions for the growth of the society in all aspects and evolving into their continuous professional development.

CLO 5. To learn and understand various object oriented concepts along with their applicability contexts

Syllabus:

Software engineering concepts, software development life cycle, software process models, modeling with UML, project organization & communication, requirements elicitation, analysis & system design, object design & code, mapping models to code, testing, project management strategies, project estimation, project scheduling, risk management, quality management.

Suggested Books:

1. Pressman, R. S. (2015). Software engineering: a practitioner's approach. 7th Ed.Mc Grahill
2. Sommerville, I. (2011). Software Engineering, 9/E. Pearson Education India.
3. Jalote, P. (2012). An integrated approach to software engineering. 5th Ed.Springer Science & Business Media.

CA127B	Business Analytics	4-0-0	4

Course Learning Outcomes:

CLO1. TousebasicfunctionsandpackagesinPython.
CLO2. Tounderstandstatisticalconcepts, skillsanddifferenthypothesistests.
CLO3. TolearnhowtopreparedatausingPython.
CLO4. To understand statistical concepts and different hypothesis tests.
CLO5. To learn how to prepare data using Python.

Syllabus:

About data, probability theory, inferential statistics, metrics & charts, hypothesis testing, Python, data preparation using Python, working with relational database in Python, data ingestion & inspection, concatenating data, merging data.

Suggested Books:

1. Persson, M. V., & Martins, L. F. (2016). Mastering Python Data Analysis. 6th Ed. Packt Publishing Ltd.
2. Halterman, R. L. (2011). Learning to program with Python. 3rd Ed. Python Software Foundation
3. Johannes,Ledolter R,2013 Data Mining and Business Analytics, 3rd Ed. Wiley

CA133A	Software Project Management	4-0-0	4

Course LearningOutcomes:

CLO 1. Apply project management concepts and techniques to an IT project necessary for employability.

CLO 2. Identify issues that could lead to IT project success or failure.

CLO 3. Explain project management in terms of the software development process.

CLO 4. Describe the responsibilities of IT project managers.

CLO 5. Apply project management concepts through working in a group as team leader or active team member on an IT project.

Syllabus:

Importance of Software Project Management – Activities Methodologies (Initiating, Planning, Executing, Monitoring & Controlling, Closing) – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Initiating - Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning. Software process and Process Models – Choice of Process models – mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II A Parametric Productivity Model – Staffing Pattern. objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules.

Suggested Books:

1. Hughes, B. (2014). MikeCotterell “Software Project Management”. 10th Edition, Tata, McGraw Hill.
2. Ramesh, G. (2015). Managing global software projects. Tata McGraw-Hill Education.
3. Royce, W. (2015). Software project management. Pearson Education India..

YEAR III (SEMESTER VI)

CA135	Advanced Java	4-0-0	4

Course Learning Outcomes:

CLO 1. Demonstrate basic concepts of OOPs using JAVA programming language to become employable.

CLO 2. Explain collection framework and easy way to use data structure in java.

CLO 3. Define AWT package to create various components of web page.

CLO 4. Understand swing package and its various components.

CLO 5. Implement various events classes, event listener and adaptor classes.

CLO 6. Understand basic steps to perform connectivity of MySQL and Java technology as per industry requirements.

CLO 7. Create small applications that interact with database and web.

Syllabus:

Introduction to basic concepts of java. Meaning of Collection Framework, Hierarchy of Collection Framework, List Collection (Array List, Linked List & Vector). Iterable & Collection Interface ,Collection Interface Methods, Properties of List Collection, Array List v/s linked list, Array List to Vector and Vector to Linked List, Array List Traversal, Linked List Specific Methods. Deque Interface Supporting LIFO and FIFO, Set Usages (Hash Set and Tree Set), web services, database connectivity, JSP, Servlets, EJB Usage of List Iterator. Event handling: Event Delegation Model, Event Classes, Source of Event and Event Listener Interfaces, Adapter classes. AWT (Abstract Window Toolkit): AWT basics, AWT hierarchy introduction, AWT component class. Layout manager: border layout, grid layout, flow layout, Box layout. Swing: introduction, hierarchy of java swing classes, JComponents class methods, creating frame in swing, using JButton, Jlabel, JTextField, JCheckBox , JRadioButton, JComboBox, JList. AWT and swing difference. JDBC: introduction, working with MySQL database, registering the drivers, connecting to database Preparing SQL statement, retrieving data from MySQL database.

Suggested Books:

1. E.Balagurusamy,"Programming with Java", 2016, 3rd Ed., TATA McGraw-Hill Publishing.

2. David Flanagan, “Java in a Nutshell”, 2015, 4th edition,OReilly Media Publications.
3. E. Balagurusamy,” Programming with Java”, 2017, 2nd Ed., TATA McGraw-Hill Publishing.

CA136	Advanced Java Lab	0-0-4	2

Course Learning Outcomes :

CLO1: Use AWT components to create user friendly interfaces for employability.

CLO2: Understand various packages required for creating java programs.

CLO3: Use swings for creating GUI in Java.

CLO4: Apply skills of event handling to interact with the GUI components.

CLO5: Understand various collections in Java and their application.

Syllabus

Classes, objects and methods: defining a class, constructors, constructor overloading, method overloading, Introduction to arraylist as a collection in Java, Linked list in Java, concept of vector class & queues demonstrate concept of frames, demonstrate layouts in Java, implementation of choice menu, demonstrate concept of swings, database connectivity of Java with MySQL

Suggested Book(s):

1. E.Balagurusamy,"Programming with Java", 2016, 3rd Ed., TATA McGraw-Hill Publishing.
2. David Flanagan, "Java in a Nutshell", 2015, 4th edition,OReilly Media Publications.
3. E. Balagurusamy," Programming with Java", 2017, 2nd Ed., TATA McGraw-Hill Publishing.

CA157	Basics of Data Sciences	4-0-0	4

Course Learning Outcomes:

CLO 1. Obtain, clean/process, and transform data

CLO 2. Analyze and interpret data using an ethically responsible approach required for employability.

CLO 3. Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues

CLO 4. Apply computing theory, languages, and algorithms, as well as mathematical and statistical models, and the principles of optimization to appropriately formulate and use data analyses

CLO 5. Formulate and use appropriate models of data analysis to solve hidden solutions to business-related challenges

Syllabus:

Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Variables and data types in R, Data frames, solving linear algebra for data sciences. Statistical modeling, probability distributions, fitting a model, hypothesis testing Exploratory, Reading the Data, Referencing in formulas , Name Range, Logical Functions, Conditional Formatting, Advanced Validation, Dynamic Tables, Sorting and Filtering, Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA: The Data Science Process, optimization for data sciences. Predictive Modeling, linear regression, model assessment, Cross validation, performance measures.

Suggested Book:

1. Van Der Aalst, W. (2016). Process mining: data science in action 2nd Ed. Heidelberg: Springer.
2. Nelson, R., & Staggers, N. (2016). Health informatics: An Inter-professional approach. 2nd Ed.Elsevier Health Sciences.
3. Zhou, Z. H. (2021). Machine learning.1st Ed. Springer Nature..

CA138	Programming Practicum	4-0-0	4

Course Learning Outcomes:

CLO 1. Understanding the data types, operators, and control structures of C.

CLO 2. Understand the behavior, working of pointers and strings

CLO 3. Understand the various concepts of OOPS and its benefits

CLO 4. Decide when to use static, constant and normal objects

CLO 5. Utilize the full strength of static polymorphism using function and operator overloading.

CLO 6. Gain skills to apply different various type conversions and dynamic memory allocation

CLO 7. Implement runtime polymorphism in different scenarios and inheritance

CLO 8. Improve skills to search and sort data using algorithms.

Syllabus:

OOPS Fundamentals: Benefits of OOPS and its features. Concept of classes: defining class, defining methods, defining objects and pointer to objects. Constructor, destructor, inline methods, accessing methods, constant object and methods and this pointer. Member objects & Static Members: Member objects, member initializers, constant member object, static data members, accessing static data members. Operator Overloading: Generals, operator functions, friend function, friend classes, operator overloading, Type Conversion & Dynamic Memory Allocation: Conversion constructors, conversion functions, ambiguity of type conversions. The new and delete operator, dynamic allocation for classes and arrays. Polymorphism & Inheritance: Concept of polymorphism, virtual methods, destroying dynamically allocated objects, virtual method table and dynamic cast. Benefits of inheritance, single, multiple and multilevel inheritance. OOPS & Data Structures-I: Types of Data Structures, Understanding time and space complexity, searching and sorting algorithms (bubble sort, selection sort, insertion sort, linear search and binary search). OOPS & Data Structures-II: Singular linked list implementation, doubly linked list implementation, stack implementation, linked list implementation of stack, infix to postfix implementation using stack, infix to prefix implementation using stack, linear Queue

implementation. OOPS & Data Structures-III: Tree & Its Operations Tree data structure and its operations. Graph theory and its basic operations.

Suggested Book:

1. Lynch, D.E. and Yeigh, T., 2013. Teacher Education in Australia: Investigations into Programming, Practicum and Partnership. 2nd Ed., Lulu Publisher.
2. K. R. Venugopal, and N. Chandrakant, C: Test Your Aptitude, 2015, 3rd Ed., McGraw Hills Education.
3. Adam Drozdek, Data Structures & Algorithms Using C++, 2016, 4th Ed., Course Technology.

CA140	Logical Reasoning	0-0-4	2

Course Learning Outcomes:

CLO 1. To improve skills required for the Aptitude test and develop an all-around personality with a mature outlook.

CLO 2. To enhance their logical thinking, verbal reasoning and numerical reasoning.

CLO 3. To take part effectively and confidently not only in campus placements programs but also in other exams like CAT, GMAT, SSC, Bank Po, UPSC etc.

Syllabus:

Calculation, Number System , Simplification, Surds & Indices, Square & Square roots, Formula Based Problems, HCF & LCM, Percentages, Averages, Ratio & Proportion, Allegation, Profit & Loss & Discount, Simple & Compound Interest & Installment, Partnership, Set Theory, Venn Diagrams, Time & Distances, Trains, Boats& Streams, Races & Game Skills, Time & Work, Pipes & Cisterns, Chain Rule, Geometry, Menstruation-Area, Perimeter, Surface Area & Volume , Permutation & Combination, Probability, Sequence & Series, Equation Linear, Quadratic Equation, Trigonometry, Logarithm Data Interpretation Data Tabulation -1 &2, Pie Charts -1&2, Bar Graph – 1 &2, Line Graph – 1& 2, Data Sufficiency Reasoning Aptitude Number Series, Alphabet Series, Inserting of Missing Character, Number Sequence, Alpha Numeric Sequence, Time Sequence, Ranking Sequence, Arithmetical Reasoning, Quantitative Analysis, Problem on Ages, Clocks, Calendars, Cube Cutting, Cubes & Dices, Coding – Decoding, Sense of Direction, Blood Relations, Puzzles 1: Classification, Puzzles 2: Sitting Arrangement –Linear , Circular, Puzzles 3: Comparison, Puzzles 4: Sequential Order of Things, Puzzles 5: Condition & Grouping, Puzzles 6: Family Relations, Mathematical Operations & Symbol Notations, Syllogisms, Odd man out, Visual reasoning, membership

Suggested Book:

1. R.S Agrawal, Quantitative Aptitude for Competitive Examinations - Quantitative Aptitude.
2. Allwein, G., & Barwise, J. (Eds.). (2016). Logical reasoning with diagrams. 2nd Ed., Oxford University Press.
3. Dowden, B. H. (2019). Logical reasoning. 4th Ed., Sacramento eCA CA: California State University Sacramento.

CA139	Basics of Cloud & IoT	4-0-0	4

Course Learning Outcomes:

CLO 1. Develop and deploy cloud application using popular cloud platforms.

CLO 2. Write comprehensive case studies analyzing and contrasting different cloud computing solutions.

CLO 3. Compare, contrast, and evaluate the key trade-offs between multiple approaches to cloud system design, and Identify appropriate design choices when solving real-world cloud computing problems.

CLO 4. Design the compatible cloud models for different applications.

CLO 5. Aware about IOT application areas and platform to become employable.

CLO 6. Integration cloud with IOT as per industry requirements.

CLO 7. Security requirements for IOT applications.

Syllabus:

Cloud Computing Overview, Cloud Computing History & Evolution, Components of Cloud Computing, Types of cloud – SAAS, PAAS, IAAS, Requirements of Cloud Computing.Benefits & disadvantages of Cloud Computing, Cloud computing types: Deployment Models, Service Models: Understanding services and applications by type.Framework: The NIST Model, Cloud Cube Model, Capacity Planning: Defining baseline and metrics, Load testing, Network capacity, Scaling.Understanding Virtualization: Virtualization Technologies, Load balancing and Virtualization, Understanding Hypervisors, Security Concerns related to cloud, Securing cloud: Security mapping, securing data, Encryption.Using the mobile cloud: connecting to the cloud, Feature phones and the cloud, using smart phones with the cloud.Introduction to Internet of Things: Definition & Characteristics of IOT, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, Domain Specific IOTs: Home Automation, Environment, Cities, Energy, Retail, Agriculture, Logistics, Industry, Health & Lifestyle.IOT Platforms Design Methodology: Introduction, IOT Design Methodology steps, Case study on IOT system for Weather monitoring.IOT physical devices and Endpoints: Basic building blocks of an IOT device, Raspberry Pi, Raspberry Pi interfaces, About the board, Internet of Things Security: Introduction, Overview of Governance, Privacy and Security Issues.

Suggested Books:

1. Arshdeep Bahga and VijayMadisetti, "Internet of Things: A Hands-on Approach", 1st Ed., 2017, Universities Press.
2. Oliver Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", 1st Ed., 2016, Wiley Edition
3. Lakhwani, K., Gianey, H. K., Wireko, J. K., & Hiran, K. K. (2017). Internet of Things (IoT): Principles, paradigms and applications of IoT. 5th Ed. Bpb Publications.

CA139A	Introduction to Internet of Things	4-0-0	4

Course Learning Outcomes:

CLO 1. Students would know the architectural overview of the IoT applications.

CLO 2. Possess an ability and skill to design and develop hardware infrastructure of IoT application.

CLO 3. They would be able to apply communication protocols for IoT application development.

CLO 4. Possess an ability to push the data onto the cloud services.

CLO 5. They would be able to analyze the sensor data and take necessary action associated with it.

Syllabus:

Introduction to Internet of Things (IoT), components of IoT, acquiring data, sensing and actuation, sensor networks, machine-to-machine communication, utilizing data, implementing IoT, IoT analytics, case studies.

Suggested Books:

4. Arshdeep Bahga and VijayMadisetti, "Internet of Things: A Hands-on Approach", 1st Ed., 2017, Universities Press.
5. Oliver Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", 1st Ed., 2016, Wiley Edition
6. Lakhwani, K., Gianey, H. K., Wireko, J. K., & Hiran, K. K. (2017). Internet of Things (IoT): Principles, paradigms and applications of IoT. 5th Ed. Bpb Publications.

CA139B	Dynamic Programming	4-0-0	4

Course Learning Outcomes:

CLO 1. Analyze the asymptotic performance of algorithms.

CLO 2. Write rigorous correctness proofs for algorithms.

CLO 3. Demonstrate a familiarity with major algorithms and data structures.

CLO 4. Apply important algorithmic design paradigms and methods of analysis.

CLO 5. Synthesize efficient algorithm skills in common engineering design situations.

Syllabus:

Introduction to dynamic programming, optimal substructure & overlapping sub problems, Fibonacci numbers, coin change problem, binomial coefficient problem, tiling problem, longest common subsequence, 0-1 knapsack, word break problem, egg dropping puzzle, painting fence algorithm, dynamic programming on trees.

Suggested Books:

1. Lew, A., & Mauch, H. (2016). Dynamic programming: A computational tool.2nd Ed. Springer
2. Springer. Powell, W. B. (2017). Approximate Dynamic Programming: Solving the curses of dimensionality 2nd Ed.. John Wiley & Sons.
3. Bertsekas, D. (2014). Dynamic programming and optimal control: Volume I Athena scientific.

REGISTRATION FOR NEXT SEMESTER

8.1 All students are eligible to register for next semester irrespective of number of backlogs unless a criterion is specified for any particular course.

8.2 A student is not permitted to register in a term if:

(i) He / She has dues outstanding to the University, hostel, or any recognized authority or body of the University,

(ii) His / Her grade sheet in the preceding term is withheld, or

(iii) He / She has been specifically debarred or asked to stay away from that term

8.3 Late registration may be granted in case a student fails to register on the stipulated date. Students failing to register on the specified day of registration will be allowed to register only after permission from Dean of School and after paying the stipulated late fee. Any student who fails to register will not be allowed to attend classes.

8.4 The registration of the student may be cancelled, if at the later stage, it is found that the student is not eligible for registration due to following reasons:

(i) If the registration of a student in a course is not found to be in accordance with the regulations, his/her registration in that course will be cancelled and the grade obtained, if any, will not be considered for final award.

(ii) The registration of a student in a course or complete set of Courses in a term can be cancelled by the concerned authority when he/she is found guilty in cases of unfair means, breach of discipline, etc. or when he/she persistently and deliberately does not pay his/her dues.

(iii) Absence for a period of four or more weeks at a stretch during a term shall result in automatic cancellation of the registration of a student from all the courses in that term.

8.5 A student who is duly registered in a term is considered to be on the rolls of the university. After registration, if he withdraws from the term, or has been given prior permission to temporarily withdraw from the University for the term, or has been asked to stay away by an appropriate authority of the University will be considered to be on the rolls of the University for that term. While such a student retains the nominal advantage of being on the rolls of the University; the loss of time from studies and its consequences cannot be helped by the University.

8.6 If for any valid reason a student is unable to register in a term, he must seek prior permission of Dean of School to drop the term. If such permission has not been requested or after a request the permission has been denied, his/her name would be struck off the rolls of the University and he/she would no longer be a student of the University. His / Her case will be automatically processed and the file will be closed. However, if such a student, after his name has been struck off the rolls of the University, is permitted to come back, his case can be considered at the sole discretion of the competent authority of the University with the provision that all his previous records as a former student are revived under the current academic and administrative structure, regulations and schedule of fees.

9 PEDAGOGICAL ASPECTS

The structural layout of the program and its courses requires that each course be divided in lecture, tutorial and practical sessions. Duration of each session as given in the column against the course in the course scheme is 55 minutes.

Lecture sessions: Lectures are delivered by traditional – chalk board method, supplemented by modern Information Communication technology (ICT) methods and using all pedagogical tools. The students are encouraged to ask questions and involve in group discussion to the extent allowed by the teacher. In some subjects where case study based methodology is adopted, the lectures are supplemented by discussions on case studies.

Tutorial Sessions: The tutorial sessions are small groups of students interacting with the teacher, solving application oriented analytical problems. The tutorial sessions are very interactive and inculcate problem solving skills in the students.

Lab / Practical Sessions: During lab / practical sessions, the students work on prescribed list of experiments and do what they have learnt in the Lecture / Tutorial sessions.

Integrated Projects: In each semester, the students identify their team mates (at the most 4 in each team) and work on a unique integrated project allotted to them by faculty / group of faculty members. The projects are allotted to them either at the start of each semester or at a later stage (but not later than Sessional test I) in the semester. Integrated projects are designed by the faculty keeping in mind the courses the students have studied so far and are currently studying. Thus, the

project statements are made such a way that the students while working on these projects apply the concepts learned so far and the deliverables are multi-faceted. The students work on the Integrated Project during their lab hours.

10 ASSESSMENT AND EVALUATION

In case of theoretical courses/subjects, the evaluations will be based on teacher assessment, quizzes, sessional tests and end term examinations.

In case of the practical subjects (Laboratory/workshops/field works), the evaluation will be based on continuous assessments and end term exams/viva.

The evaluation of the project work/training will be based on the seminars, projects reports and end term viva by the expert committee.

Examinations

To assess the students attainments in the subjects (Theory, Laboratory, sessionals), Seminars, project work etc., the system of continuous assessment is adopted by the University. In conformity to this, there will be sessional exams, quizzes, assignments, seminars and End term exams, in addition to the other continuous evaluation components.

A student may be debarred from appearing in the end term examinations for following reasons:

(a) Disciplinary action taken against him/her.

(b) Attendance criteria are not fulfilled.

In case any debarred student appears in the examinations by default, , his/her results will be treated as null and void.

The evaluation will be continuous and the weightage of various components are as given in Table 1 (For Theory courses) and in Table 2 (for Practical Courses).

Table-1: Evaluation components for Theory Courses

Components	Weightage
Internal Evaluation Component (IEC) (Test/Assignments/MCQ/Open Book Test/Case Study)	20%
Sessional Tests (STs)	30%
End Term Examination	50%
Total	**100%**

There are three Sessional Tests (STs) for all theory papers and the average of best two is considered. The End Term examination for practical courses includes conduct of experiment and an oral examination (viva voce).

Table--2: Evaluation Components for Practical Courses

Components	Weightage
Lab Performance / File work	40%
Internal Viva – Voce	20%
End Term	40%
Total	**100%**

The medium of examination is English.

11 LETTER AWARD GRADING SCHEME

11.1 The list of letter and non-letter grades, their applicability and connotation are given below:

(a) Letter Grades

% Marks Range of Total	Grade	Qualitative Meaning	Grade Point
80 – 100	O	Outstanding	10
70 – 79	A+	Excellent	9
60 – 69	A	Very Good	8
55 – 59	B+	Good	7
50 – 54	B	Above Average	6
45 – 49	C	Average	5
40 – 44	P	Pass	4
0 – 39	F	Fail	0
	Ab	Absent	

(b) Non-letter Grades:

Noncredit courses will be graded as Excellent, Good, Fair or Poor.

11.2 The Grade I (Incomplete) may be awarded in the following conditions:

(i) Where a case of unfair means is pending, a 'Grade I' is awarded till the case is finalized

(ii) Where a case of indiscipline is pending, a 'Grade I' is awarded till the case is finalized

(iii) In cases of unfair means and indiscipline where the results for a particular examination are declared null and void

(iv) In cases, where the student does not complete his course work because of some reason viz, shortage of attendance / is absent in the end term examination.

11.3 The Cumulative Grade Point Average (CGPA) denotes the overall performance of a student in all courses in which he/she is awarded letter grades. It is the weighted average of the grade points of all the letter grades received by the student from the time since his entry into the University.

Calculation of CGPA:

The CGPA (calculated on a 10 point scale) would be used to describe the overall performance of a student (from of admission till the point of reckoning) in all courses for which LETTER GRADES will be awarded. SGPA will indicate the performance of student for any particular semester. Formulas for calculation of SGPA and CGPA have been provided as below:

$$\text{SGPA}_i = \frac{\sum_{j=i}^{n} C_{ij} G_j}{\sum_{j=1}^{n} C_{ij}} \qquad \text{CGPA} = \frac{\sum_{i=I}^{N} SGPA_i * \sum_{j=i}^{n} C_{ij}}{\sum_{i=I}^{N} \left(\sum_{j=I}^{n} C_{ij} \right)}$$

Where n = number of subjects in the semester; N = number of semesters; $SGPA_i$ = SGPA for the i^{th} Semester; C_{ij} = number of credits for the j^{th} course in i^{th} semester; and G_j = Grade point corresponding to the grade obtained in the j^{th} course.

Example to Understand the Calculation of SGPA

Suppose a student is registered in four courses 'W', 'X', 'Y' and 'Z' in a particular semester as mentioned below in the Column - I of the table. Column - II in the table below depicts the number of credits, which those courses carried. At the end of the semester, student was awarded with the grades as mentioned in Column – III in the table given below. Column – IV indicates the

corresponding grade weight. Column – V and Column – VI indicate essentially the Credit value and Grade Points for every course completed by a student in that particular semester.

Courses in which student registered (Col. I)	Credits (Col. II)	Letter Grade (Col. III)	Grade Value (Col. IV)	Credit Value (Col. V)	Grade Points (Col. VI)
Course W	3	B	6	3 x 6	18
Course X	3	A	8	3 x 8	24
Course Y	3	O	10	3 x 10	30
Course Z	2	O	10	2 x 10	20
Total	**11**			**Total**	**92**

Thus, the total SGPA of the student would be =

$$SGPA = \frac{Total\ grade\ pts.}{Total\ no.of\ credits} = \frac{92}{11} = 8.36$$

Suppose the SGPA of the student in two successive terms is 7.0 and 8.0 with respective course credits being 12 and 11, then the

$$CGPA = \frac{7 \times 12 + 8 \times 11}{12 + 11} = \frac{84 + 88}{23} = 7.48$$

12 PROMOTION RULES

Any bonafide student, who appears for the examination conducted by the University, shall be promoted to the next higher semester and shall carry forward all course(s) / subject(s) in which he/she is declared fail. The student shall have to pass all papers within stipulated maximum duration as prescribed by the University to qualify for the award of degree. Further, any specific condition stipulated for a particular course, by the concerned regulatory body, shall be enforced.

13 ELIGIBILITY TO AWARD THE DEGREE

13.1 A student is deemed to have fulfilled the requirement of graduation for a degree (single or dual degree) or a higher level degree when he has:

(i) Cleared all Courses prescribed for the program.

(ii) Earned the minimum credits required for the program as described in the Academic Programme Guide.

(iii) Obtained the minimum CGPA of 4.5 for the award of degree in UG programs; and satisfied all requirements of these regulations.

Minimum credits to be earned for award of degree in BCA

Course / Year	Bachelor of Computer Applications (For Semester Track)	For Co-op Track
Year I	48	48
Year II	50	50
Year III	44	44
Total	**142**	**142**

13.2 A student is deemed to have become eligible for the degree if:

He/shesatisfy all rules of evaluation.However, in case of a student having outstanding dues against him to be paid to the University, Hostel or any other recognized organ of the University, His degree will be withheld until the said dues are cleared.

13.3 Under extreme exceptional circumstances where gross violation of graduation is detected at later stage the Academic Council may recommend to the Governing Body, the recall of a degree already awarded.

Appendix: A Mapping of CLO with PO

Course Code	Course Name	CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CA101	Introduction to Information Technology	**CLO 1.** Understand the computing basics, network applications, human computer interactions. Evaluate the fundamentals of computers, IT and the various related technologies to enhance IT related skills.	H	H		M	H		M	H		H
		CLO 2. Appreciate the benefits of different number systems and be able to perform appropriate computations on different number systems as well as able to understand computer codes.		M	H	M		M	H		H	M
		CLO 3. Enhance calculation skills using binary arithmetic. Evaluate the Boolean expressions and reduce those to simplified forms.	M	H	M		M	M	M	H		H

		CLO 4. Learn Skills of designing digital circuits using the logic gates. Comprehend the need, benefits and functions of operating systems in computers.		M	M	H		H			H	H
		CLO 5. Realize the significance of open source movement and the various licenses available under open source paradigm. To understand basic concepts of Microprocessors.	H	M			H		H	M		
CA104	PC Assembly and Troubleshooting Lab	**CLO 1.** Identify the main components for the PC to enable new startup.		H		H	H	H		M	M	
		CLO 2. Learn about power supplies and the skills to trouble-shoot various power-related problems.	M	H	M				M			H
		CLO 3. Have an idea about the processor generations used in PCs starting from the first Intel generations to current CPU families.		H	M		H		M		M	H

		CLO 4. Familiarize themselves with PC memories such as RAM and ROM devices. This includes RAM types, RAM upgrading, ROM BIOS, and the CMOS chip.	M	H		H		H		H	H	
		CLO 5. Know about motherboards and the various technologies connected to main boards such as Chipsets, Buses, and various BIOS types. Terms such as PCI, ISA, AGP, MCA, POST, Bootstrap loader, IDE controllers, Regulators, Heat sinks, and others will be familiar to the students to become entrepreneurs.		M	H	M		M	H		H	M
CA146	Web Technologies I	**CLO 1.** Understand the paradigms and objects used in web development process.	M	H	M		M	M	M	H		H

		CLO 2. Differentiate between client and server side programming		M	M	H		H			H	H
		CLO 3. Apply the HTML and CSS concepts to create and design webpages and enhance web designing skills.	H	M			H		H	M		
		CLO 4. Understand the principles of creating an effective web page that confirm to web standards by employing cascading style sheets.		H		H	H	H		M	M	
		CLO 5. Apply Critical thinking and problem solving skills required to successfully design and implement a website.	M	H	M				M			H
CA147	Programming with C-I	CLO1. Develop the logic by understanding the semantics and syntax of C to enhance employability		H	M		H		M		M	H
		CLO2. Use break, continue and go to in looping constructs.	H	H		M	H		M	H		H

		CLO3.Manipulate tabular data (i.e. Arrays)		M	H	M		M	H		H	M
		CLO4. Use the user defined data types (structures and unions).	M	H	M		M	M	M	H		H
		CLO5. Able to write C programs, increasing coding skills to gain employability.		M	M	H		H			H	H
ES148	Programming with C-I Lab	CLO1. Develop the logic by understanding the semantics and syntax of C to enhance employability	H	M			H		H	M		
		CLO2. Use break, continue and go to in looping constructs.		H		H	H	H		M	M	
		CLO3.Manipulate tabular data (i.e. Arrays)	M	H	M				M			H

		CLO4. Use the user defined data types (structures and unions).		H	M		H		M		M	H
		CLO5. Able to write C programs, increasing coding skills to gain employability.	M	H		H		H		H	H	
EL101	Functional English	**CLO01:** To develop confidence to respond in English during situation where the use of English is imperative		M	H	M		M	H		H	M
		CLO02: To develop fluency in actual conversation in the English language and give students the confidence to talk efficiently and effortlessly in English.	M	H	M		M	M	M	H		H
		CLO03 : To develop the speech skills necessary for confident and intelligent participation in group discussion		M	M	H		H			H	H

		CLO04: To make formal and extempore speeches and presentations in English. Students will be able to increase efficiency in communication using it as an essential tool in influencing clients and effectively disseminating ideas.	H	M			H		H	M		
		CLO05: To develop the skills related to teamwork and to take up team leader roles in society as well as in future workplace.		H		H	H	H		M	M	
		CLO06: Learn comprehension skills including comprehension of the grammar, writing, speaking, listening, & reading parts of the English Language	M	H	M				M			H
AM111	Foundations of Algebra and Calculus	**CLO1:** Construct and analyze the graphs of trigonometry functions and will apply the concepts of trigonometry to any angle in a rectangular co-ordinate plane.		H	M		H		M		M	H

		CLO2: Describe how circle, parabola, ellipse and hyperbola form the sections of cone and drive the standard equations of conics.	M	H		H		H		H	H	
		CLO3: Understand the respective application areas such as maxima-minima and area of a plane region through an overview of differentiation and integration respectively.		M	H	M		M	H		H	M
		CLO4: Understand the Mathematical concepts and their applications in computational problems using the acquired board based knowledge to enhance calculation skills.	M	H	M		M	M	M	H		H
CA142	Networking Fundamentals	CLO 7. Describe and analyses the hardware, software, components of a network and the interrelations required for employability.		H		H	H	H		M	M	

		CLO 8. Explain networking protocols and their hierarchical relationship hardware and software. Compare protocol models and select appropriate protocols for a particular design.	M	H	M				M			H
		CLO 9. Manage multiple operating systems, systems software, network services and security. Evaluate and compare systems software and emerging industry technologies.		H	M		H		M		M	H
		CLO 10. Explain concepts and theories of networking and apply them to various situations, classifying networks, analyzing performance and implementing new technologies.		H	M		H		M		M	H

		CLO 11. Identify infrastructure components and the roles they serve, and design infrastructure including devices, topologies, protocols, systems software, management and security. Analyze performance of enterprise network systems.	M			H				H		M
		CLO 12. Effectively communicate technical information verbally, in writing, and in presentations to improve employability.	M	H		H		H		H	H	
CA143	Networking Fundamentals Lab	CLO1: Identify the role of network devices.		H		H	H	H		M	M	

		CLO2: Construct straight through cable, cross cable and roll over cable	M	H	M				M			H
		CLO3: Learn skill to employ IP addressing and understand the concept of subnetting		H	M		H		M		M	H
		CLO4: Establish a peer to peer network and confirm the communication between the devices using ping command		H	M		H		M		M	H
		CLO5: Establish small network topologies using simulator	M			H				H		M

		CLO6: Connect two or more different networks.	M	H				H		H	H	
CA155	Programming with C-II	**CLO 1.** Develop the logic by understanding the semantics and syntax of C to enhance employability.	M			H				H		M
		CLO 2. Use break, continue and go to in looping constructs.	M	H				H		H	H	
		CLO 3. Manipulate tabular data (i.e. Arrays)		H	M				M		M	H

		CLO 4. Use the user defined data types (structures and unions).		H					H	H		
		CLO 5. Modularize their complex problems using derived and user defined data types (data structures).		H	M		H		M		M	H
		CLO 6. Able to write C programs, increasing coding skills to gain employability.		H						H	H	
CA159	Computer System Architecture	**CLO 1.** Design trade-offs Basic fundamentals in digital logic & structure of a digital computer.	M			H	M					H

		CLO 2. Identify performance issues in processor and memory design of a digital computer.		H						H	H	
		CLO 3. To Develop independent learning skills and be able to learn more about different computer architectures and hardware.		M			M					H
		CLO 4. To articulate design issues in the development of Multiprocessor organization & architecture.	H		M					M	H	
CA161	Web Technologies II	**CLO 1.** Develop familiarity with the JavaScript language.		M	H	M		M	H		H	M

		CLO 2. Learn to use best-practice idioms and patterns.	M	H	M				M	H		H
		CLO 3. Understand and implement how to deal with various DOM elements to enhance web development skills.		M		H		H			H	H
		CLO 4. Understand concepts commonly used in dynamic language programming, such as introspection, higher-order functions, and closures.	H	M			H		H	M		
		CLO 5. Understand advanced language features such as prototypical inheritance.		H			H	H		M	M	

		CLO 6. Become adept at implementing client-side interfaces through the use of the DOM, jQuery and AJAX**.**		H	M				M			H
ES101	Environmental Sciences	**CLO 1.** Describe about all the natural resources, various ecosystems and energy resources, environmental pollution, waste management, biodiversity and human population.			M			M			H	
		CLO 2. Design, identify and analyze both natural (disasters such as floods and earthquakes) and man-made (industrial pollution and global warming) environmental problems.		M			H				M	

		CLO 3. Analyze the societal and environmental impacts of energy with respect to meet the growing energy needs for sustainable growth.	H								H	
		CLO 4. Apply the above knowledge, as an activity to do various Case studies, required to understand the interrelationships of the natural world.					H					
		CLO 5. Understand the real world issues to improve skills related to pollution.	H		M					M		H

AM108	Basics of Statistical Mathematics	**CLO 1.** Possess an ability to solve the problems of data interpretation using measures of central tendency, measures of Variation and concepts of correlation and regression.	M	H	M				M			H
		CLO 2. Introduce and form matrices for present mathematical solutions in a concise and informative manner. Use matrices to solve the problems of system of linear equations and solve various live problems using matrices.		M		H		H			H	H
		CLO 3. To analyze and correlate many real life problems mathematically and thus find the appropriate solution for them using theory of probability.	H	M			H		H	M		

		CLO 4. To improve skills on calculating standard measures such as mean , median mode		H			H	H		M	M	
		CLO 5. Able to gain skills to correlate Programming with Mathematics		H	M				M			H
CA112	Software Engineering	**CLO 1.** How to apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment.		M	H	M		M	H		H	M
		CLO 2. To develop skills in one or more significant application domains.	M	H	M		M	M	M	H		H
		CLO 3. Work as an individual and as part of a multidisciplinary team to develop and deliver quality software.		M	M	H		H			H	H

		CLO 4. Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle.	H	M			H		H	M		
		CLO 5. Demonstrate the skill to use the techniques and tools necessary for engineering practice		H		H	H	H		M	M	
CA113	Fundamentals of Object Oriented Programming	**CLO 1.** Develop the logic by understanding the semantics and syntax of C++	M	H	M				M			H
		CLO 2. Modularize their complex problems using derived and user defined data types (data structures).		H	M		H		M		M	H
		CLO 3. Declare constructor to initialize variables.	H	H		M	H		M	H		H
		CLO 4. Understand the concept of reusability of a code using inheritance and improve employability skills.		M	H	M		M	H		H	M
		CLO 5. Use the overloading of functions and operators in program domain.	M	H	M		M	M	M	H		H

		CLO 6. To be able to convert a real life problem in C++ code and enhance employability probability.		M	M	H		H			H	H
CA115	Relational Database Management System	**CLO 1.** Understand the concept of Relational models, architecture for DBMS, EF Codd's rules, normalization, managing concurrent transactions, recovery and security of database.	H	H		M	H		M	H		H
		CLO 2. Implement ER model to identify the entities and attributes involved in the database to improve employability chances.		M	H	M		M	H		H	M
		CLO 3. Implement normalization to have a non-redundant anomaly free database to improve employability.	M	H	M		M	M	M	H		H
		CLO 4. Develop a normalized and secured database having backup (Implementation of the recovery techniques) and enhance employability.		M	M	H		H			H	H

		CLO 5. Analyze the difference between RDBMS and other database storing techniques.	H	M			H		H	M		
CA162	Web Technologies III	**CLO 1.** Understand the purpose of client side scripting.	H	H			H			H		H
		CLO 2. Decide when to use offline and hosted jQuery and DOM.		M	H	M			H		H	M
		CLO 3. Utilize the full strength of jQuery using chaining.	M	H			M	M		H		H
		CLO 4. Implement different filters on wrapper set will be achievable by the students.	M		H				M			
		CLO 5. Explore core jQuery features which would help in designing GUI to enhance web development skills.	H				H					H
		CLO 6. Apply event routines and regular expressions to execute complex queries.		M				H				
CL203	Business English	**CLO 1.** Apply business communication strategies and principles to prepare effective communication for domestic and international business situations.		M					M			

		CLO 2. Identify ethical, legal, cultural, and global issues affecting business communication and deliver an effective oral business presentation.	H				H			H		
		CLO 3. Utilize analytical and problem solving skills appropriate to business communication.		M								M
		CLO 4. Participate in team activities that lead to the development of collaborative work skills					M					M
		CLO 5. Select appropriate organizational formats and channels used in developing and presenting business messages	H					M				
		CLO 6. Compose and revise accurate business documents using computer technology and communicate via electronic mail, Internet, and other technologies			M				H	H		
AM109	Discrete Mathematics	**CLO 1.** To investigate and solve a variety of live problems related to sets, Relations and Functions.	H	H		M	H		M	H		H

		CLO 2. To understand and apply the theory and techniques of Lattice, Logic and Boolean algebra		M	H	M		M	H		H	M
		CLO 3. To gain skills related to Graph Theory and its relevance within the context of computer science and	M	H	M		M	M	M	H		H
		CLO 4. Enhance skills to findg solutions of live problems related to shortest path etc.		M	M	H		H			H	H
		CLO 5. Gain skills to solve real life problems using combinatory.	H	M			H		H	M		
HR101	Human Values & Professional Ethics	**CLO 1.** Understand basic concepts of human values and value education.	M	H	M				M			H
		CLO 1. Understand importance of personal development and creation of a positive personality.		H	M		H		M		M	H

		CLO 2. Understand importance of value education towards national and global development.	M	H		H		H		H	H	
		CLO 3. Identify constitutional or national values, social, professional, religious and aesthetic values.		M	M	H		H			H	H
		CLO 4. Understand about national Integration and international cooperation necessary employability	H	M			H		H	M		
		CLO 5. Acquire basic working knowledge of human rights and institutions engaged in protection of these rights.		H		H	H	H		M	M	
		CLO 6. Understand basic concepts of human values and value education.	M	H	M				M			H

CA121	Data Structures	**CLO 1.** Define basic static and dynamic data structures and relevant standard algorithms for them: arrays, stack, queue, dynamically linked lists, trees.		M	H	M		M	H		H	M
		CLO 2. Handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures	M	H	M		M	M	M	H		H
		CLO 3. Select basic data structures and algorithms for autonomous realization of simple programs or program parts required to work in industry.		M	M	H		H			H	H
		CLO 4. Know the importance of memory management through dynamic memory allocation and make use of memory efficient data structure like linked list.		M	M	H		H			H	H

		CLO 5. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.	H	H		M	H		M	H		H
		CLO 6. Ability to sensibly select appropriate data structures and algorithms for problems enhance employability.		M	H	M		M	H		H	M
CA117	Web programming Using PHP	**CLO 1.** Understand how server-side programming works on the web. PHP Basic syntax for variable types and calculations. Creating conditional structure. Storing data into various types of arrays.	M	H	M		M	M	M	H		H
		CLO 2. Using PHP built in function and creating custom functions Understanding Global variables in form submission.		M	M	H		H			H	H
		CLO 3. How to receive and process form submission data. Reading and writing cookies	H	M			H		H	M		

		CLO 4. Manage state of web application using session management. Creating a database in phpMyAdmin. Reading and process data in MySQL database		H		H	H	H		M	M	
		CLO 5. Be able to develop websites and can work on live projects essential for entrepreneurship	M	H	M				M			H
CA125	Introduction to Java Programming	**CLO 1.** Create Java applications that leverage the object- oriented features of the java language, such as encapsulation, inheritance and polymorphism	M	H	M				M			H
		CLO 2. Enable the students to understand about interface and its uses to achieve the multiple inheritances.		H	M		H		M		M	H
		CLO 3. Create user exception and handle using exception handling techniques required for industry employability.		H	M		H		M		M	H
		CLO 4. Create an applet which can be executed on web browser through which student can gain insight of interactive web development.	M	H		H		H		H	H	

		CLO 5. Enable the student to understand the concept of window based programming by making use of AWT components.		M	H	M		M	H		H	M
CA119	Operating System Concepts	**CLO 1.** Student should be able to identify the different types of Operating System and their components.	M	H	M		M	M	M	H		H
		CLO 2. Design and implementation of new system calls and gain skills to work in open source operating system.		M	M	H		H			H	H
		CLO 3. Implementation of existing resource management algorithms in Linux operating system .		H		H	H	H		M	M	
		CLO 4. To identify various system security and protection issues and gain necessary skills.	M	H	M				M			H
		CLO 5. To completely administer the system using various Operating systems (Windows and Ubuntu) for managing its resources.		H	M		H		M		M	H
CL206	Soft Skills	**CLO 1.** Personality Development training		M			M					

		CLO 2. Enabling to interact efficiently and eff ectively		H						M		
		CLO 3. Acquire career skills and fully pursue to partake in a successful career path				H						
		CLO 4. Enabling students to develop a cooperative mindset							H			
		CLO 5. Prepare good resume, prepare for interviews and towards working in teams	H		M							H
		CLO 6. Explore desired career opportunities in the employment market in consideration of individual interest.						M				M