DATTA MEGHE INSTITUTE OF MEDICAL SCIENCES

(DEEMED TO BE UNIVERSITY)

SAWANGI (MEGHE), WARDHA

SCHOOL OF ALLIED SCIENCES

FACULTY OF SCIENCE & TECHNOLOGY

COURSE CURRICULUM FOR

BACHELOR OF COMPUTER APPLICATION

B.C.A.

UNDER

FACULTY OF SCIENCE & TECHNOLOGY

Year of Revision -2022

Implemented W.E.F. AY 2022-23

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1. PREAMBLE

DattaMeghe Institute of medical sciences undertakes important measures to enhance academic standards and quality in education including innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters. The university formulates various regulations and guidelines from time to time to improve the education system and maintain minimum standards and quality.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students.

DATTA MEGHE INSTITUTE OF MEDICAL SCIENCES - VISION AND MISSION:

Vision:

To emerge as the Global Centre of excellence in the best evidence based higher education encompassing a quality centric, innovative and interdisciplinary approach, generating regulative research and offering effective and affordable health care for the benefit of the mankind.

Mission:

DMIMS shall develop competent, confident, concerned, compassionate globally relevant professionals by quality, learner, community and evidence centric ‘competency-based model’ of higher education with value orientation, through all its constituent units. It shall foster a conducive milieu for interdisciplinary research practices generating consequential and meaningful outcomes for the nation in general and the region in particular. It shall deliver comprehensive quality health care services to the rural, needy, marginalized and underprivileged populace. This shall be achieved through appropriate collaborative linkages and a proactive, transparent and accountable decentralized governance system.

About School of Allied Sciences:

VISION, MISSION AND VALUES

Building a professional workforce of allied research experts. Not only for the current jobs but also for the tasks proposed to be generated in times to come, to invoke the required talents, logical reasoning, out of box thought.

THE MISSION OF OURS:

Meeting the needs of lifelong learning by providing learners of all ages with high-quality, affordable, creative and sensitive education and training services, drawing on the strengths of and working with the resources of the university and the community.

VALUES OF OURS:

- Providing superb service
- Promoting a working and learning atmosphere that is respectful
- Engaging alliances for outreach and partnerships and giving back to the community
- Providing a range of state, national and international quality programmes and services
- Bringing together the university, continuing education, and our culture
- Opening inclusive, open and protected routes for all students
- Growing Creative Chances
- Responsibly managing capital.

2. ABOUT THE COURSE

BCA is an acronym for Bachelor of Computer Application. The three-year regular BCA is designed with programming skills and software domain specialisation to enable students to link the profession with passion. Becoming a “Specialist” with industry of choice allow learners to choose “Career by Choice”. The CIFA model is designed to develop quality degree programs.

- **Co-creation:** The front-end alignment to enhance learning excellence and the back-end alignment to ensure career excellence with global academic partners and hiring organisation makes this programme highly engaging and exciting.
- **Innovation:** The integrated industry programme is designed to introduce students to the current needs and requirements of the fast-growing primary sector globally and is aligned to prepare the students through the concept of knowing, doing and being.
- **Focus:** The programme is designed for the students who intend to acquire and/or upgrade business knowledge & skills, sectorial exposure and Domain expertise.
- **Alignment:** The integration of local and global requirements and required competencies and attributes to develop while undergoing the program ensures the highest ROI and lifelong learning.

A comprehensive three-year, UG degree programme aims to create future Programmers.

The programme is meant for students passionate to pursue a career by choice.

3. AIM

This course, Bachelor of Computer Application, is designed and introduced by University to bridge the gap and produce employable graduate in Information technology which will enable the industry to grow and the graduates to become successful in the field of Information Technology / Computer Application.

Goals

- To enable a learner to pursue any area of knowledge domain depending upon his / her interest.
- To widen the horizon of learner’s intellectual insight.
- Rigidity of present system does not allow pursuit of areas of interest as well as widening the educational horizon of the learner, and
- Provision of choice is an essential condition for broad-based learner’s profile across areas of knowledge.

A comprehensive **three-year, UG degree** programme aims to create future Programmers. The programme is meant for students passionate to pursue a **career by choice**.

4. OBJECTIVES:

The objectives of the program are to -

1. Impart knowledge of computer and programming logic environment in Computer Applications
2. Impart Knowledge of advanced IT applications in different business sectors with usage of Computer Applications
3. Develop the capacity to continuously learn and adapt to the changing technologies and organizational environments.
4. Evaluate and compare cutting edge technologies and techniques and its application in the solution of common IT problems.
5. To equip students with the technical knowledge required for an IT professional to handle multi-tasking and multi-programming situations and to assess and develop computer Applications

Programme Outcome:

PO1	Computational knowledge: Acquire knowledge of Computing Fundamentals, Basic Mathematics, Computing Specialization and Domain Knowledge of proper computing models from defined problems.
PO2	Problem analysis: Identify, formulate review research literate and analyze complex engineering problems reading substantiated conclusions using first principles mathematics, computing science and relevant domains.
PO3	Design/development of solutions: Ability to design system s/w or process as per needs and specifications.
PO4	Conduct investigations of complex computing problems: Use research-based knowledge and research methods including design of experiments, analysis & interpretation of data & synthesis of information to provide valid conclusions.
PO5	Modern Tool Usage: Ability to demonstrate skills to use modern s/w & h/w tools to analyze problems.
PO6	Professional Ethics: Apply ethical principles and commit to professional ethics and cyber regulations.
PO7	Life-Long Learning: Ability to develop confidence for self-education and life-long learning in the broadest context of technological change.
PO8	Project management and finance: Ability to demonstrate knowledge & understanding of the engineering and management principles and apply them as a member & as a leader in a team to manage multidisciplinary projects.

Programme Specific Outcomes:

PSO1	Attain the ability to design and develop Computer Applications, evaluate and recognize potential skills and provide innovative solutions.
PSO2	Explore technical knowledge in diverse areas of Computer Applications an experience and environment conducive in cultivating skills for successful career, entrepreneurship and higher studies

5. ELIGIBILITY CRITERIA:

The aspiring candidate should have passed the Higher Secondary (10+2) or equivalent examination recognized by any Indian The candidate has attained the age of 17 years as in the year of admission.

6. INTAKE CAPACITY in Regular Mode-

90 candidates per year

7. TEACHING LEARNING METHODOLOGY –

- The modality of teaching for teaching learning modules will be in the form of didactic
- Lectures, self-directed learning, seminars presentation Microteaching etc.

8. MEDIUM OF INSTRUCTION:

- English shall be the medium of instruction for all the subjects of study and for examination of the course.

9. ATTENDANCE:

A candidate has to secure minimum 80% attendance in overall with at least-

1. 75% attendance in theoretical
2. 80% in Skills training (practical) for qualifying to appear for the final examination

10. COURSE DURATION-

- The B.C.A. Course is of 3 years duration, divided into six Semesters (2 semesters each year) including dissertation/Project in sixth semester.

11. EDUCATIONAL PROGRAM

A) Distribution of Course duration

- The Program is of a Three Year (Six semesters) Full Time Degree Program.
- The program shall be based on credit system comprising 138 credit points.
- Theory Courses offered shall be of 2 to 4 credits and practical courses of 4 credits each.
- For Theory Course, one credit is equivalent to one clock hour direct teaching in a week and for Practical Course, one credit is equivalent to one and half hours of laboratory work in a week.

The new Curriculum would focus on learning aspect from four dimensions viz. Conceptual Learning, Skills Learning and Practical / Hands on with respect to:

1. Core Courses (CC),
2. Generic Elective Course (GEC),
3. Skill Enhancement Compulsory Course(SECC)
4. Ability Enhancement Compulsory Course(AECC)
5. Industry Enabled Global Certification Electives,
6. Discipline Specific Electives (DSE),
7. Project & Seminar (PS),
8. Internship

B) Distribution of Hours and Credits:

The Course Structure for Undergraduate Programme of Bachelor of Computer Application (BCA):

BCA FIRST YEAR SEMESTER – I

Sr. No	Core	Course Code	Theory Paper/Practical	Teaching Scheme (Hrs/Week)			C	Duration of University Exam. (Hrs.)	Total Marks
				L	T	P			
1	CC	BCA101	Foundational Mathematics	3	1	0	**4**	3	100
2	CC	BCA102	Digital Computer Fundamentals	4	0	0	**4**	3	100
3	CC	BCA103	Programming Concepts Using C	3	1	0	**4**	3	100
4	CC	BCA104	Digital Electronics	4	0	0	**4**	3	100
5	CC	BCA105	Web Development	4	0	0	**4**	3	100
6	SECC	BCA106	Web Development Lab	0	0	4	**2**	-	100
7	SECC	BCA107	Programming Concepts Using C Lab	0	0	4	**2**	-	100
8	AECC	BCA108	Communication Skills/ English	3	0	0	**3**	2	100
			Total	**21**	**2**	**8**	**27**	**--**	**800**

BCA FIRST YEAR SEMESTER – II

Sr. No	Core	Course Code	Theory Paper/Practical	Teaching Scheme (Hrs/Week)			C	Duration of University Exam. (Hrs.)	Total Marks
				L	T	P			
1	CC	BCA201	Discrete Mathematics	3	1	0	4	3	100
2	CC	BCA202	Database Management Systems	4	0	0	4	3	100
3	CC	BCA203	Object Oriented Programming using C++	3	1	0	4	3	100
4	CC	BCA204	Operating Systems	4	0	0	4	3	100
5	CC	BCA205	Data Structure & Algorithm	4	0	0	4	3	100
6	SECC	BCA206	Database Management Systems Lab	0	0	4	2	-	100
7	SECC	BCA207	DS Using C++ Lab	0	0	4	2	-	100
8	SECC	BCA208	IEGCE – 1 (MTC - M365)	0	2	0	2	- internal assesment	100
9	AECC	BCA209	Environmental Science- Grading	2	0	0	0	- internal assesment	100
Total				**20**	**4**	**8**	**26**	**--**	**900**

BCA SECOND YEAR SEMESTER – III

Sr. No	Core	Course Code	Theory Paper/Practical	Teaching Scheme (Hrs/Week)			C	Duration of University Exam. (Hrs.)	Total Marks
				L	T	P			
1	CC	BCA301	Statistics & Probability	3	1	0	4	3	100
2	CC	BCA302	Theory of Computation	3	1	0	4	3	100
3	CC	BCA303	Computer Networks	3	1	0	4	3	100
4	CC	BCA304	Java Programming	3	1	0	4	3	100
5	GEC	BCA305	Enterprise Resource Planning (with MIS)	2	0	0	2	3	100
6	SECC	BCA306	Computer Networks Lab	0	0	4	2	-	100
7	SECC	BCA307	Java Programming Lab	0	0	4	2	-	100
8	AECC	BCA308	Capstone Project	0	0	4	2	-	100
Total				**14**	**4**	**12**	**24**	**-**	**800**

BCA SECOND YEAR SEMESTER – IV

Sr. No	Core	Course Code	Theory Paper/Practical	Teaching Scheme (Hrs/Week)			C	Duration of University Exam. (Hrs.)	Total Marks
				L	T	P			
1	CC	BCA401	Distributed Database Management Systems	3	1	0	**4**	3	100
2	CC	BCA402	Artificial Intelligence	3	1	0	**4**	3	100
3	CC	BCA403	Object Oriented Modelling and Design	3	1	0	**4**	3	100
4	CC	BCA404	Cloud Computing	3	1	0	**4**	3	100
5	CC	BCA405	Bootstrap Programming	4	0	0	**4**	3	100
6	GEC	BCA406	Bootstrap Programming Lab	0	0	4	**2**	-	100
7	SECC	BCA407	Object Oriented Modelling and Design Lab	0	0	4	**2**	-	100
8	SECC	BCA408	IEGCE – 2 (Database Fundamentals)	0	2	0	**2**	-	100
			Total	**16**	**6**	**8**	**26**	**--**	**800**

BCA THIRD YEAR SEMESTER – V

Sr. No	Core	Course Code	Theory Paper/Practical	Teaching Scheme (Hrs/Week)			C	Duration of University Exam. (Hrs.)	Total Marks
				L	T	P			
1	CC	BCA501	Data Mining and Data Warehousing	3	1	0	**4**	3	100
2	CC	BCA502	Software Engineering	4	0	0	**4**	3	100
3	CC	BCA503	Organisation Behaviour	4	0	0	**4**	3	100
4	CC	BCA504	Python Programming	3	1	0	**4**	3	100
5	DSE	BCA505	Elective 1: Mobile Applications Using Android Elective 1: Multimedia Applications	2	1	0	3	3	100
6	SECC	BCA506	Python Programming Lab	0	0	4	2	-	100
7	SECC	BCA507	Data Mining and Data Warehousing Lab	0	0	4	2	-	100
	SECC	BCA508	IEGCE – 3 (MTA – PYTHON)	0	2	0	2	-	100
			Total	**16**	**5**	**8**	**25**	**--**	**700**

BCA THIRD YEAR SEMESTER – VI

Sr. No	Core	Course Code	Theory Paper/Practical	Teaching Scheme (Hrs/Week)			C	Duration of University Exam. (Hrs.)	Total Marks
				L	T	P			
1	CC	BCA601	Introduction to Cyber Security	3	1	0	**4**	3	100
2	CC	BCA602	Software Testing	3	1	0	**4**	3	100
3	DSE	BCA603	Elective 2: Introduction to Data Science Elective 2: Big Data Analytics	2	1	0	**3**	3	100
4	PS	BCA604	Project/ Internship	0	0	12	**6**	3	200
Total				**8**	**3**	**12**	**17**	**--**	**500**

SEM	L	T	P	C
SEM I	21	2	8	**27**
SEM II	20	4	8	**26**
SEM III	14	4	12	**24**
SEM IV	16	6	8	**26**
SEM V	16	5	8	**25**
SEM VI	8	3	12	**17**
TOTAL	**95**	**24**	**56**	**145**

Elective – 1

Sr. No	Semester	Course Name	Total Credits
1	V	Mobile Applications Using Android	**3**
2	V	Multimedia Applications	**3**

Elective – 2

Sr. No	Semester	Course Name	Total Credits
1	VI	Data Science	**3**
2	VI	Big Data Analytics	**3**

Industry Enabled Global Certification Electives (IEGCE)

Sr. No	Semester	Course Code	Course Name	Total Credits
1	II	-	MTC – M365 – Microsoft	**2**
2	IV	-	Database Fundamentals	**2**
3	V	-	MTA – Python	**2**

Summary of the Program: BCA

Sr. No	Particulars	Total Courses	Total Credits	Total Marks
1	Core Courses	25	100	2500
2	Ability Enhancement Compulsory Course (AECC)	3	5	300
3	Skill Enhancement Compulsory Course (SECC)	12	24	1200
4	Generic Elective Course (GE)	2	4	200
5	Discipline Specific Electives(DSE)	2	6	200
6	Project & Internship	1	6	200
	Total	**45**	**145**	**4600**

Syllabus Details

BCA I Year - Semester I

Course: Foundational Mathematics	Course Code: BCA101

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To learn set theory and their representations
2	To be able to define relations, pigeonhole principle and mathematical induction
3	To gain knowledge of domain, range of functions and its types
4	To learn the concept of counting principles
5	To understand the concept of vectors and matrices

Course Content

Unit No.	Module Name	Contents	Hours
1.	Set Theory	**Set Theory**- Introduction, Sets and their representations, empty set, Finite & infinite sets, equal sets, subsets, power sets, universal sets, complements of a set, Algebra on sets, Cartesian products of sets, Venn diagrams, operations on set, Principle of Inclusion-Exclusion.	12
2	Relations	**Relations:** Definition, Types of relations, reflexive, symmetric, and transitive relations. Relation matrix and the graph of relation, Partial order relations, Equivalence relations, Equivalence Classes, Composition of relations, The pigeonhole principle, Mathematical Induction.	12
3	Functions	**Functions:** Definition, domain of a function, range of a function, identity and constant function, Sum of a function, Product of a function, Types of function, One to one function, onto functions, bijective functions, composite functions, inverse of a function, recursively defined function.	12
4	Counting Principles	**Counting Principles:** Fundamental principle of counting, Product rule, sum rule, Meaning of Factorial Notation, Permutation - Definition, Permutation of n distinct objects, Permutations when all the objects are not distinct, Circular permutations, Combinations, Simple application of permutation and combination.	12
5	Vectors and Matrices	**Vectors and Matrices:** Introduction, Vectors, Matrices, Matrix Addition, Scalar Multiplication, Matrix Multiplication, Transpose of a matrix, Square Matrices, Invertible (Non singular) Matrices, Inverse of a matrix, Determinants.	12
		Total No. of Hrs	60

Course Outcome

Students should able to

CO1	Understand the concepts of sets using Venn diagrams
CO2	Explain pigeon hole principle and concept of Mathematical induction
CO3	Evaluate domain, range and inverse of a function
CO4	Apply the concept of permutations and combinations in real life
CO5	Identify the various types of matrices

Recommended Resources	
Text Books	1. Mathematics Volume I By R.D. Sharma (DhanpatRai Publication) 2. Mathematics Volume II By R.D. Sharma (DhanpatRai Publication) 3. Discrete Mathematical Structures with applications to computer Science byJ.P. Tremblay& R. Manohar.
Reference Books	1. Discrete mathematics By Vinay Kumar (BPB) 2. Discrete Mathematical Structures by Kolman Busby and Ross (Pearson) 3. Discrete Mathematics by Norman Biggs. (Oxford). 4. Logic and Discrete Mathematics: Grassmann, Tremblay (Pearson). 5. Kenneth H Rosen Discrete Mathematics & it's Applications TMH 6. Engineering Mathematics Volume I By S.S. Sastry (Prentice-Hall of India) 7. Discrete mathematics Schaum's Series By Seymour LipSchutz, Marc Lipson (TataMcGraw Hill).

Course: Digital Computer Fundamentals	Course Code: BCA102

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To understand computer system.
2	To understand computer organization and memory structure.
3	To understand the operating system and its concept.
4	To study internet and its tools.
5	To know emerging trends in IT.

Course Contents			
Unit No.	Module Name	Content	Hours
1	Computer Basics	1.1.Introduction 1.2.Evolution of Computers 1.3.Characteristics of computers 1.4.Computer Generations 1.5.Classification of Computers 1.6.Computer Applications 1.7.Limitations of computers	12
2	Computer Organization, Memory and Storage	2.1Introduction 2.2 Basic Computer Organization 2.3Input Devices 2.4Output Devices 2.5Central Processing Unit 2.6The System Bus Architecture 2.7Memory or Storage Unit	12
3	Information Technology Basics	3.1 Types of software 3.2 Operating System 3.3 Information Technology 3.4 History of Browsers 3.5 Need for Information Storage and Processing 3.6 Information Technology Components 3.7 Role of Information Technology 3.8 Information Technology and the Internet	12

4	Internet and its Tools	4.1 Introduction 4.2 Internet Evolution 4.3 Basic Internet Terminology 4.4 Data Over Internet 4.5 Modes of Data Transmission 4.6 Types of Networks 4.7 Types of Topologies 4.8 Protocols used in Internet 4.9 Getting Connected to Internet Applications 4.10 Internet Applications 4.11 Email, Mailbox, Email creating and sending. 4.12 Google Sheet 4.13 E-commerce	12
5	Emerging Trends in IT	5.1 Introduction 5.2 Electronic Commerce 5.3 Electronic Data Interchange 5.4 Smart Cards 5.5 Mobile Communication 5.6 Internet Protocol TV	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Understand computer system.
CO2	Know computer organization and memory structure.
CO3	Evaluate the operating system and its concept.
CO4	Study internet and its tools.
CO5	Know emerging trends in IT.

Recommended Resources	
Text Books	1. Digital Design- Morris Mano, PHI, 3rdEdition. 2. V Rajaraman. Introduction to Information Technology, 3rd Edition, PHI Learning Private Limited, 2018 3. "Computer Fundamentals "Goel, Anita Pearson Education, New Delhi. 4. Computer Basics Absolute Miller. Michael QUE Publishing; 8th edition August, Beginner's Guide, Windows 10. 5. Linux: Easy Linux for Alvaro, Felix Create Space Independent Beginners Publishing Platform.
Reference Books	1. Microsoft Office 2010: On Johnson, Steve Pearson Education, New Delhi India, Demand. 2. OpenOffice.org for Leete. Gurdy, Wiley Publishing, New Delhi. 2003 Dummies Finkelstein Ellen, Mary Leete 3. Computer Fundamentals Dr.RajendraDevraj Publications, Dist. Solapur. | Kawale Maharashtra

Course: Programming Concepts using C	Course Code: BCA103

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To learn the development tools of algorithms and flowcharts
2	To identify and learn the character set and various expressions
3	To understand the concepts of arrays, functions& structures
4	To learn how to interface with machines using pointers
5	To learn the techniques of file handling

Course Content			
Unit No.	Module Name	Content	Hours
1.	**Development Tools**	• Algorithm, • Flowcharts • Pseudo code (Definition and its characteristics) • Developing Algorithm and • Drawing flowcharts • Editor and Compiler • Compilation Process • C Character set • Tokens, Identifier. • Keywords, Variables. • Data types.	12
2	**Introduction to C**	• Variable declaration syntax • Storage Classes in C. • Operators and Expressions: Arithmetic, Relational, Logical, Bit-Wise, Increment, Decrement, Conditional and Special operators. • Evaluation order of Operator/ Hierarchy • Selection Statement: if, if-else, Nested if, switch. • Iteration statement: for, while, do. While, Nested loops, • Jump statement: break, continue, goto.	12
3	**Arrays & String Handling**	• Arrays: Definition • One-Dimensional-Array Initialization of array • Writing and Reading data from an array • Bounce Checking • Searching,SortingandMergingoftwoarrays. • Two-DimensionalArray: Declaring,Initialization • OperationonMatrix:Addition, Multiplication,Transpose etc. • **String:**StringManipulation usingstringlibraryfunctions. • **Programming using String**	12

4	Structure&Functions	• Structure: Declaration, Definition, • Accessing structure members, • **Structure:**NeedofStructure,periodoperator, • InitializingStructure,sizeof(),ArraysofStructure, • Nested Structures. • **Unions:**Conceptandapplications,enum • **Function:**ArithmeticandStringLibraryFunction,Userdefinedfunctions, • Advantageof Function,CategoryofFunction, • NestingFunction,Recursion. • FunctionwithArrays, • PassingStructure elementstoFunctions. • **StorageClass:**auto,static,extern, Register.	12
5	PointerandFile Concept	• **Pointer:**DeclaringandInitializingpointervariable,PointerOperator, • CallbyvalueandCall byAddress • **DynamicMemoryManagementFunctions:** malloc(),realloc(), free() • **Files:**Conceptoffile,OperationonFiles,Defining,Openingandclosingfiles,ModesofFiles,file handlingfunction, • CommandLine Argument.	12
		Total No. of Hrs	60

Course Outcome	
Students should able to	
CO1	Understand the process of algorithms and flowcharts
CO2	Explain the character set and various expressions
CO3	Apply the concepts of arrays, string and functions
CO4	Identify between structure and pointers
CO5	Evaluate the techniques of file handling

Recommended Resources	
Text Books	1. Dr.S.B.Kishor,"ProgramminginC",DasGanu,2016,ISBN:978-93-84336-21-9 2. Programming in C by E. Balagurusamy TMH Publications 3. The Art of programming through flowcharts &algorithm by Anil B. Chaudhari Firewall Media, Laxmi publication, New Publication.
Reference Books	1. C Programming –KernighanRitchie 2. Programming with C – Y. Kanetkar. 3. C Programming – Holzner, PHI Publication. 4. Programming in C – Ravichandra

Course: Digital Electronics	Course Code: BCA 104

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
4	0	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To introduce digital and analog system and the detail of digital signal
2	To understand logic gates and number system
3	To gain knowledge of combinational Circuits and Arithmetic circuit
4	To be able to understand Sequential Circuits
5	To understand shift registers

Course Contents			
Unit No.	Module No.	Content	Hours
1		**1. Introduction to Digital and Analog system:** • Overview of Analog System • Overview of Digital System • Logic Systems Representation -Positive and negative • Waveform Representation of Analog and Digital system **2. Detail of Digital Signal:** • Advantages of Digital system • Disadvantages • Difference between Analog and Digital System • Binary Digit **3. Boolean Algebra:** • Rules and laws of Boolean algebra • Simplification examples based on rules of Boolean algebra • De-morgan's Theorems	12

		• Boolean Expressions and Truth Tables • Min-term and Maxterms • Principal of Duality	
2		1. **Basic of Logic Gates:** • Logical Operators, Logic Gates-Basic Gates • NOT, AND, OR Gates 2. **Other gates and Universal Gate** • NAND Gate • NOR Gate • XOR Gate • EX-CLUSIVE OR Gate • EX-CLUSIVE NOR Gate • Implementation of Other Gates using Universal Gates 3. **Introduction to Number Systems:** • Types-Decimal, Binary, Octal, Hexadecimal • Conversion from Binary number to BCD and vice-versa • Binary arithmetic operations; Addition and Subtraction • Representation of Negative Numbers • 1's complement and 2's complement and their examples	12
3		1. **Introduction to combinational Circuits** • Design procedure of Combinational circuit • Multiplexer • De-Multiplexer. • Encoder, Decoder • Difference between Decoder and Multiplexer 2. **Arithmetic circuit: Adders** • Difference between Serial and Parallel Adder • Half-Adder, • Full-Adder • Difference between Half and Full Adder • Concept of Subtractor	12
4		1. **Introduction to Sequential Circuits:** • Overview of Sequential circuit • Classification of Sequential circuit-Synchronous and Asynchronous and their difference • Introduction of Latches 2. **Types of Flip-flop:** • RS, T, D, JK; Master-Salve JK • T Flip-flop • D Flip-flop • JK Flip-flop	12

		• Mater-Slave JK Flip-flop **3. Difference between Combinational and sequential circuits.**	
5		**1. Introduction to shift registers :** • Basic shift register • Types of shift registers- Serial in to serial out Serial in to parallel out • Parallel in to Serial out Parallel in to Parallel out **2. Introduction to counters :** • Overview of counters • Types of counters • Difference between synchronous and asynchronous counter • Application of Counter	12
		Total No. of Hrs	

Course Outcome	
Students should able to	
	Explain digital and analog system and the detail of digital signal
	Evaluate logic gates and number system
	Understand the difference between combinational Circuits and Arithmetic circuit
	Understand Sequential Circuits and Types of Flip-flop
	Understand shift registers and counters

Recommended Resources	
Text Books	1. Digital Design- Morris Mano, PHI, 3rdEdition. 2. Switching Theory and Logic Design-A. Anand Kumar, PHI, 2ndEdition.
Reference Books	1. Fundamentals of Logic Design" Charles H.Roth., 6th Edition, Thomson Learning, 2013. 2. Modern Digital Electronics- R.P. Jain, 4th Edition. 3. Bakshi, U. A. &Godse, A. P., 2009. Analog and Digital Electronics, Technical Publications 4. Godse, A. P. &Godse, D. A., 2009. Digital Electronics and Logic Design, Technical Publications.

Course: Web Development	Course Code: BCA 105

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
4	0	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To introduce web designing principles.
2	To understand basics of Internet.
3	To gain knowledge of HTML Coding.
4	To be able to perform programming.
5	To understand & implement CSS, Javascript.

Course Contents			
Unit No.	Module No.	Content	Hours
1	**Web Design Principles**	• Basic principles involved in developing a web site • Planning process • Rules of web designing • Designing navigation bar, tool bar, title bar. • Page design and study • Home Page Layout • Web Development a. Web Development Process b. Web Development Tools	
2	**Basics in Web Design**	• Brief History of Internet • Components of Internet 1. WWW 2. URL 3. Web Site 4. Web Server 5. Web Browser • Why create a web site • Web Standards • Web Page: 1. Static Web Page 2. Dynamic Web Page • Audience requirement. • Applications and advantages.	

3	**Introductions to HTML**	• What is HTML • HTML Documents • Basic structure of an HTML document • Creating an HTML document • Working with Editor and Browser • HTML Tags: a. Heading b. Paragraphs • Line Breaks • Horizontal Rule	
4	**Elements of HTML**	• Introduction to elements of HTML • Tags for formatting text: <B>, <I>, <U>, <STRIKE> • HTML Font tag a. Font color b. Font Size c. Font Face • Marquee tag • Working with Lists a. Ordered list b. unordered list • Formatting table with Table tag	
5	**Programs with HTML**	• Working with Hyperlinks and hypertexts. • HTML Colors a. Color coding method b. Hex Codes c. RGB Values • Working with background color and Image. • Upload document on a webpage. • Creating web site structure • Creating Titles for web pages • Join web pages • Cascading style sheets: Introduction to CSS, creating style sheets, common tasks with CSS, Colors, the font - family, font metrics	12
		Total No. of Hrs	60

Course Outcome	
Students should able to	
	know web designing principles.
	understand basics of Internet.
	gain knowledge of HTML Coding.
	perform programming.
	understand& implement CSS, Javascript.

Recommended Resources	
Text Books	1. Kogent Learning Solutions Inc. HTML 5 in simple steps Dream-tech Press 2. A beginner's guide to HTML NCSA,14th May,2003 Murray, Tom/Lynchburg Creating a Web Page and Web Site College,2002
Reference Books	1. Steven M. Schafer HTML, XHTML, and CSS Bible, 5ed Wiley India 2. John Duckett Beginning HTML, XHTML, CSS, and JavaScript Wiley India

Course: Web Development Lab	Course Code: BCA106

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Lab participation/ Attendance)	CIA-2 (Written Practical Logbook)	CIA-3 (Viva/Oral)	Written Performance	Viva / Oral	
0	0	4	2	10	10	10	50	20	100
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives	
1	To design basic framework.
2	To implement different tags for designing front end.
3	To implement web development tools.

List of Programs

1. Write a program in HTML to display a message using basic tags, Heading tag and Paragraph tag. Use Line break and HR rule.
2. A. Write a program in HTML using Unordered List tag.
3. Write a program in HTML using Ordered List tag.
4. Write a program in HTML using Definition List tag.
5. A. Write a program in HTML using Font tag and its attributes.
6. Write a program in HTML using marquee tag and its attributes.
7. Write a program to illustrate HTML color.
8. Write a program to illustrate HTML anchor tag and its attributes.
9. Write a program in HTML using Table tag and its attributes.
10. Write a program in HTML using Image tag and its attributes.
11. Write a program in HTML using Hyperlink tag (anchor tag). Show links to pages, text, Image.
12. Write a program in HTML using Table tag, Table caption tag and set table height and width. Use table head, table foot, table body tags. Also merge rows or columns.
13. Design a mini project using HTML, CSS and JavaScript technologies in Web Development and write its report.

Course Outcome	
Students should able to	
CO1	To design basic framework.
CO2	To implement different tags for designing front end.
CO3	To implement web development tools.

Course: Programming Concepts Using C Lab	Course Code: BCA107

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Lab participation/ Attendance)	CIA-2 (Written Practical Logbook)	CIA-3 (Viva/Oral)	Written Performance	Viva/ Oral	
0	0	4	2	10	10	10	50	20	100
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives	
1	To introduce students to the basic knowledge of programming fundamentals of C language.
2	To impart writing skill of C programming to the students and solving problems.
3	To impart the concepts like looping, array, functions, pointers, file, structure.

List of Programs

1. Write a C program to find sum and average of three numbers.
2. Write a C program to generate the first n terms of the Fibonacci sequence
3. Write a C program to Check whether given number is Armstrong Number or Not
4. Write a C program to evaluate algebraic expression (ax+b)/(ax-b)
5. Write a C program to find the roots of a quadratic equation.
6. Write a C program to find factorial of a given integer using non-recursive function.
7. Write a C program to find both the largest and smallest number in a list of integers.
8. Write a C program perform arithmetic operations using switch statement.
9. Write a C Program to Sort the Array in an Ascending Order
10. Write a C program to perform addition of two matrices
11. Write a C program to use function to insert a sub-string in to given main string from a given position.
12. Write a C program using user defined functions to determine whether the given string is palindrome or not
13. Write a C program to find the length of the string using Pointer.
14. Write a C Program to Calculate Total and Percentage marks of a student using structure.

a) Write a C program to copy the contents of one file to another.

b) Write a C program to merge two files into a third file.

Course Outcome	
Students should able to	
CO1	Understand the basic knowledge of programming fundamentals of C language.
CO2	Acquire knowledge for writing skill of C programming for solving problems.
CO3	Understand the concepts like looping, array, functions, pointers, file and structure.

Course: Communication skills/English	Course Code: BCA108

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
1	1	0	2	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To understand the need for communication and its elements
2	To know the importance of listening and reading skills
3	To obtain the basic writing skills
4	To enrich the knowledge in letter writing skills
5	To know the importance of oral communication and speech

Course Content			
Unit No.	Module Name	Contents	Hours
1.	Communication and Its Elements	**Communication and Its Elements:** Communication Process Need of communication competency Role of vocabulary in effective communication Word formation; A set of selected 50 synonyms, antonyms, homonyms & homophones; suffixes &prefixes -	6
2	Listening and Reading Skills	**Listening and Reading Skills:** Listening comprehension & reading comprehension, newspaper activity; Listening to recorded speeches, Listening –Importance, types and barriers.	6
3	Writing Skills	**Writing Skills:** Fundamentals of business letter writing, Business letters- Functions and importance, Types of business letters, report writing-format and examples, E-Mail writing.	6
4	Letter Writing	**Letter Writing:** Types of letter writing; Structure & Lay out; Leave application; Letter of enquiry & response with respect to educational & official matters; Informal letter expressing or discussing social or educational issues.	6
5	Spoken Skills	**Spoken Skills:** Oral communication- Concept, Scope and Importance; Importance of Pronunciation Group discussion Debate, Speech Body language- meaning and Importance of Body Language Interview techniques & Telephone etiquettes	6
		Total No. of Hrs	**30**

Course Outcome	
Students should able to	
CO1	Identify the role of vocabulary in effective communication
CO2	Explain the Importance, types and barriers of Listening
CO3	Execute e-mail writing and report writing
CO4	Understand the procedure of leave letter writing
CO5	Involve in group discussion and attending interviews

Recommended Resources	
Text Books	1. Public Speaking and Influencing Men in Business: Dale Carnegie. 2. Professional Communication Skills: Bhatia and Sheikh.
Reference Books	1. Communication: K. K.Sinha. 2. Communication Skills: Dr.P.Prasad. 3. Communication: Raman and Sharma

BCA I Year: Semester II

Course: Discrete Mathematics	Course Code: BCA201

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To understand the propositional calculus.
2	To understand and apply normal forms.
3	To understand predicate calculus and inference.
4	To understand the concept of quantifier.
5	To understand the concept of Graph theory

Course Content			
Unit No.	Module Name	Content	Hours
1	**Propositional Calculus**	Propositional Calculus • Connectives, Negation, conjunction, Disjunction, statement formulas • Truth tables, conditional and Bi-conditional, • Tautologies and Contradiction, Equivalence of Proposition, duality law, Tautologies implications.	12
2	**Types of Normal Forms**	Types of Normal Forms • Disjunctive normal forms, • connective normal forms • Principal disjunctive normal form, Principal conjunctive normal form.	12
3	**Predicate Calculus**	Predicate Calculus • The theory of Inference for statement Calculus, • Validity using truth tables, • Rules of inference Consistency of premises and indirect method of Proof	12
4	**Quantifier**	Quantifier • Introduction, • Quantifier, Predicate formulas, • Free and Bound variables, Theory of predicate calculus.	12
5	Graph Theory	Graph Theory	12

		• Basic concepts • Types of graphs • Representation of graph in memory • Euler path and circuits • Hamiltonian Path and circuits • Trees • Basic concepts • Labeled trees • Undirected trees	
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Understand the implementation of propositional calculus.
CO2	Understand the concept of normal forms and its evaluation.
CO3	Understand the predicate calculus, inference and its applications
CO4	Understand the concept of quantifier, predicate formulas.
CO5	Understand the concept of graphs and trees

Recommended Resources	
Text Books	1. Discrete Mathematical Structures with applications to computer Science byJ. P. Tremblay& R. Manohar, (TMH) 2. Discrete Mathematical Structures by Kolman Busby and Ross (Pearson) 3. Discrete Mathematics by Norman Biggs. (Oxford). 4. Logic and Discrete Mathematics: Grassmann, Tremblay (Pearson)
Reference Books	1. Introduction to Automata Theory, Languages, and computation: Hopcroft, Motwani and Ullman (Pearson) 2.An introduction to the theory of computer science, languages and machines: Sudkamp 3. Kenneth H Rosen Discrete Mathematics &it's Applications TMH

Course: Database Management System	Course Code: BCA202

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	100	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To Understand the basic concepts and the applications of database systems
2	To understand the internal storage structures using different file and indexing Techniques which will help in physical DB design.
3	To understand the relational database design principles
4	To Master the basics of SQL and construct queries using SQL
5	To become familiar with the basic issues of transaction processing and concurrency control

Course Content

Unit No.	Module Name	Content	Hours
1	**Introduction**	Introduction to database Systems, Basic concepts &Definitions, Data Dictionary, DBA, File-oriented system vs. Database System, Database Language. Database System Architecture-Schemas, Sub Schemas & Instances, 3-level database architecture, Data Abstraction, Data Independence, Mappings, Structure, Components & functions of DBMS, Data models, Mapping E-R model to Relational, Network and Object Oriented Data models, types of Database systems,	12
2	**Storage Strategies**	Detailed Storage Architecture, Storing Data, Magnetic Disk, RAID, Other Disks, Magnetic Tape, Storage Access, File & Record Organization, File Organizations & Indexes, Order Indices, B+ Tree Index Files, Hashing	12
3	**Relational Algebra**	Tuple & Domain Relational Calculus, Relational Query Languages: SQL and QBE. Database Design: Database development life cycle(DDLC),Automated design tools, Functional dependency and Decomposition, Dependency Preservation & lossless Design	12
4	**Normalization**	Introduction, Non loss decomposition and functional dependencies, First,Second, and third normal forms – dependency preservation, Boyce/Codd normal form. Higher Normal Forms - Introduction, Multi-valued dependencies and Fourth normal form, Join dependencies and Fifth normal form	12
5	**Transaction processing and concurrency control**	Transaction concepts, concurrency control, locking and Timestamp methods for concurrency control. Database Recovery System: Types of Data Base failure & Types of Database Recovery, Recovery techniques	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Understand the basic concepts and the applications of database systems
CO2	Understand the internal storage structures using different file and indexing Techniques which will help in physical DB design.
CO3	Understand the relational database design principles
CO4	Master the basics of SQL and construct queries using SQL
CO5	Understand the basic issues of transaction processing and concurrency control

Recommended Resources	
Text Books	1. Database System Concepts, Silberschatz, Korth, McGraw hill, Sixth Edition. 2. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition.
Reference Books	1. Fundamentals of Database Systems, ElmasriNavathe Pearson Education. 2. An Introduction to Database systems, C.J. Date, A.Kannan, S.SwamiNadhan, Pearson, Eight Edition .

Course: Object Oriented Programming using C++	Course Code: BCA203

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To introduce objective oriented programming and its procedure
2	To learn and understand objects and classes
3	To gain knowledge of constructors and destructors
4	To learn about inheritance and its functions
5	To understand the concept of polymorphism

Course Content			
Unit No.	Module Name	Content	Hours
1.	**Introduction to Object Oriented Programming**	**Introduction to Object Oriented Programming**: Need & requirement, Procedure Oriented Programming (POP) verses Object Oriented Programming (OOP), Basic concepts of Object-Oriented Programming, Object Oriented Languages, and Applications of OOP. Beginning with C++: What is C++? , keywords, variables, constants basic data types, operators, scope resolution operator, memory management operators, console input/output, structure of C++ program.	12
2	**Classes and Objects**	**Classes and Objects:** Structures in C++. Class & Object: Introduction, specifying a class, access specifies, defining member functions, creating Objects, memory allocations for objects. DYNAMIC OBJECTS: Pointers to Objects, Creating and Deleting Dynamic Objects: New and Delete operators, Array of Objects, Array of Pointers, this Pointer.	12
3	**Constructors & Destructors**	**Constructors & Destructors** Concepts of Constructors, Types of constructors: Default, Parameterized, Copy. Overloaded Constructors: Multiple Constructors in a Class, Constructors with default arguments. Destructors.	12
4	**Inheritance**	**Inheritance:** Introduction, defining a derived class, visibility modes & effects. Types of Inheritance: Single, multilevel, multiple,	12

		hierarchical, hybrid, Virtual base class, VIRTUAL FUNCTIONS: Need for Virtual Functions, definition, Pure Virtual Functions, abstract class, constructors in derived class.	
5	**Polymorphism**	**Polymorphism** Introduction, Types of polymorphism: Compile time, Run time, Compile time Polymorphism: Function overloading, operator overloading: Overloading unary and binary operators, Rules for operator overloading.	12
		Total No. of Hrs.	**60**

Course Outcome	
Students should able to	
CO1	Explain objective oriented programming and its procedure.
CO2	Understand objects and classes.
CO3	Gain knowledge of constructors and destructors.
CO4	Analyze inheritance and its functions.
CO5	Explain the concept of polymorphism.

Recommended Resources	
Text Books	1. Mastering C++ by K R Venugopal Tata McGraw-Hill, New Delhi. 2. The C++ Programming Language –BjarneStroustrup
Reference Books	1. Programming with C++ -Ravichandran 2. Programming with C++ -Robert Lafore 3. Object Oriented Programming with C++ by E. Balagurusamy, McGraw Hill

Course: Operating Systems	Course Code: BCA204

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
4	0	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To define operating system structure and its process management
2	To learn CPU scheduling methods and algorithms
3	To obtain system model for deadlock and starvation
4	To analyse the logical and physical way of memory management
5	To learn I/O Management and file management methods

Course Contents			
Unit No.	Module Name	Content	Hours
1	Operating System Structure	**Operating System Structure:** Simple structure, Layered approach, Modules. System Boot. Operating System functions, Characteristics of OS. Process Management: What is Process? Process states, Creation, Termination. Process Control block. Operations on Process, Concurrent process, Processes Threads, Multithreading, and Micro Kernels. Process creation using fork (), Process termination. Inter-process Communication – Shared memory system, Message passing systems. Multithreading Models.	12
2	CPU Scheduling	**CPU Scheduling:** Schedulers, Scheduling Methodology, CPU Scheduling Algorithm: FCFS, SJF, RR, Priority Scheduling. Context switch. Pre-emptive scheduling, Dispatcher. Performance comparison: Deterministic Modeling, Queuing analysis, Simulators. Process Synchronization: Background, Critical Section Problem, Semaphores: Usage, Implementation. Classic Problems of Synchronization – The bounded buffer problem, The reader writer problem.	12
3	Deadlock and Starvation	**Deadlock and Starvation:** System Model. Resource Allocation Graph, Conditions for Dead Lock, Dead Lock Prevention, Deadlock Avoidance: - Safe state, Resource allocation graph algorithm, Banker's Algorithm Dead Lock Detection. Recovery from Deadlock: Process termination, Resource pre-emption.	12
4	Memory Management	**Memory Management:** Logical Vs. Physical Address Space, Swapping, Memory Management Requirement, Dynamic Loading and Dynamic Linking and shared libraries. **Memory Allocation Method:** Single Partition allocation, Multiple Partitions, Compaction, paging, Shared Pages. Segmentation, Segmentation with paging. Advantages and Disadvantages of Segmentation. Protection. Fragmentation. Virtual Memory Management – Background, Demand paging, Performance of demand paging, Page	12

		replacement – FIFO, OPT, LRU, Second chance page replacement.	
5	**File Allocation Methods**	**I/O Management:** I/O hardware, I/O Buffering, Disk I/O, Raid, Disk Cache. **File Management:** File Management system. File Accessing Methods: Sequential, Direct, Other access methods. File Directories. **File Allocation Methods:** Contiguous allocation, Linked allocation, Indexed allocation. Directory and Disk Structure – Storage structure, Directory overview, Single level directory, Two level directory, Tree structure directory, Acyclic graph directory, General graph directory. File Space Management, Disk Space Management, Record blocking. Free Space Management – Bit vector, Linked list, Grouping, Counting, Space maps	12
		Total No. of Hrs	**60**

Course Outcome	
Students will be able to	
CO1	Understand operating system structure and its process management
CO2	Expertise CPU scheduling methods and algorithms
CO3	Process out the system model for deadlock and starvation
CO4	Exhibit the techniques of logical and physical way of memory management
CO5	Develop the accessing methods of file management and allocations

Recommended Resources	
Text Books	1. Silberchatz and Galvin, Operating System concepts; 10th Edition; John Wiley and Sons, 2018. 2. Tanenbaum; Modern Operating Systems; 4th Edition; PHI, 2015.
Reference Books	1. Operating Systems- John J. Donoven. 2. Operating System : A.S.Godbole (TMH)

Course: Data Structure and Algorithm	Course Code: BCA205

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	100	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	Learn the basic types for data structure, implementation and application.
2	Know the strength and weakness of different data structures
3	Use the appropriate data structure in context of solution of given problem..
4	Develop programming skills which require to solve given problem
5	Understand the fundamental Data Structures including linked-lists, trees, binary search trees, AVL trees, stacks, queues, priority queues, and hash-tables and skiplists.

Course Content			
Unit No.	Module Name	Content	Hours
1.	**General Concepts and Linear Data Structures**	Abstract data structure, Time and space analysis of algorithms, Big oh and theta notations and omega notations, Average, best and worst case analysis, Representation of Arrays -Single and Multi-dimensional-Address calculation using column and row major ordering.	12
2	**Linked List**	Linked List, Representation of Single, Double, Header, Circular Single and Double Linked list, all possible operations on Single and Double linked List using Dynamic representation, Polynomial Representation and its Manipulation.	
3	**Stacks&Queue**	Stacks terminology, Representation of Stacks in Memory, Operation on Stacks, Polish Notations, Translation of infix to postfix & prefix expression, Infix to Postfix Conversion, Evaluation of Postfix Expression, Recursion, Problems on Recursion, Quick Sort and Tower of Hanoi Problem. Representation of Queues in Memory, Circular Queue. Dequeue and Priority Queue. Operations of above Structure using Array and Linked Representation.	12
4	**Searching & Sorting**	SORTING (Numerical Problem and Algorithm): Selection Sort, Insertion Sort, Merge Sort, SEARCHING (Numerical Problem and Algorithm): Linear Search, Binary Search. Efficiency of Sorting Methods, Big-O Notations. Hash Tables, Hashing	12

		Technique, Collision Resolution Technique.	
5	**Trees and Graphs**	Basic Terminologies, Representation of Binary Trees in Memory, Traversing of Binary tree, Binary Search Tree, Operation on Binary Search Tree, Types of trees. GRAPHS: Basic Terminologies, Definition and Representation of Graphs in Memory: Linked List and Matrix Representation. Traversing graphs: BSF, DFS Method.	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation.
CO2	Understand basic data structures such as arrays, linked lists, stacks and queues.
CO3	Describe the hash function and concepts of collision and its resolution methods
CO4	Solve problem involving graphs, trees and heaps
CO5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data

Recommended Resources	
Text Books	1. Classical Data Structures: D. Samanta. PHI, New Delhi. 2. Datastructure: LipsctuzSchum Outline Series
Reference Books	1. Data structure Using C++: Y. Kanetkar 2. Data Structures Using C++: Tenenbaum 3. Data structures by Tremblay Sorenson 4. Data structures by Bhagat Singh Naps

Course: Database Management System Lab	Course Code: BCA206

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Lab participation/ Attendance)	CIA-2 (Written Practical Logbook)	CIA-3 (Viva/Oral)	Written Performance	Viva/ Oral	
0	0	4	2	10	10	10	50	20	100
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives	
1	To understand the practical applicability of database management system concepts.
2	Working on existing database systems, designing of database, creating relational database, analysis of table design
3	The lab course also provide practical knowledge to understand advanced database concepts

List of Programs

1. Design a suitable database structure t entities and relationships to relation table for a given scenario.
   Two assignments shall be carried out i.e. consider two different scenarios (eg. bank, college)
2. Write relational algebra queries for a given set of relations.
3. Perform the following: Viewing all databases, Creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting Records in a Table, Saving (Commit) and Undoing (rollback)
4. Perform the following: Altering a Table, Dropping/Truncating/Renaming Tables, Backing up / Restoring a Database.
5. For a given set of relation schemes, create tables and perform the following Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause), Queries involving- Date Functions, String Functions , Math Functions Join Queries- Inner Join, Outer Join Subqueries- With IN clause, With EXISTS clause
6. For a given set of relation tables perform the following : Creating Views (with and without check option), Dropping views, Selecting from a view
7. Write a Pl/SQL program using FOR loop to insert ten rows into a database table.
8. Given the table EMPLOYEE (EmpNo, Name, Salary, Designation, DeptID)
   write a cursor to select the five highest paid employees from the table.
9. Illustrate how you can embed PL/SQL in a high-level host language such as C/Java and demonstrates how a banking debit transaction might be done.

10. Given an integer i, write a PL/SQL procedure to insert the tuple (i, 'xxx') into a given relation.

Course Outcome	
Students should able to	
CO1	Students get practical knowledge on designing and creating relational database systems.

CO2	Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL
CO3	Use of various software to design and build ER Diagrams, UML, Flow chart for related database systems.
CO4	Students will be able to design and implement database applications on their own

Course: Data Structure using C++ Lab	Course Code: BCA207

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Lab participation/ Attendance)	CIA-2 (Written Practical Logbook)	CIA-3 (Viva/Oral)	Written Performance	Viva / Oral	
0	0	4	2	10	10	10	50	20	100
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives	
1	Introduces object-oriented programming concepts using the C++ language.
2	Introduces the principles of data abstraction, inheritance and polymorphism;
3	to develop skills to design and analyze simple linear and non linear data structures
4	to gain knowledge in practical applications of data structures .

List of Programs

1. Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.
2. Write a C++ program to declare Struct. Initialize and display contents of member variables.
3. Write a C++ program to declare a class. Declare pointer to class. Initialize and display the contents of the class member. Implementation of searching and sorting techniques.
4. Write a C++ program to create multilevel inheritance. (Hint: Classes A1, A2, A3)
5. Write a C++ program to create an array of pointers. Invoke functions using array objects.
6. Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels.
7. Implementation of list using array and linked list.
8. Implementation of push and pop operation on stack
9. Implementation of polish notation and its conversion
10. Write a program to solve the problems using iteration/recursion
11. Program for recursion removal using stack
12. Program for insertion /deletion operation on various queue & Implementation of priority queue for process scheduling
13. Program for storing data as tree structure and implementation of various traversal Techniques
14. Program for storing data as graph structure and implementation of various traversal techniques
15. Program for finding shortest path in graph

Course Outcome	
Students should able to	
CO1	Ability to develop applications for a range of problems using object-oriented programming techniques
CO2	Be able to design and analyse the time and space efficiency of the data structure ·

CO3	Be capable to identity the appropriate data structure for given problem
CO4	Have practical knowledge on the applications of data structures

Course: Environmental Studies	Course Code: BCA209

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
1	1	0	2	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To understand multidisciplinary nature of environmental studies
2	To learn about Natural resources
3	To gain knowledge of Ecosystems
4	To be able to understand Biodiversity and its conservation
5	To discuss about environmental pollution and social issues

Course Content			
Unit No.	Module Name	Content	Hours
1.	The Multidisciplinary Nature Of Environmental Studies	**THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES:** • Basic definitions related to environment; • Scope, vis-à-vis environmental science and environmental engineering; • uses of environmental degradation, • atmospheric composition and associated spheres, 1.5 habitat and climate; • objective, goals and principles involved in environmental education, • environmental awareness, • Environmental ethics, • environmental organization and their involvement	6
2	Natural Resources	**NATURAL RESOURCES**: • Renewable and non-renewable resources; • forest resources, over-exploitation, and deforestation / afforestation; • water resources, impact of over-utilization of surface and ground water, floods, drought, conflicts over water, dams • mineral resources: dereliction of mines, environmental effects of extracting and using mineral resources; • Food resources, modern agriculture and its impact, problem associated with fertilizer and pesticide, water logging, salinity ; • energy resources, renewable, non- renewable energy sources, • solar energy, • wind energy, • hydro energy,biomass energy, geothermal energy, • nuclear energy and its associated hazards;	6

		• land as a resource, • land degradation, • man induced landslides, • soil erosion and desertification	
3	**Ecosystems**	**ECOSYSTEMS:** • Concept of an ecosystem, • structure and function of an ecosystem, • producers, consumers and decomposers, • energy flow in the ecosystem, • ecological succession, • food chains, • food webs and ecological pyramids; • characteristic features, structure and function of the following ecosystem • forest ecosystem, • grassland ecosystem • desert ecosystem • aquatic ecosystems.	**6**
4	**Biodiversity and Its Conservation**	**BIODIVERSITY AND ITS CONSERVATION:** • Bio-geographical classification of India; • biodiversity at global, national and local levels, • India as a mega-diversity nation, • hot-spots of biodiversity; • value of biodiversity-consumptive use, productive use, social, ethical aesthetic and option values; • threats to biodiversity; • conservation of biodiversity: in- situ and ex-situ conservation of biodiversity.	**6**
5	**Environmental Pollution and Social Issues**	**ENVIRONMENTAL POLLUTION AND SOCIAL ISSUES:** • Pollution • Causes, effects and control measures of air pollution, • water pollution, • soil pollution, • marine pollution, • noise pollution, • thermal pollution; • solid waste management,e-waste management; • disaster management –floods, earthquake, cyclone and landslides. Water conservation, rain water harvesting, watershed management; • climate change, global warming, • acid rain, ozone layer depletion; • Environmental Protection Act, • Air (Prevention and Control of Pollution) Act, • Water (Prevention and Control of Pollution) Act, • Wildlife Protection Act, Forest Conservation Act.	**6**
		Total No. of Hrs	**30**

Course Outcome	
Students should able to	
CO1	Understand multidisciplinary nature of environmental studies
CO2	Explain the concept of Natural resources
CO3	Gain knowledge of Ecosystems
CO4	Understand Biodiversity and its conservation
CO5	Understand environmental pollution and social issues

Recommended Resources	
Text Books	1. Agarwal, K.C., "Environmental Biology", 2nd Edition, Nidhi Publ. Ltd., Bikaner, 2001. 2. BharuchaErach, "The Biodiversity of India", 2nd Edition, Mapin Publishing Pvt. Ltd.,2006. 3. Kaushik, Anubha, and Kaushik, C.P., "Perspectives in Environmental Studies", 4thEdition,New Age International Publishers,2004 4. Brunner R. C., "Hazardous Waste Incineration", 1st Edition McGraw Hill Inc.,1989.
Reference Books	1. Clark R.S., "Marine Pollution", 1st Edition Clanderson PressOxford,1989 2. .Cunningham, W.P., Cooper, T.H. Gorhani, E. & Hepworth, M.T., Environmental Encyclopedia", 2nd Edition, Jaico Publ. House,2001. 3. De, A. K., "Environmental Chemistry", 2nd Edition, Wiley Eastern,1989 4. Jadhav, H. and Bhosale, V.M ., "Environmental Protection and Laws", 1st Edition, Himalaya Pub. House, Delhi, 1995. 5. Mckinney, M.L. and Schocl. R.M., "Environmental Science Systems & Solutions", 2nd Edition, Web enhanced edition,1996

BCA II Year: Semester III

Course: Statistics and Probability	Course Code: BCA301

Teaching Scheme (Hrs/Week)				Continuous In-Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class Participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) - 3Hrs.									

Course Objectives	
1	To understand the basic concepts in probability, conditional probability and independent events.
2	To focus on the random variable, mathematical expectation, and different types of distributions.
3	To understand the basic concepts in mathematical expectations.
4	To be able to apply the sampling theory and estimation theory.
5	To be able to formulate sample variance.

Course Content			
Unit No.	Module Name	Content	Hours
1.	Basic Probability	**Basic Probability** - Random Experiments - Sample Spaces Events - The Concept of Probability -The Axioms of Probability - Some Important Theorems on Probability - Assignment of Probabilities - Conditional Probability -Theorems on Conditional Probability – Independent Events -Bayes' Theorem	12
2	Random Variables and Probability Distributions	**Random Variables and Probability Distributions** - Random Variables - Discrete Probability Distributions -Distribution Functions for Random Variables - Continuous Random Variables – Graphical Interpretations -Joint Distributions -Independent Random Variables - Change of Variables - Probability Distributions of Functions of Random Variables	12
3	Mathematical Expectation	**Mathematical Expectation** - Definition of Mathematical Expectation - Functions of Random Variables - Theorems on Expectation - Variance & Standard Deviation - Theorems on Variance - Standardized Random Variables	12

4	**Sampling Theory**	**Sampling Theory -** Population and Sample, Types of Sampling. Statistical Inference- Sampling With and Without Replacement Random Samples - Random Numbers - Population Parameters - Sample Statistics -Sampling Distributions - Sample Mean - Sampling Distribution of Means - Sampling Distribution of Proportions - Sampling Distribution of Differences and Sums.	12
5	**Sample Variance**	**Sample Variance** - Sampling Distribution of Variances - Computation of Mean, Variance, and Moments for Grouped Data - The Least-Squares Parabola - Multiple Regression Standard Error of Estimate The Linear Correlation Coefficient Generalized Correlation Coefficient Rank Correlation	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.
CO2	Define and explain the different statistical distributions (e.g., Normal, Binomial, Poisson).
CO3	Apply the standard deviation
CO4	Define and demonstrate the concepts of estimation and properties of estimators.
CO5	Apply the method of least squares to estimate the parameters in a regression model.

Course - Theory of Computation	Course Code: BCA302

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To Study computing machines by describing, classifying and comparing different types of Computational models.
2	Encourage students to study & develop fundamentals for 'Computational Theory'.
3	To understand the concept of machines: finite automata, pushdown automata, linear bounded automata, and Turing machines.
4	To understand the formal languages and grammars: regular grammar and regular languages, context-free languages and context-free grammar; and introduction to context-sensitive language and context-free grammar, and unrestricted grammar and languages.
5	To understand the complexity or difficulty level of problems when solved using these machines.

Course Contents			
Unit No.	Module Name	Content	Hours
1	Introduction	**Basic Concepts:** Symbols, Strings, Language, Formal Language, Natural Language. Basic Machine And Finite State Machine. **Finite Automata:** Definition And Construction – DFA , NFA, NFA with epsilon-Moves, Minimization Of FA, Equivalence of NFA and DFA, Conversion of NFA with epsilon moves to NFA, Conversion of NFA With epsilon moves to DFA, Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines.	12
2	Regular Expressions, Regular Grammar And Languages	Definition and Identities of Regular Expressions, Regular Grammar and Finite Automata: FA to RG and RG to FA, Left Linear and Right Linear Grammar and Inter-conversion between them. Closure Properties of RLs, Pumping Lemma for RL.	12
3	Context Free Grammar And	Definition and Construction of CFG, Definition and Generation of CFL from CFG. Ambiguous Grammar and Removal of Ambiguity. Simplification of Grammar. Normal Forms of Grammar: CNF and GNF. Chomsky Hierarchy.	12

	Languages		
4	**Pushdown Automata And Turing Machines**	**Pushdown Automata:** Definition and Construction of DPDA and NPDA. Equivalence of PDAs and CFGs, Closure Properties Of CFLs, Concept of Post Machines. **Turing Machines:** Definition and Construction of Turing Machines. Languages of TM. Types of TM. Time Complexity of TM, Halting Problem, Church's Turing Hypothesis, Comparison And Applications of DFA, PDA and TM.	12
5	**Decidability And Reducibility**	Decidable Languages, Decidable Problems Concerning Regular Languages, Decidable Problems Concerning Context-Free Languages. Decidable Problems With The TM, Turing Reducibility.	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Design Finite Automata machines for given problems.
CO2	Analyse a given Finite Automata machine and find out its Language.
CO3	Design Pushdown Automata machine for given CF language(s).
CO4	Generate the strings/sentences of a given context-free languages using its grammar.
CO5	Design Turing machines for given any computational problem.

Recommended Resources	
Text Books	1. John C. martin, "Introduction to Language and Theory of Computation", TMH, Third Edition. 978-0-07-066048-9. 2. Michel Sipser "Introduction to Theory of Computation" Thomson Course Technology, Second Edition 0-534-95097-3. 3. Kavi Mahesh, "Theory of Computation" Wiley-India, ISBN : 978-81-265-3311-4
Reference Books	1. HopcroftUlman, "Introduction To Automata Theory, Languages And Computations", Pearson Education Asia, 2nd Edition 2. Daniel I.A. Cohen, "Introduction to Computer Theory" Wiley-India, ISBN: 978-81-265-1334-5 3. E V Krishnamurthy, "Introduction to Theory of Computer Science", EWP Second 2nd Edition. 4. K.L.P Mishra, N. Chandrasekaran, " Theory Of Computer Science (Automata, Languages and Computation)", Prentice Hall India, 2nd Edition 5. Daniel I.A. Cohen, "Introduction to Automata Theory Languages and Computations", Pearson Education Asia, Second Edition.

Course: Computer Networks	Course Code: BCA303

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To develop an understanding of computer networking basics.
2	To gain knowledge of Layers involved in computer network.
3	To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications.
4	To analyse the concept of Transport Layer
5	To gain knowledge of Presentation Layer

Course Contents			
Unit No.	Module Name	Content	Hours
1	Basics of Computer Network	**Basics of Computer Network:** Uses of Computer Networks, Network Hardware:- LAN,WAN,MAN, Network Software-protocol hierarchies, design issues for layers, connection oriented and connection less services, service primitives, Services to protocol relationship. Reference models- OSI and TCP/IP. Performance: Bandwidth and Latency.	12
2	Physical Layer	**Physical Layer:** Packet Switching, Circuit Switching: Multiplexing: TDM FDM. Multiple Access: Random Access, Controlled Access, Channelization, LAN: Token Ring, FDDI, Ethernet- Fast Ethernet. Data Link Layer: Protocols, Error Detection and Correction, Flow Control protocols, Error control protocols.	12
3	Network Layer	**Network Layer:**Network Layer Protocols: IPv4, IPv6, ARP, ICMP. Routing Algorithms –Shortest path Algorithm. Congestion Control Algorithms: Leaky bucket algorithm. Congestion prevention Policies.	12
4	Transport Layer	**Transport Layer:** The transport Service: Service Provided to upper layers, Transport Service primitives, Berkeley sockets, Port Numbers, Transport Layer Protocols: Introduction to UDP, Remote procedure call, Introduction to TCP, Performance issues: Performance problems in Computer Network.	12
5	Presentation Layer	**Presentation Layer:** Functions Application Layer: WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP.	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Understand the basics of Computer Network
CO2	Recognize the technological trends of Computer Networking.
CO3	Discuss the key technological components of the Network.
CO4	Evaluate the challenges in building networks and solutions to those.
CO5	Communicate effectively in a variety of professional contexts.

Recommended Resources	
Text Books	1. Data Communications and Networking, Behrouz A Forouzan, Fourth Edition, (McGraw Hill)
Reference Books	1. Computer Communication Network design and analysis by Schwartz. 2. Computer Networks (PHI) by Andrew S. Tanenbaum. 3. Data and Computer Communication by William Stallings. 4. ComputerNetworks: A Top-Down Approach by Behrouz A Forouzan, FirouzMosharraf, Mc-Graw Hill.

Course - Java Programming	Course Code: BCA304

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
2	To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
3	To have the ability to write a computer program to solve specified problems.
4	To be able to use the Java SDK environment to create, debug and run simple Java programs.
5	To understand the applications created by Java Programming.

Course Contents			
Unit No.	Module Name	Content	Hours
1	Introduction to Java	**Introduction to Java**: Features of Java, JDK Environment Object **Oriented Programming Concept**: Overview of Programming, Paradigm, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism, Difference between C++ and JAVA.	12
2	Java Programming Fundamental and Classes and Objects	**Java Programming Fundamental:** Structure of JAVA program, Data types, Variables, Operators, Keywords, Naming Convention, Decision Making (if, switch), Looping (for, while), Type Casting **Classes and Objects:** Creating Classes and objects, Memory allocation for objects, Constructor, Implementation of Inheritance, Implementation of Polymorphism, Method Overloading, Method Overriding, Nested and Inner classes.	12
3	Arrays, Strings, Abstract Class, Interface and Packages	**Arrays and Strings:** Arrays, Creating an array, Types of Arrays, String class Methods, String Buffer methods. **Abstract Class, Interface and Packages**: Modifiers and Access Control, Abstract classes and methods, Interfaces, Packages Concept, Creating user defined packages	12
4	Exception Handling and	**Exception Handling:** Exception types, Using try catch and multiple catch, Nested try, throw, throws and finally, Creating User defined Exceptions. **Multithreading:** Multithreading Concept, Thread Life Cycle, Creating multithreading Application, Thread Priorities, Thread synchronization, Inter	12

	Multithreading	thread communication	
5	**Applet Programming and Abstract Window Toolkit Components and Graphics Containers**	**Applet Programming**: Introduction, Types Applet, Applet Life cycle, Creating Applet, Applet tag. **Abstract Window Toolkit Components and Graphics Containers:** Frames and Panels Layout Managers a. Border Layout b. Flow Layout c. Grid Layout d. Card Layout, AWT all Components Event Delegation Model, Event Source and Handlers Event Categories, Listeners, adapters Anonymous Classes	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Explain the fundamental concepts and features of Java Programming language.
CO2	Implement the basic principles of Object Oriented Programming which includes inheritance, polymorphism, encapsulation and abstraction.
CO3	Create arrays, and perform different operations on it.
CO4	Able to differentiate between Abstract Window Toolkit Components and Graphics Containers.
CO5	Develop applications by using Java Programming

Recommended Resources	
Text Books	1. E Balagurusamy , Programming with JAVA, TMH, 2007 2. Herbert Schildt , "Java-The Complete Reference", 8th Edition, 2009.
Reference Books	1. Java Programming (For absolute beginners) Russell PHI 2. Cay Horstmann, "Core Java", Wiley Publication , 3rd Edition., 2009

Course: Enterprise Resource Planning (with MIS)	Course Code: BCA305

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
2	0	0	2	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.
2	To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
3	To train the students to develop the basic understanding of how ERP enriches the Business organizations in achieving a multidimensional growth.
4	To analyse SWOT using various ERP products supply chain enabled ERP
5	To aim at preparing the students technological competitive and make them ready to Self - upgrade with the higher technical skills.

Course Contents			
Unit No.	Module Name	Content	Hours
1	Introduction	Business needs and ERP, ERP as an overview, entries as an overview, Benefits of ERP, ERP and related technologies, ERP architecture, business process reengineering, data warehousing, data mining, on line analytical processing supply choice management.	6
2	ERP	Client server architecture and ERP, ERP implementation life cycle, implementation methodologies, ERP implementation –The hidden cost, organizing implementations, vendors, consultants and users, contracts with vendors, consultants and employees, project management and monitoring. After ERP implementation.	6
3	The Business Module	Business models in an ERP package finance, manufacturing human resource, plant maintenance, materials management, quality management sales and distribution.	6
4	Analysis	Selection of ERP, SWOT analysis of various ERP products supply chain enabled ERP. ERP and Electronic Data Interchange (EDI) integration, ERP in manufacturing and non-manufacturing industries.	6
5	MIS	Management information system in a digital firm: Management Information System (MIS): Concept, Definition, Role of MIS, Impact of the MIS, MIS and the user, Management as a control system MIS: A support to the management, Management effectiveness and MIS, Organization as a System, MIS: Organization Effectiveness, MIS for a digital firm.	6

		E-Business Enterprise: A digital firm - Introduction, Organization of business in a digital firm, E-Business, E-Commerce, E-Communication, E-Collaboration, Real Time Enterprise.	
			Total No. of Hrs **30**

Course Outcome	
Students should able to	
CO1	Make basic use of Enterprise software, and its role in integrating business functions.
CO2	Evaluate the methodologies of ERP
CO3	Analyse the strategic options for ERP identification and adoption.
CO4	Design the ERP implementation strategies.
CO5	Create reengineered business processes for successful ERP implementation.

Recommended Resources	
Text Books	1. Enterprise Resource Planning – Alexis Leon – Second Edition – TMH
Reference Books	1. Enterprise Resource Planning by ParagDiwan and Sunil Sharma (Pentagon Pren.) 2. ERP in practice – Vaman - TMH 3. Daniel E.O'Leary, Enterprise Resource Planning Systems, Cambridge University Press, 2002. 4. Ellen Monk, Bret Wagner, Concepts in Enterprise resource planning, Cengage learning, Third edition, 2009.

Course: Computer Networks Lab	Course Code: BCA306

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Lab participation/ Attendance)	CIA-2 (Written Practical Logbook)	CIA-3 (Viva/Oral)	Written Performance	Viva / Oral	
0	0	4	2	10	10	10	50	20	100
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives	
1	To understand the working with Computer Networks
2	To understand different types of Network cables.
3	To learn the Local Area Networking concepts.
4	To configure the Static and Default Routes in networking.
5	To plan the Network-based Firewalls.

List of Programs

1. Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.
2. Study of Network Devices in Detail.
3. Study of network IP.
4. Connect the computers in Local Area Network.
5. Study of basic network command and Network configuration commands.
6. Performing an Initial Switch Configuration.
7. Performing an Initial Router Configuration.
8. Configuring and Troubleshooting a Switched Network.
9. Connecting a Switch.
10. Configuring WEP on a Wireless Router.
11. Examining WAN Connections.
12. Interpreting Ping and Traceroute Output.
13. Demonstrating Distribution Layer Functions.
14. Exploring Different LAN Switch Options.
15. Implementing an IP Addressing Scheme.
16. Examining Network Address Translation (NAT).
17. Observing Static and Dynamic Routing.
18. Configuring Ethernet and Serial Interfaces.
19. Configuring a Default Route.
20. Configuring Static and Default Routes.
21. Planning Network-based Firewalls.
22. Configuring a Cisco Router as a DHCP Server.

Course Outcome	
Students should able to	
CO1	Describe the general principles of data communication.
CO2	Describe how computer networks are organized with the concept of layered approach.

CO3	Implement a simple LAN with hubs, bridges and switches.
CO4	Analyse the contents in a given data link layer packet, based on the layer concepts.
CO5	Decide routing entries given a simple example of network topology.

Course: Java Programming Lab	Course Code: BCA 307

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Lab participation/ Attendance)	CIA-2 (Written Practical Logbook)	CIA-3 (Viva/Oral)	Written Performance	Viva / Oral	
0	0	4	2	10	10	10	50	20	100
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives	
1	The course is designed to develop skills to implement java programming.
2	Students will be able to identify and apply the suitable programming to design applications and interface.
3	Students will be able to gain knowledge in practical applications of java.
4	Designing Enterprise based applications by encapsulating an application's business logic.
5	Designing applications using pre-built frameworks.

List of Programs

1. Write A Program to find the largest of n natural numbers.

2. Write A Program to find whether a given number is prime or not.

3. Write a menu driven program for following:
   a. Display a Fibonacci series
   b. Compute Factorial of a number
   c. Write A Program to check whether a given number is odd or even.
   d. Write A Program to check whether a given string is palindrome or not.

4. Write A Program to print the sum and product of digits of an Integer and reverse the Integer.

5. Write a program to create an array of 10 integers. Accept values from the user in that array. Input another number from the user and find out how many numbers are equal to the number passed, how many are greater and how many are less than the number passed.

6. Write a program that will prompt the user for a list of 5 prices. Compute the average of the prices and find out all the prices that are higher than the calculated average.

7. Write a program in java to input N numbers in an array and print out the Armstrong numbers from the set.

8. Write java program for the following matrix operations:
   a. Addition of two matrices
   b. Summation of two matrices
   c. Transpose of a matrix
   d. Input the elements of matrices from user.

9. Write a java program that computes the area of a circle, rectangle and a Cylinder using function overloading.

10. Write a Java for the implementation of Multiple inheritance using interfaces to calculate the area of a rectangle and triangle.

11. Write a java program to create a frame window in an Applet. Display your name, address and qualification in the frame window.

12. Write a java program to draw a line between two coordinates in a window.

13. Write a java program to display the following graphics in an applet window.
    a. Rectangles
    b. Circles
    c. Ellipses
    d. Arcs
    e. Polygons

14. Write a program for the following string operations:
    a. Compare two strings
    b. Concatenate two strings
    c. Compute length of a string

15. Write a program that reads two integer numbers for the variables a and b. If any other character except number (0-9) is entered then the error is caught by NumberFormatException object. After that ex.getMessage() prints the information about the error occurring causes.

16. Write a program to display an image in applet.

17. Create a class called Fraction that can be used to represent the ratio of two integers. Include appropriate constructors and methods. If the denominator becomes zero, throw and handle an exception.

Course Outcome	
Students should able to	
CO1	Write Java application programs using OOP principles and proper program structuring.
CO2	Develop Java program using packages, inheritance and interface.
CO3	Write Java programs to implement error handling techniques using exception handling and develop programs using class and inputs from keyboard.
CO4	Develop graphical User Interface using AWT.
CO5	Demonstrate event handling mechanism.

Course: Capstone Project	Course Code: BCA308

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Lab participation/ Attendance)	CIA-2 (Written Practical Logbook)	CIA-3 (Viva/Oral)	Written Performance	Viva / Oral	
0	0	4	2	10	10	10	50	20	100
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives	
1	Exposure to Learning and knowledge access techniques using Conferences, Journal papers and participation in research activities
2	To develop software engineering documents and testing plans
3	To use algorithmic solutions using distributed, Embedded, concurrent and parallel environments
4	To apply algorithmic strategies while solving problems.
5	To encourage and expose students for participation in National/ International paper presentation activities.

Activity Planning:

1. Project workstation selection, installations and setup along with report to the guide.

2. Programming of the project, GUI (if any) as per Term work submission.(recommended submission date:- Progress report every week during laboratory)

3. Test tool selection for various testing and generate various testing result charts, graphs etc. including reliability testing.

4. Review of design and necessary corrective actions taking into consideration feedback report of Term assessment, and other competitions/conference.

5. Students to publish at least one technical paper in Conference/peer review journal.

6. Final term work submissions in the prescribed format given by the guides consisting of a project report consisting of a preliminary report, detailed design (all necessary UML diagrams) document, User Interface design , test results generated by selected project testing tool, conclusions, appendix (if necessary), glossary, tools used and references at the end.

7. The Term examination is conducted by panel of examiners (preferably guide and expert from Industry having relevant experience (or senior teacher in the subject in case of non- availability of industry expert).

8. The project assessment shall be done using Live Project Demonstration [in existing functional condition], using necessary simulators (if required) and presentation by the students.

Tools:

Preferably 64-bit FOSS (Free and open-source software) tools, 3-tier architectures along with latest version of Free and open-source software Operating systems like Fedora 21 or equivalent, LAMP tools, WEB server, Applications servers, Database servers, MongoDB or latest open source Bigdata tools, Free and open-source software Programming Tools like gcc,g++, Java and other tools are as per the requirement of the SRS. The documentation tools like Open Source, GIT, Latex.

Seminar Topic Selection and Evaluation

Seminar based on state-of-the art in the selected Project Domain. The presentation and the report should cover motivation, mathematical modeling, data-table discussion and conclusion. The reports to be prepared using LATEX derivative.

It is mandatory on the seminar guides to maintain a progressive record of the seminar of 1 Hrs per month per seminar which shall include the discussion agenda, weekly outcomes achieved during practical sessions, corrective actions and comments on the progress report as per the plan submitted by the students including dates and timing, along with the signature of the student as per the class and teacher time table, such record of progressive work shall be referred by the examiners during evaluation.

BCA II Year Semester IV

Course: Distributed Database Management Systems	Course Code: BCA401

Teaching Scheme (Hrs/Week)				Continuous In-Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class Participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) - 3Hrs.									

Course Objectives	
1	To understand the difference between the centralized and distributed database systems in general.
2	To introduce the students to the needed techniques that are used to design and manage a distributed database.
3	Develop the logical design of the database using data modeling concepts such as entity-relationship diagrams.
4	Create a relational database using a relational database package.
5	Assess the quality and ease of use of data modeling and diagramming tools.

Course Content			
Unit No.	Module Name	Content	Hours
1.	Distributed DBMS Architecture and Distributed Database Design	**Introduction**: Distributed Data Processing, Distributed Database, System, Promises of DDBSs, Problem areas. **Distributed DBMS Architecture:** Architectural Models for Distributed DBMS, DDMBS Architecture. **Distributed Database Design:** Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.	12
2	Query processing and decomposition and Distributed query Optimization	**Query processing and decomposition:** Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data. **Distributed query Optimization:** Query optimization, centralized query optimization, distributed query optimization algorithms.	12
3	Transaction Management	**Transaction Management:** Definition, properties of transaction, types of transactions, distributed concurrency control: serializability, concurrency control mechanisms & algorithms, time - stamped & optimistic concurrency control Algorithms, deadlock Management.	12
4	Distributed	**Distributed DBMS Reliability:** Reliability concepts and measures, fault-	12

	DBMS Reliability and Parallel Database Systems	tolerance in distributed systems, failures in Distributed DBMS, local & distributed reliability protocols, site failures and network partitioning. **Parallel Database Systems:** Parallel database system architectures, parallel data placement, parallel query processing, load balancing, database clusters.	
5	**Distributed object Database Management Systems and Object Oriented Data Model**	**Distributed object Database Management Systems:** Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing. **Object Oriented Data Model:** Inheritance, object identity, persistent programming languages, persistence of objects, comparison OODBMS and ORDBMS	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Understand theoretical and practical aspects of distributed database systems.
CO2	Study and identify various issues related to the development of distributed database system.
CO3	Understand the design aspects of object-oriented database system and related development.
CO4	Understand distributed database systems architecture and design.
CO5	Be able to apply methods and techniques for distributed quey processing and optimisation.

Recommended Resources	
Text Books	4. A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", fifth Edition McGraw-Hill 5. M. Tamer OZSU and PatuckValduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001. 6. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill.
Reference Books	1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The Complete Book", Second Edition, Pearson International Edition 2. Rob, Coronel, "Database Systems", Seventh Edition, Cengage Learning

Course - Artificial Intelligence	Course Code: BCA402

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To provide a strong foundation of fundamental concepts in Artificial Intelligence & Machine Learning.
2	To provide a basic exposition to the goals and methods of Artificial Intelligence & Machine Learning.
3	To enable the student to apply these techniques in applications which involve perception, reasoning and learning.
4	To know about the basic building block of AI & the concept of machine thinking.
5	Explain the evolution of AI and modern concepts and programming platforms for AI.

Course Contents			
Unit No.	Module Name	Content	Hours
1	Overview of AI &ML	**Overview of AI &ML:** Introduction and history of AI, Introduction and history of ML, Overlap between ML and AI. Applications of AI & ML in the modern context.	12
2	AI Problems and ML	**AI Problems:** How are AI problems different from others, Branches of AI, Real life uses of AI ML: Game Playing, Natural Language Processing, Expert Systems, Image Understanding, and Robotics. Machine Learning, Virtual Reality, Computer Vision, Nature Inspired Computing. (With real time recent examples & case studies.)	12
3	Types of data and Foundational Statistics	**Types of data:** Structured, Semi-structured, Unstructured, Presence of noise in data. **Foundational Statistics:** Central tendencies, variance, standard deviation, frequencies, Principle of counting, definitions of probability theory, conditional probability, events.	12
4	Advanced Statistics	**Advanced Statistics:** Continuous probability distribution, normal distribution. Central Limit Theorem, Binomial Distribution, Poisson distribution, Linear regression.	12
5	Foundational Linear Algebra	**Foundational Linear Algebra:** Introduction to linear algebra, notations and definitions Operations on matrices - additions, subtraction, multiplication, scalar multiplication, vector multiplication, Matrix inversion, transformation.	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Explain what constitutes "Artificial" Intelligence and how to identify systems with Artificial Intelligence
CO2	Explain how Artificial Intelligence enables capabilities that are beyond conventional technology, for example, chess-playing computers, self-driving cars, robotic vacuum cleaners.
CO3	Define the concept of Artificial Intelligence.
CO4	Apply AI techniques to real-world problems to develop intelligent systems.
CO5	Select appropriately from a range of techniques when implementing intelligent systems.

Recommended Resources	
Text Books	1. Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair, Tata McGraw Hill. 2. Introduction to Artificial Intelligence and Expert Systems by Dan W. Patterson, Pearson Education. 3. Artificial Intelligence: A Modern Approach by S. Russell and P. Norvig, Prentice Hall. 4. Introduction to Machine Learning by EthemAlpaydin, PHI Learning. 5. Machine Learning: An Algorithmic Perspective by Stephen Marsland, Chapman and Hall/CRC.
Reference Books	1. Foundations of AIML , Facilitators Handbook Release 1.0.0 , Suresh K. Xebia 2. Artificial Intelligence: Foundations Of Computational Agents- D. Poole- Cambridge University Press, 2010 3. "Artificial Intelligence and Intelligent Systems"- Padhy N.P-4th impression , Oxford University Press, 2007. 4. Super intelligence paths, Dangers and Strategies- Nick Bostrom 5. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2008.

Course: Object Oriented Modelling and Design	Course Code: BCA403

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To learn the basics of modelling techniques.
2	To study the Modeling as Design Technique.
3	To be familiar with Process Overview, System Conception and Domain Analysis.
4	To understand and master the concepts of Class Design, Implementation Modeling and Legacy Systems.
5	To apply the knowledge of Design Patterns.

Course Content			
Unit No.	Module Name	Content	Hours
1.	**Introduction, Modeling Concepts, Class Modeling**	What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO modeling history. **Modeling as Design Technique:**Modeling; abstraction; The three models. **Class Modeling:** Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips.	12
2	**Advanced Class Modeling, State Modeling, Advanced State Modeling, Interaction Modeling**	**Advanced object and class concepts:** Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips. **State Modeling:** Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips. **Advanced State Modeling:** Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips. **Interaction Modeling:** Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models.	12
3	**Process Overview,**	**Process Overview**: Development stages; Development life cycle. **System Conception:** Devising a system concept; Elaborating a concept;	12

	System Conception, Domain Analysis and Application Analysis, System Design	Preparing a problem statement. **Domain Analysis:** Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis. **Application Analysis:** Application interaction model; Application class model; Application state model; Adding operations. System design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example.	
4	**Class Design, Implementation Modeling, Legacy Systems**	**Class Design:** Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example. **Implementation Modeling:** Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations; Testing. **Legacy Systems:** Reverse engineering; Building the class models; Building the interaction model; Building the state model; Reverse engineering tips; Wrapping; Maintenance.	12
5	**Design Patterns – 1 And 2**	What is a **pattern** and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description. **Communication Patterns:** Forwarder-Receiver; Client-Dispatcher-Server; Publisher Subscriber. **Management Patterns:** Command processor; View handler. IDIOMS: Introduction; What can idioms provide? Idioms and style; Where to find idioms; Counted Pointer example.	12
		Total No. of Hrs	60

Course Outcome	
Students should able to	
CO1	Understand importance of modeling in the software development life cycle.
CO2	Study the Modeling as Design Technique.
CO3	Familiar with the object-oriented approach to analyzing and designing systems and software solutions.
CO4	Understand and master the concepts of Class Design, Implementation Modeling and Legacy Systems.
CO5	Explain How to Employ the UML notation to create effective and efficient system designs.

Recommended Resources	
Text Books	1. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, 2nd Edition, Pearson Education, 2005.

	2. Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2007.
Reference Books	1. Grady Booch et al: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson Education, 2007. 2. Brahma Dathan, SarnathRamnath: Object-Oriented Analysis, Design, and Implementation, Universities Press, 2009. 3. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, Wiley-Dreamtech India, 2004. 4. Simon Bennett, Steve McRobb and Ray Farmer: Object-Oriented Systems Analysis and Design Using UML, 2nd Edition, Tata McGraw-Hill, 2002.

Course - Cloud Computing	Course Code: BCA404

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To Study Cloud Computing Concepts.
2	Enhancing Cloud Computing Environment.
3	To Study Various Platforms.
4	To Have Thorough Knowledge of Virtualization Technologies.
5	To study the applications that uses cloud computing.

Course Contents			
Unit No.	Module Name	Content	Hours
1	Cloud Introduction	**Cloud Introduction:** **Cloud Computing Fundamentals:** Cloud Computing Definition, Types of Cloud **Cloud Services:** Benefits and Challenges of Cloud Computing, Evolution of Cloud Computing, Usage Scenarios and Applications, Business Models Around Cloud, Major Players in Cloud Computing, Issues in Cloud, Eucalyptus, Nimbus , Open Nebula, CloudSim.	12
2	Cloud Services and File System	**Cloud Services and File System:** **Types of Cloud services:** Software as a Service, Platform as a Service, Infrastructure as a Service, Database as a Service, Monitoring as a Service, Communication as Services. Service Providers, Google App Engine, Amazon EC2, Microsoft Azure, Sales force. Introduction to Map Reduce, GFS, HDFS, Hadoop Framework.	12
3	Collaborating With Cloud	**Collaborating With Cloud:** Collaborating on Calendars, Schedules and Task Management, Collaborating on Event Management, Contact Management, Project Management, Collaborating on Word Processing, Databases, Storing and Sharing Files- Collaborating via Web-Based Communication Tools, Evaluating Web Mail Services, Collaborating via Social Networks, Collaborating via Blogs and Wikis.	12
4	Virtualization For	**Virtualization For Cloud:** Need for Virtualization, Pros and Cons of Virtualization, Types of Virtualization, System VM, Process VM, Virtual Machine Monitor, Virtual Machine Properties, Interpretation and Binary	12

	Cloud	Translation, HLL VM, Hypervisors, Xen, KVM , VM Ware, Virtual Box, Hyper-V.	
5	**Security, Standards and Applications**	**Security, Standards and Applications** **Security in Clouds:** Cloud Security Challenges, Software as a Service Security. **Common Standards:** The Open Cloud Consortium, The Distributed Management Task Force, Standards for Application Developers , Standards for Messaging, Standards for Security, End user Access to Cloud Computing, Mobile Internet Devices and the Cloud.	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Able to Understand Cloud Computing Concepts
CO2	Develop Basic Applications of Cloud Computing.
CO3	Analyze various cloud programming models and apply them to solve problems on the cloud.
CO4	Apply fundamental concepts in cloud infrastructures to understand the trade-offs in power, efficiency and cost, and then study how to leverage and manage single and multiple data centres to build and deploy cloud applications that are resilient, elastic and cost-efficient.
CO5	Discuss system, network and storage virtualization and outline their role in enabling the cloud computing system model.

Recommended Resources	
Text Books	1. Bloor R., Kanfman M., Halper F. Judith Hurwitz “Cloud Computing ” Wiley India Edition,2010 2. John Rittinghouse& James Ransome, “Cloud Computing Implementation Management and Strategy”, CRC Press, 2010 3. Antohy T Velte ,Cloud Computing : “A Practical Approach”, McGraw Hill,2009
Reference Books	1. Michael Miller, Cloud Computing: “Web-Based Applications That Change the Way You Work and Collaborate Online”, Que Publishing, August 2008. 2. James E Smith, Ravi Nair, “Virtual Machines”, Morgan Kaufmann Publishers, 2006.

Course: Bootstrap Programming	Course Code: BCA405

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
4	0	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	Built-in Support for layout, grids, fluid grids, and responsive designs.
2	Pre-built CSS: Contains global CSS classes for typography, tables, grids, forms, buttons, images, and more.
3	Components: Contains lots of reusable components including Icons, Dropdowns, Navbars, Breadcrumbs, Popovers, Alerts, and many more.
4	JavaScript Plug-ins: Contains lots of custom jQuery plug-ins. You can include them all or one by one.
5	Customizable Components: We can customize Bootstrap's components with LESS variables andjQuery plug-ins to create our own version.

Course Content			
Unit No.	Module No.	Content	Hours
1.	Front-end Web UI Frameworks Overview: Bootstrap	**Front-end Web UI Frameworks Overview: Bootstrap** How to Use the Learning Resources, What is Full-Stack Web Development? Node.js and NPM Front-end Web UI Frameworks, Introduction to Bootstrap, Responsive Web Design, Setting up Environment, How to apply Bootstrap to Applications.	12
2	Bootstrap's Javascriptcomponents	How to customize Bootstrap's components, Less variables, and jQuery plug-in, Bootstrap Typography, Bootstrap Tables, Bootstrap Form Layout, Bootstrap Button, Bootstrap images, display text hide or show the text in Bootstrap	12
3	Bootstrap Grid	What is Bootstrap Grid? Apply Bootstrap Grid, What is Container, How to Reordering Columns, Advantages of Bootstrap Grid, How to Display responsive Images, How to change class properties, How to use readymade themes,	12
4	Bootstrap Core Components	**Bootstrap Components:** Colors, Tables, Images, Jumbotron , Alerts, Buttons, Button Groups, Badges, Progress Bars, Spinners, Pagination, List Groups, Cards, Dropdowns, Collapse, Navs, Navbar, Carousel, Modal, Tooltip, Popover, Toast, Scrollspy, Offcanvas, Utilities, Flex	12
5	Bootstrap Forms and Web Tools	**Bootstrap Forms**: Select Menus, Checks and Radios, Range, Input Groups, Floating Labels, Form Validation. **Web Tools:**CSS Preprocessors: Less and Sass, JQuery and Sass, NPM Scripts, Task Runners	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Enhance the students for implementing UI Frameworks.
CO2	Apply basic programming using CSS.
CO3	Implement Bootstrap JavaScript.
CO4	Learn a variety of useful tools.
CO5	Develop Responsive, mobile first projects on the web.

Recommended Resources	
Text Books	Modular Design Frameworks: A Projects-based Guide for UI/UX Designers September 2017 by James Cabrera.
Reference Books	1. Bootstrap in 24 Hours, Sams Teach Yourself, Sams Publishing, Kyrnin, Jennifer (Author), English (Publication Language) 2. Node.js Web Development: Server-side web development made easy with Node 14 using practical... 3. Mastering Bootstrap 4 - Second Edition: Master the latest version of Bootstrap 4 to build highly. Jakobus, Benjamin (Author) English (Publication Language)354 Pages - 02/22/2018 (Publication Date) - Packt Publishing (Publisher) 4. Bootstrap Site Blueprints Volume II: Maximize the potential of Bootstrap for faster and more. Lambert, Matt (Author) English (Publication Language)328 Pages - 01/06/2016 (Publication Date) - Packt Publishing (Publisher)

Course: Bootstrap Lab	Course Code: BCA406

Course: Object Oriented Modelling and Design Lab	Course Code: BCA407

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Lab participation/ Attendance)	CIA-2 (Written Practical Logbook)	CIA-3 (Viva/Oral)	Written Performance	Viva / Oral	
0	0	4	2	10	10	10	50	20	100
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives	
1	To understand the Object-based view of Systems.
2	To develop robust object-based models for Systems.
3	To inculcate necessary skills to handle complexity in software design.
4	The importance of modeling in the software development life cycle
5	The object-oriented approach to analyzing and designing systems and software solutions

List of Programs

1. Introduction of object oriented analysis and object oriented design.
2. Object Oriented Modeling, Choose a hypothetical system of significant complexity (on your project topic) and write an SRS.
3. Draw one or more Use Case diagrams for capturing and representing requirements of the system. Use case diagrams must include template showing description and steps of the Use Case for various scenarios.
4. Draw basic class diagrams to identify and describe key concepts like classes, types in your system and their relationships.
5. Draw sequence diagrams OR communication diagrams with advanced notation for your system to show objects and their message exchanges.
6. Draw activity diagrams to display either business flows or like flow charts.
7. Draw component diagrams assuming that you will build your system reusing existing components along with a few new ones.
8. Draw deployment diagrams to model the runtime architecture of your system.
9. Draw Usecase diagrams of projects with suitable example.
10. Draw Class diagrams of projects with suitable example.
11. Draw Component Diagram of projects with suitable example.
12. Draw Deployment Diagram of projects with suitable example.

Course Outcome	
Students should able to	
CO1	Ability to analyze and model software specifications.

CO2	Ability to abstract object-based views for generic software systems.
CO3	Ability to deliver robust software components.
CO4	Show the importance of systems analysis and design in solving complex problems.
CO5	Show how the object-oriented approach differs from the traditional approach to systems analysis and design.

BCA III Year Semester V

Course: Data Mining and Data Warehousing	Course Code: BCA501

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	Be familiar with mathematical foundations of data mining tools
2	Understand and implement classical models and algorithms in data warehouses and data mining
3	Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
4	Master data mining techniques in various applications like social, scientific and environmental context.
5	Develop skill in selecting the appropriate data mining algorithm for solving practical problems

Course Content			
Unit No.	Module Name	Content	Hours
1.	Data Warehouse	Introduction to Data Ware House, Differences between operational data base systems and data Ware House, Data Ware House characteristics, Data Ware House Architecture and its components, Extraction-Transformation-Loading, Logical (Multidimensional), Data Modeling, Schema Design, star and snow-Flake Schema, Fact Constellation, Fact Table, Fully Addictive, Semi-Addictive, Non-Addictive Measures; Fact Less-Facts, Dimension Table characteristics; Fact-Less-Facts, Dimension Table characteristics; OLAP cube, OLAP Operations, OLAP Server Architecture-ROLAP, MOLAP and HOLAP.	12
2	Introduction to Data Mining	Introduction, What is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Pre-processing- Data Cleaning, Missing Data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binarization , Data Transformation; Measures of similarity and dissimilarity-Basics.	12
3	Association Rules	Problem Definition, Frequent Item Set Generation, The APRIORI Principle, Support and Confidence Measures, Association Rule Generation, APRIORI Algorithm, The Partition Algorithms, FP-Growth Algorithms, Compact Representation of Frequent Item Set-Maximal Frequent Item Set, Closed Frequent Item Set.	12
4	Classification	Problem definition, General Approaches to solving a classification problem, Evaluation of Classifiers, Classification techniques, Decision	12

		trees-Decision Tree Construction, Methods for expressing attribute test conditions, Measures for Selecting the Best split, Algorithm for Decision tree Induction, Naïve-Bayes Classifier, Bayesian Belief Networks; K-nearest neighbour classification-Algorithm and characteristics.	
5	**Clustering**	Problem Definition, Clustering overview, Evaluation of clustering algorithms, Partitioning clustering K-Means Algorithm, K-Means Additional Issues, PAM Algorithm, Hierarchical Clustering-Algorithm- Agglomerative Methods and Divisive Methods, Basic Agglomerative Hierarchical Clustering Algorithm, Specific techniques, Key Issues in Hierarchical Clustering, Strengths and weakness, Outlier Detection	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Understand the functionality of the various data mining and data warehousing component
CO2	Appreciate the strengths and limitations of various data mining and data warehousing models
CO3	Explain the analysing techniques of various data
CO4	Describe different methodologies used in data mining and data ware housing.
CO5	Compare different approaches of data ware housing and data mining with various technologies.

Recommended Resources	
Text Books	1) Data Mining-Concepts and Techniques- Jiawei Han, MichelineKamber, Morgan Kaufmann Publishers, Elsevier, 3rd Edition, 2011. 2) Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
Reference Books	1) Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press. 2) Data Ware Housing Fundamentals, PualrajPonnaiah, Wiley Student Edition. 3) The Data Ware House Life Cycle Toolkit- Ralph Kimball, Wiley Student Edition. 4) Data Mining, VikaramPudi, P Radha Krishna, Oxford University.

Course: Software Engineering	Course Code: BCA 502

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2	Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams.
3	Apply their foundations in software engineering to adapt to readily changing environments using the appropriate theory, principles and processes.
4	Be successful professionals in the field with solid fundamental knowledge of software engineering
5	Utilize and exhibit strong communication and interpersonal skills, as well as professional and ethical principles when functioning as members and leaders of multi-disciplinary teams

Course Content			
Unit No.	Module Name	Content	Hours
1.	**Introduction**	Software What is software? Types of software Characteristics of Software Attributes of good software Software Engineering: What is software engineering? Software engineering costs What are the key challenges facing software engineering? Systems engineering & software Engineering	12
2	**Software Development Process Models**	What is a software process? What is a software process model? The waterfall model, Evolutionary development, Component-Based Software Engineering (CBSE), Process Iteration: Incremental delivery, Spiral development, Rapid software development: Agile methods, Extreme programming, Rapid application development (RAD), Software prototyping.	12
3	**Software Requirements**	Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document. Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. System models: Context models, behavioral models, data models, object models, structured methods.	12
4	**Design Engineering**	Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use	12

		case diagrams, component diagrams.	
5	**Testing Strategies**	A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging. Quality Management:Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	How to apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment
CO2	An ability to work in one or more significant application domains
CO3	Work as an individual and as part of a multidisciplinary team to develop and deliver quality software
CO4	Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle
CO5	Demonstrate an ability to use the techniques and tools necessary for engineering practice

Recommended Resources	
Text Books	1) Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, McGraw Hill International Edition. 2) Software Engineering- Sommerville, 7th edition, Pearson Education. 3) The unified modeling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.
Reference Books	1) Software Engineering, an Engineering approach- James F. Peters, WitoldPedrycz, John Wiley. 2) Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill Companies. 3) Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.

Course: Organisational Behaviour	Course Code: 503

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
4	0	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To provide the students with the conceptualframework and the theories underlying Organizational Behaviour.
2	to improve students understanding of human behaviour in organization andthe ability to lead people to achieve more effectively toward increased organizationalperformance
3	Understand individual behaviour in organizations, including diversity, attitudes, jobsatisfaction, emotions, moods, personality, values, perception, decision making, andmotivational theories.
4	Understand group behaviour in organizations, including communication, leadership,power and politics, conflict, and negotiations.
5	Understand the organizational system, including organizational structures, culture,human resources, and change.

Course Content			
Unit No.	Module Name	Content	Hours
1.	Introduction to OB and Cognitive Processes-I	**Introduction to OB** - Definition, Nature and Scope – Environmental and organizational context – Impactof IT, globalization, Diversity, Ethics, culture, reward systems and organizational design onOrganizational Behaviour. **Cognitive Processes-I:** Perception and Attribution: Nature and importance ofPerception – Perceptual selectivity and organization – Social perception – Attribution Theories – Locusof control –Attribution Errors – Impression Management.	
2	Cognitive Processes-II	**Cognitive Processes-II:** Personality and Attitudes – Personality as a continuum – Meaning of personality- Johari Window and Transactional Analysis - Nature and Dimension of Attitudes – Job satisfaction andorganizational commitment-Motivational needs and processes- Work-Motivation Approaches Theoriesof Motivation- Motivation across cultures - Positive organizational behaviour: Optimism – Emotionalintelligence – Self-Efficacy.	
3	Dynamics of OB-I andDynamics of OB –II	**Dynamics of OB-I:** Communication – types – interactive communication in organizations – barriers tocommunication and strategies to improve the follow of communication - Decision Making: Participativedecision-making techniques – creativity and group decision making. **Dynamics of OB –II** Stress andConflict: Meaning and types of stress – Meaning and types of conflict - Effect of stress and intraindividual conflict - strategies to cope with stress and conflict.	
4	Dynamics of OB –III	**Dynamics of OB –III** Power and Politics: Meaning and types of power – empowerment - Groups Vs.Teams – Nature of groups – dynamics of informa	

		groups – dysfunctions of groups and teams – teamsin modern work place.	
5	**Leading High performance**	**Leading High performance:** Job design and Goal setting for High performance- Quality of Work LifeSocio technical Design and High-performance work practices - Behavioural performance management:reinforcement and punishment as principles of Learning – Process of Behavioural modification -Leadership theories - Styles, Activities and skills of Great leaders.	
		Total No. of Hrs	60

Course Outcome	
Students should able to	
CO1	to discuss the development of the field of organizational behaviour and explain the micro and macro approaches
CO2	to analyze and compare different models used to explain individual behaviour related to motivation and rewards
CO3	to identify the processes used in developing communication and resolving conflicts
CO4	to explain group dynamics and demonstrate skills required for working in groups (team building)
CO5	to identify the various leadership styles and the role of leaders in a decision making process.

Recommended Resources	
Text Books	1. Luthans, Fred: Organizational Behaviour 10/e, McGraw-Hill, 2009 2. McShane: Organizational Behaviour, 3e, TMH, 2008 3. Nelson: Organizational Behaviour, 3/e, Thomson, 2008. 4. Newstrom W. John & Davis Keith, OrganisationalBehaviour-- Human Behaviour at Work, 12/e,TMH, New Delhi, 2009. 5. Pierce and Gardner: Management and OrganisationalBehaviour: An Integrated perspective, Thomson, 2009.
Reference Books	1. Robbins, P. Stephen, Timothy A. Judge: Organisational Behaviour, 12/e, PHI/Pearson, New Delhi, 2009. 2. PareekUdai: Behavioural Process at Work: Oxford & IBH, New Delhi, 2009. 3. Schermerhorn: Organizational Behaviour 9/e, Wiley, 2008. 4. Hitt: Organizational Behaviour, Wiley, 2008 5. Aswathappa: Organisational Behaviour, 7/e, Himalaya, 2009 6. Mullins: Management and Organisational Behaviour, Pearson, 2008. 7. McShane, Glinow: Organisational Behaviour--Essentials, TMH, 2009. 8. Ivancevich: Organisational Behaviour and Management, 7/e, TMH, 2008.

Course: Python Programming	Course Code: BCA504

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To know the basics of Programming.
2	To structure a Python Program as a set of functions.
3	To use Python data structures-lists, tuples, dictionaries.
4	To do input/output with files in Python.
5	To construct Python programs as a set of objects.

Course Content

Unit No.	Module Name	Content	Hours
1.	Introduction to Python Programming	**Python Interpreter and Interactive Mode** – Variables and Identifiers – Arithmetic Operators – Values and Types – Statements, Reading Input, print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language. **Control Flow Statements**: The if, The if…else, The if…if…else Decision Control Statements, Nested if Statement, The while Loop, The for Loop, The continue and break Statements. - Elements of programming	12
2	Functionsand Strings	**Functions**: Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments. **Strings**: Creating and Storing Strings, Basic String Operations, Accessing Characters inString by Index Number, String Slicing and Joining, String Methods, Formatting Strings.	12
3	Lists	**Lists**: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples : tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.	12
4	Files and exception	**Files and exception**: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.	12
5	Object-Oriented Programming	**Object-Oriented Programming**: Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance The Polymorphism. **Functional Programming**: Lambda. Iterators, Generators, List	12

		Comprehensions.	
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Develop algorithmic solutions to simple computational problems and execute simple Python programs.
CO2	Structure a Python program into functions.
CO3	Represent compound data using Python lists, tuples, and dictionaries.
CO4	Read and write data from/to files in Python Programs.
CO5	Implement programs with classes and objects.

Recommended Resources	
Text Books	1. Introduction to Python Programming. Gowrishankar S., Veena A. CRC Press, Taylor & Francis Group, 2019 2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition,Updated for Python 3, Shroff/O'Reilly Publishers, 2016 3. P. K. Sinha&PritiSinha, "Computer Fundamentals", BPB Publications, 2007. 4. Dr. Anita Goel, Computer Fundamentals, Pearson Education, 2010. 5. T. Budd, Exploring Python, TMH, 1st Ed, 2011
Reference Books	1. Learning To Program With Python. Richard L. Halterman. Copyright © 2011 2. Python for Everybody, Exploring Data Using Python 3. Dr. Charles R. Severance.

Course: Elective I- Mobile Applications using Android	Course Code: BCA505

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
2	1	0	3	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	Describe the Android SDK features and the Development Framework and understanding Activities.
2	Create adaptive, responsive user interfaces that work across a wide range of devices.
3	Perform background work and long-running tasks in Android applications
4	Know the concepts of Storing, sharing and retrieving data in Android applications
5	Learn how permissions, security and performance affect application. Finally, make sure your app is ready to share with the world, and publish it

Course Contents			
Unit No.	Module Name	Content	Hours
1	Introduction	What Is Android?, Android Versions, Features of Android, Architecture of Android, Android Devices in the Market, The Android Market, Obtaining the Required Tools, Eclipse, Android SDK, Android Development Tools (ADT), Creating Android Virtual Devices (AVDs), Creating Your First Android Application, Anatomy of an Android Application. Understanding Activities, Applying Styles and Themes to Activity, Hiding the Activity Title, Displaying a Dialog Window, Displaying a Progress Dialog, Linking Activities Using Intents, Resolving Intent Filter Collision, Returning Results from an Intent	9
2	Components	Understanding the Components of a Screen, Views and View Groups, Linear Layout, Absolute Layout, Table Layout, Relative Layout, Frame Layout, Scroll View, Adapting to Display Orientation, Anchoring Views, Resizing and Repositioning, Managing Changes to Screen Orientation, Persisting State Information during Changes in Configuration, Detecting Orientation Changes, Controlling the Orientation of the Activity, Creating the User Interface Programmatically, Basic Views .	9
3	Views	Using Image Views to Display Pictures - Gallery and Image View Views, Image Switcher, Grid View, Using Menus with Views - Creating the Helper Methods, Options Menu, Context Menu, Saving and Loading User Preferences - Using get Shared Preferences (), Using get Preferences (),	9

		Persisting Data to Files - Saving to Internal Storage, Saving to External Storage (SD Card), Choosing the Best Storage Option, Using Static Resources, Creating and Using Databases .	
4	**Data Sharing in Android**	Sharing Data in Android, Using a Content Provider - Predefined Query String Constants, Projections, Filtering, Sorting, Creating Your Own Content Providers - Using the Content Provider. SMS Messaging - Sending SMS Messages Programmatically, Getting Feedback After Sending the Message, Sending SMS Messages Using Intent, Receiving SMS Messages, Updating an Activity from a Broadcast Receiver, Invoking an Activity from a Broadcast Receiver.	**9**
5	**Creation your own Services**	Creating Your Own Services - Performing Long-Running Tasks in a Service, Performing Repeated Tasks in a Service, Executing Asynchronous Tasks on, Separate Threads Using Intent Service, Communicating between a Service and an Activity, Binding Activities to Services. Preparing for Publishing, Versioning, Digitally Signing Your Android Applications, Deploying APK Files - Using the adb.exe Tool, Using a Web Server, Publishing on the Android Market, Creating a Developer Profile, Submitting Your Apps.	**9**
		Total No. of Hrs	**45**

Course Outcome	
Students will be able to	
CO1	Comprehend the basic features of Android Platform and Create Activities in Android.
CO2	Demonstrate the design concepts of user interface using components, views and menus in Android.
CO3	Create and use databases for Android Application.
CO4	Implement messaging services in Android.
CO5	Deploy mobile applications in various marketplaces for distribution.

Recommended Resources	
Text Books	1. Wei – Meng Lee, Beginning Android Application Development, Wiley publications 2. Reto Meier, Professional Android 4 Application Development, Wiley publications
Reference Books	3. Mark Murphy; Beginning Android 3; Apress Springer India Pvt Ltd. ;1st Edition; 2011;ISBN13: 978-1-4302- 3297-1 4. SayedHashimi , SatyaKomatineni, Dave MacLean; Pro Android 4; press Springer India Pvt Ltd; 1st Edition; 2012; ISBN: 978-1-4302-3930-7 5. The Android Developer's Cookbook: Building Applications with the Android SDK by James Steele, Nelson To, Addison-Wesley Professional; 2010

Course: Elective I- Multimedia Applications	Course Code: BCA504

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
2	1	0	3	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	Understanding of the fundamental elements in multimedia
2	The emphasis will be on learning the representations, perceptions and applications of multimedia
3	To identify a range of concepts, techniques and tools for creating and editing the interactive multimedia applications.
4	To identify both theoretical aspects in designing multimedia systems surrounding
5	Understanding of multimedia technologies using contemporary hardware and software technologies.

Course Contents			
Unit No.	Module Name	Content	Hours
1	**Introduction**	Definition of multimedia, Multimedia Basics, Where to use Multimedia, Multimedia Elements, and Multimedia Applications **Multimedia Systems Architecture**: Multimedia Workstation Architecture, High resolution Graphic displays, Multimedia Architecture Based on interface bus, Network architecture for Multimedia systems. Evolving Technologies For Multimedia Systems: Hyper Speech, HDTV and UDTV, 3DTechnologies and Holography, Virtual Reality, Video conferencing.	9
2	**Hardware**	Macintosh Versus Windows Platform, Connections, Memory and Storage Devices, Input Devices, Output Hardware, Communication Devices Basic Software Tools : Text Editing, Word Processing, OCR Software, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing, Sound Editing, Animation, Video, Digital Movie tools, Movie Editors, Compressing Movie Files Making instant Multimedia : Linking Multimedia Object, office suites, word processors ,	9

		spread sheets, databases, presentation tools, power point Multimedia authoring tools: Types of authoring tools, card and page based authoring tools, Icon based authoring tools, and Time based authoring tools.	
3	**Text, Images, Sound and Video**	**Text** : About Fonts and Faces, Using Text in Multimedia, Designing with Text, Hypermedia and Hypertext, The Power of Hypertext, Using Hypertext, Hypermedia Structures, Hypertext tools. **Images:** Making Still Images, Bitmaps, 1 bit images, 8-bit gray level images, 8-bit color images, Dithering, 24 bit color images, Vector Drawing, Vector-Drawn Objects vs. Bitmaps, 3-D Drawing and Rendering, Color, Understanding Natural Light and Color, Computerized Color, Color Palettes, Color Look-up table. **Sound :** The Power of Sound, Digital Audio, Making Digital Audio Files, MIDI Audio, MIDI vs. Digital Audio, Multimedia System Sounds, Adding Sound to Your Multimedia Project, Audio Recording, Keeping Track of Your Sounds, Audio CDs, Sound for Your Mobile, Sound for the Internet. Animation: the Power of Motion, Principles of Animation, Animation by Computer, Animation Techniques. **Video:** Using Video, How Video Works and Is Displayed, Analog Video, Digital Video, Displays, Digital Video Containers, Codec, Video Format Converters, Obtaining Video Clips, Shooting and Editing Video.	**9**
4	**Data Compression**	Need for Data compression, General Data compression Scheme, Compression standards, Non-lossy compression for images, Lossy compression for Photographs and video, Hardware Vs Software Compression. Compression Schemes and standards:(Only Concepts of) Binary image compression, Color, Gray Scale image compression, JPEG, video image compression, Multimedia Standards for Video, Requirements for Full-motion Video Compression, MPEG, Audio compression, Fractal compression, advantages / disadvantages.	**9**
5	**Data and File Format Standards**	Data and File Format Standards: Popular File Formats: RTF, RIFF, GIF, PNG, TIFF, MIDI, JPEG, JFIF, AVI, WAV, BMP, WMF, MIX, MPEG standards -TWAIN. Multimedia Databases, Storage and Retrieval, Database Management systems, Database Organization and Transaction management for multimedia systems. Multimedia Skills: The Team, Project Manager, Multimedia Designer, Interface Designer, Writer, Video Specialist, Audio Specialist, Multimedia Programmer, Producer of Multimedia for the Web.	**9**
		Total No. of Hrs	**45**

Course Outcome	
Students will be able to	
CO1	Critically analyze and synthesis the key components of multimedia technologies including text, graphics, voice, video and animation
CO2	be able to evaluate the role of multimedia technologies in the online and web environment
CO3	be able to define the characteristics of each media type and describe their application

CO4	be able to develop, edit and improve interactive web pages that
CO5	Incorporate a variety of digital media such as graphics, voice, animation and video

Recommended Resources	
Text Books	1. Multimedia: Making It Work By Tay Vaughan Eighth Edition, TMH 2. Fundamental of Multimedia -Ze-Nian Li & M. S. Drew ,PHI 3. Multimedia Systems Design -Prabhat k. Andleigh, KiranThakra 4. Multimedia Systems -John F. Koegel Buford
Reference Books	1. Computer Graphics Multimedia and Animation -Malay K. Pakhira PHI, New Delhi - Second edition. 2. Principles of Multimedia by Ranjan Parekh -2nd Edition TMH. 3. Computer Graphics and Multimedia -AnirbanMukhapathyay, AruopChattopadhyay -Vikas Publishing Ltd -Second Edition 4. Multimedia Technology and Applications-David Hillman Galgotia Publications Pvt Ltd.- Second Edition

Course: Python Programming Lab	Course Code: BCA506

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Lab participation/ Attendance)	CIA-2 (Written Practical Logbook)	CIA-3 (Viva/Oral)	Written Performance	Viva / Oral	
0	0	4	2	10	10	10	50	20	100
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives	
1	To write, test, and debug simple Python programs.
2	To implement Python programs with conditionals and loops.
3	Use functions for structuring Python programs.
4	Represent compound data using Python lists, tuples, and dictionaries.
5	Read and write data from/to files in Python.

List of Programs

1. Write a program to demonstrate basic data type in python.
2. Write a program to implement various operators in python.
3. Write a program to implement various conditional statements in python.
4. Write a program to implement various looping statements in python.
5. Write a program to implement various string operations.
6. Write a program to demonstrate list & related functions in python.
7. Write a program to demonstrate tuple & related functions in python.
8. Write a program to demonstrate Dictionary & related functions in python.
9. Write a program to read and write from a file, and copy a file
10. Write a program to implement numpy and pandas packages.
11. Write a program to Import Excel File and csv File and perform operation in it
12. Write a Program to Create Different Types of Chart by importing CSV file.
13. Write a Program to Import the data, Clean Data, Train Data.

Course Outcome	
Students should able to	
CO1	Write, test, and debug simple Python programs.
CO2	Implement Python programs with conditionals and loops.

CO3	Develop Python programs step-wise by defining functions and calling them.
CO4	Use Python lists, tuples, dictionaries for representing compound data.
CO5	Read and write data from/to files in Python

Course: Data Warehousing and Data Mining Lab	Course Code: BCA507

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Lab participation/ Attendance)	CIA-2 (Written Practical Logbook)	CIA-3 (Viva/Oral)	Written Performance	Viva / Oral	
0	0	4	2	10	10	10	50	20	100
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives	
1	Learn how to build a data warehouse and query it.
2	Demonstrate the working of algorithms for data mining tasks such association rule mining, classification, clustering and regression
3	Exercise the data mining techniques with varied input values for different parameters

List of Programs

1.Data Processing Techniques:

(i) Data Cleaning
(ii) Data Transformation-Normalization
(iii) Data Integration

14. Data Warehouse Schemas: Star, Snowflake, Fact Constellation.
15. Data Cube Construction-OLAP operations
16. Data Extraction, Transformations, Loading operations
17. Implementation of Apriori algorithm
18. Implementation of FP-Growth algorithm
19. Implementation of Decision Tree Induction
20. Calculating information gain measures
21. Classification of data using Bayesian approach
22. Classification of data using K-Nearest Neighbor approach
23. Implementation of K-Means algorithm
24. Demonstration of classification rule process on WEKA data-set using Naive Bayes algorithm.\
25. Case Study: Create Student. ariff file to suggest better college using Decision tree
26. Case Study: Create Placement.ariff file to identify the students who are eligible for placements using KNN

Course Outcome	
Students should able to	
CO1	Ability to understand the various kinds of tools.
CO2	Demonstrate the classification, clustering and etc. in large data sets
CO3	Ability to add mining algorithms as a component to the exiting tools.

BCA III Year Semester VI

Course: Introduction to Cyber Security	Course Code: BCA601

Teaching Scheme (Hrs/Week)				Continuous In-Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class Participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) - 3Hrs.									

Course Objectives	
1	To prepare students with the technical knowledge and skills needed to protect and defend computer systems and networks.
2	To develop graduates that can plan, implement, and monitor cyber security mechanisms to help ensure the protection of information technology assets.
3	Exhibit knowledge to secure corrupted systems, protect personal data, and secure computer networks in an Organization
4	Practice with an expertise in academics to design and implement security solutions.
5	Understand key terms and concepts in Cryptography, Governance and Compliance and develop cyber security strategies and policies.

Course Content			
Unit No.	Module Name	Content	Hours
1.	Security Basics	Introduction, Elements of Information Security, Security Policy, Techniques, Steps, Categories, Operational Model of Network Security, Basic Terminologies in Network Security. Threats and Vulnerability, Difference between Security and Privacy.	12
2	Data Encryption Techniques And Standards	Introduction, Encryption Methods: Symmetric, Asymmetric, Cryptography, Substitution Ciphers. Transposition Ciphers, Stenography applications and limitations, Block Ciphers and methods of operations, Feistal Cipher, Data Encryption Standard (DES), Triple DES, DES Design Criteria, Weak Keys in DES Algorithms, Advance Encryption Standard (AES).	12
3	Public Key And Management	Public Key Cryptography, RSA Algorithm: Working, Key length, Security, Key Distribution, Deffie-Hellman Key Exchange, Elliptic Curve: Arithmetic, Cryptography, Security, Authentication methods, Message Digest, Kerberos, X.509 Authentication service. Digital Signatures: Implementation, Algorithms, Standards (DSS), Authentication Protocol.	12
4	Security Requirements	**IP Security:** Introduction, Architecture, IPV6, IPv4, IPSec protocols, and Operations, AH Protocol, ESP Protocol, ISAKMP Protocol, Oakkey determination Protocol, VPN. WEB Security: Introduction, Secure Socket	12

		Layer (SSL), SSL Session and Connection, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, Handshake Protocol. **Electronic Mail Security:** Introduction, Pretty Good Privacy, MIME, S/MIME, Comparison. Secure Electronic Transaction (SET).	
5	**Firewall, Intrusion and Confidentiality**	Computer Intrusions. Firewall Introduction, Characteristics and types, Benefits and limitations. Firewall architecture, Trusted Systems, Access Control. Intrusion detection, IDS: Need, Methods, Types of IDS, Password Management, Limitations and Challenges. **Confidentiality**: Introduction to Personally Identifiable Information (PII), Cyber Stalking, PII impact levels with examples Cyber Stalking, Cybercrime, PII Confidentiality Safeguards, Information Protection Law: Indian Perspective.	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Analyze and evaluate the cyber security needs of an organization.
CO2	Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
CO3	Measure the performance and troubleshoot cyber security systems.
CO4	Implement cyber security solutions and use of cyber security, information assurance and cyber/computer forensics software/tools.
CO5	Comprehend and execute risk management processes, risk treatment methods, and key risk and performance indicators and design operational and strategic cyber security strategies and policies.

Recommended Resources	
Text Books	1. Bernard Menezes, "Network Security and Cryptography", Cengage Learning India, 2014, ISBN No.: 8131513491 2. Nina Godbole, SunitBelapure, "Cyber Security", Wiley India, 2014, ISBN No.: 978-81-345-2179-1
Reference Books	1. Eoghan Casey, "Digital Evidence and Computer Crime Forensic Science,Computers and the Internet", ELSEVIER, 2011, ISBN 978-0-12-374268-1 2. AtulKahate, "Cryptography and Network Security", McGraw Hill Publication, 2nd Edition, 2008, ISBN : 978-0-07-064823-4 3. William Stallings, "Cryptography and network security principles and practices", Pearson, 6th Edition, ISBN : 978-93-325-1877-3 4. Forouzan, "Cryptography and Network Security (SIE)", McGraw Hill, ISBN, 007070208X, 9780070702080 5. Dr.Nilakshi Jain-Digital Forensic: The Fascinating World of Digital Evidences- Wiley India-ISBN: 9788126565740

Course - Elective 2: Introduction to Data Science	Course Code: BCA602

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
2	1	0	3	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	Provide a strong foundation for data science and application areas related to it.
2	Understand the underlying core concepts and emerging technologies in data science.
3	Learn the process of working with data on large scale.
4	Explore the concepts of Data Processing.
5	Prepare students for advanced courses in Data Science.

Course Contents			
Unit No.	Module Name	Content	Hours
1	Data Evolution	Data to Data Science – Understanding data: Introduction – Type of Data, Data Evolution – Data Sources. Preparing and gathering data and knowledge - Philosophies of data science - data all around us: the virtual wilderness - Data wrangling: from capture to domestication - Data science in a big data world - Benefits and uses of data science and big data – facets of data.	12
2	Digital Data-An Imprint	Overview of the data science process - retrieving data - Cleansing, integrating, and transforming data.	12
3	Machine learning	Modelling Process – Training model – Validating model – Predicting new observations –Supervised learning, Unsupervised learning, Semi-supervised learning. Exploratory data analysis.	12
4	No SQL	Distributing data storage and processing with frameworks - Case study: Assessing risk when loaning money - Join the NoSQL movement - Introduction to NoSQL - Case Study. The rise of graph databases – Introducing connected data and graph databases.	12
5	Ethics and Data Science	Doing Good Data Science, Data Ownership, The Five Cs, Implementing the Five Cs, Ethics and Security Training, Developing Guiding Principles, Building Ethics into a Data-Driven Culture, Regulation, Building Our Future, Case Study.	12
		Total No. of Hrs	**60**

Course Outcome
Students should able to

CO1	Understand the fundamental concepts of data science.
CO2	Evaluate the data analysis techniques for applications handling large data and Demonstrate the data science process.
CO3	Understand concept of machine learning used in the data science process.
CO4	Visualize and present the inference using various tools.
CO5	Learn to think through the ethics surrounding privacy, data sharing.

Recommended Resources	
Text Books	1. Introducing Data Science, Davy Cielen, Arno D. B. Meysman and Mohamed Ali, Manning Publications, 2016. 2. Think Like a Data Scientist, Brian Godsey, Manning Publications, 2017. 3. Ethics and Data Science, Mike Loukides, Hilary Mason and D J Patil, O'Reilly, 1st edition, 2018.
Reference Books	1. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 1st edition, 2015. 2. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt, O' Reilly, 1st edition, 2013. 3. Mining of Massive Datasets, Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014. 4. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013.

Course: Software Testing	Course Code: BCA602

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To study fundamental concepts in software testing
2	To discuss various software testing issues and solutions in software unit test, integration and system testing.
3	To expose the automated software testing tools , need of automation .

Course Contents			
Unit No.	Module Name	Content	Hours
1	**Basics of Software Testing and Testing Methods**	**Software Testing:** Objectives of Testing. Failure, Error, Fault, Defect, Bug Terminology. Test Case, When to Start and Stop Testing of Software (Entry and Exit Criteria). Verification and Validation (V Model), Quality Assurance, Quality Control. Methods of Testing: Static and dynamic Testing. **White Box Testing**: Inspections, Walkthroughs, Technical Reviews, Functional Testing, Code Coverage Testing, Code Complexity Testing. **Black Box Testing**: Requirement Based Testing, Boundary Value Analysis, Equivalence Partitioning.	12
2	**Types and Levels of Testing**	**Levels of Testing** **Unit Testing:** Driver Stub **Integration Testing:** Top-Down Integration, Bottom Up Integration, Bi- Directional Integration **Testing on Web Application:** Performance Testing, Load Testing, Stress Testing, Security Testing , Client Server Testing **Acceptance testing:** Alpha Testing, Beta Testing, Special Tests: Regression Testing, GUI testing	12
3	**Test Management**	**Test Planning** : Preparing a Test Plan, Deciding Test Approach, Setting Up Criteria for Testing, Identifying Responsibilities, Staffing, Resource Requirements, Test Deliverables, Testing Tasks **Test Management**: Test Infrastructure Management, Test People Management.	12

		Test Process: Base Lining a Test Plan, Test Case Specification. **Test Reporting**: Executing Test Cases, Preparing Test Summary Report.	
4	**Defect Management**	Defect Classification, Defect Management Process. Defect Life Cycle, Defect Template Estimate Expected Impact of a Defect, Techniques for Finding Defects, Reporting a Defect.	**12**
5	**Testing Tools and Measurements**	Manual Testing and Need for Automated Testing Tools, Advantages and disadvantages of using Tools, Selecting Testing Tool, When to use Automated testing Tool, Testing using Automated Tools. **Metrics and Measurement:** Types of Metrics, Product metrics and Process metrics, Object Oriented metrics in Testing.	**12**
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Apply various software testing methods.
CO2	Prepare test cases for different types and levels of testing
CO3	Prepare test plan for an application
CO4	Identify bugs to create defect report of given application.
CO5	Test software for performance measures using automated testing tools.

Recommended Resources	
Text Books	2. Software Testing: Principles and Practices SrinivasanDesikanGopalaswamy Ramesh PEARSON Publisher: Pearson India 2005, ISBN: 9788177581218, 3. Software Testing: Principles, Techniques and Tools Limaye M. G. Tata McGraw Hill Education, New Delhi., 2007 ISBN 13:9780070139909
Reference Books	1. Software Testing: Principles and Practices ChauhanNaresh Oxford University Press Noida 2. Software Testing Singh Yogesh Cambridge University Press, Bengaluru. ISBN 978-1-107-65278-1

Course - Elective 2: Big Data Analytics	Course Code: BCA602

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
2	1	0	3	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	Understand the Big Data Platform and its Use cases
2	Provide HDFS Concepts and Interfacing with HDFS
3	Provide hands on Hodoop Eco System
4	Apply analytics on Structured, Unstructured Data.
5	Exposure to Data Analytics with R.

Course Contents			
Unit No.	Module Name	Content	Hours
1	Introduction To Big Data And Hadoop	Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to InfosphereBigInsights and Big Sheets	12
2	HDFS (Hadoop Distributed File System)	The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.	12
3	Map Reduce	Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	12
4	Hadoop Eco System	**Pig:** Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. **Hive:** Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. **Hbase:**HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. **Big SQL:** Introduction	12
5	Data	Machine Learning: Introduction, Supervised Learning, Unsupervised Learning,	12

	Analytics with R	Collaborative Filtering. Big Data Analytics with BigR.	
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Outline the importance of Big Data Analytics
CO2	Apply statistical techniques for Big data Analytics.
CO3	Analyze problems appropriate to mining data streams.
CO4	Use Graph Analytics for Big Data and provide solutions
CO5	Apply Hadoop map Reduce programming for handing Big Data

Recommended Resources

Text Books

1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
2. AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012
3. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
4. Tom White “ Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
5. SeemaAcharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015.

Reference Books

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
2. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013)
3. Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013), Oracle press.
4. AnandRajaraman and Jefrey David Ulman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
5. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
6. Glen J. Myat, “Making Sense of Data”, John Wiley & Sons, 2007
7. Pete Warden, “Big Data Glossary”, O’Reily, 2011.
8. Michael Mineli, Michele Chambers, AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
9. ArvindSathi, “BigDataAnalytics: Disruptive Technologies for Changing the Game”, MC Press, 2012.
10. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan, "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

Course: Project & Internship	Course Code: BCA604

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Lab participation/ Attendance)	CIA-2 (Written Practical Logbook)	CIA-3 (Viva/Oral)	Written Performance	Viva / Oral	
0	0	12	6	10	10	10	50	20	100
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives	
1	Exposure to Learning and knowledge access techniques using Conferences, Journal papers and participation in research activities
2	To develop software engineering documents and testing plans
3	To use algorithmic solutions using distributed, Embedded, concurrent and parallel environments
4	To apply algorithmic strategies while solving problems.
5	To encourage and expose students for participation in National/ International paper presentation activities.

Activity Planning:

1. Project workstation selection, installations and setup along with report to the guide.

2. Programming of the project, GUI (if any) as per Term work submission.(recommended submission date:- Progress report every week during laboratory)

3. Test tool selection for various testing and generate various testing result charts, graphs etc. including reliability testing.

4. Review of design and necessary corrective actions taking into consideration feedback report of Term assessment, and other competitions/conference.

5. Students to publish at least one technical paper in Conference/peer review journal.

6. Final term work submissions in the prescribed format given by the guides consisting of a project report consisting of a preliminary report, detailed design (all necessary UML diagrams) document, User Interface design , test results generated by selected project testing tool, conclusions, appendix (if necessary), glossary, tools used and references at the end.

7. The Term examination is conducted by panel of examiners (preferably guide and expert from

Industry having relevant experience (or senior teacher in the subject in case of non- availability of industry expert).

8. The project assessment shall be done using Live Project Demonstration [in existing functional condition], using necessary simulators (if required) and presentation by the students.

Tools:

All the tools that has been learned during the course.

Preferably 64-bit FOSS (Free and open-source software) tools, 3-tier architectures along with latest version of Free and open-source software Operating systems like Fedora 21 or equivalent, LAMP tools, WEB server, Applications servers, Database servers, MongoDB or latest open source Bigdata tools, Free and open-source software Programming Tools like GCC, G++, Eclipse, Python, Java and other tools are as per the requirement of the SRS. The documentation tools like Open Source, GIT, Latex.

Seminar Topic Selection and Evaluation

Seminar based on state-of-the art in the selected Project Domain. The presentation and the report should cover motivation, mathematical modeling, data-table discussion and conclusion. The reports to be prepared using LATEX derivative.

It is mandatory on the seminar guides to maintain a progressive record of the seminar of 1 Hrs per month per seminar which shall include the discussion agenda, weekly outcomes achieved during practical sessions, corrective actions and comments on the progress report as per the plan submitted by the students including dates and timing, along with the signature of the student as per the class and teacher time table, such record of progressive work shall be referred by the examiners during evaluation.