RANI CHANNAMMA UNIVERSITY, BELAGAVI

PROGRAM /COURSE STRUCTURE AND SYLLABUS
as per the Choice Based Credit System (CBCS)
designed in accordance with
Learning Outcomes-Based Curriculum Framework (LOCF)
of National Education Policy (NEP) 2020
for
BACHELOR OF COMPUTER APPLICATIONS (BCA)

w.e.f.

Academic Year 2021-22 and onwards

Board of Studies (UG) Committee (NEP-Bachelor of Computer Applications)

Bachelor of Computer Applications (BCA) Programme 2021-22

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PREAMBLE

Computer Application (CA) has been evolving as an important branch of science and technology in last two decade and it has carved out a space for itself like computer science and engineering. Computer application spans theory and more application and it requires thinking both in abstract terms and in concrete terms.The ever-evolving discipline of computer application has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers and its applications, but finding a solution requires both computer science expertise and knowledge of the particular application domain.Computer science has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Mathematical and Statistical Analysis, Data Science, Computational Science, and Software Engineering.

Universities and other HEIs introduced programmes of computer application. Information Technology is growing rapidly. Increasing applications of computers in almost all areas of human endeavour has led to vibrant industries with concurrent rapid change in technology. Unlike other basic disciplines, developing core competency in this discipline that can be reasonably stable becomes a challenge.In India, it was initially introduced at the Master (postgraduate) level as MCA and M.Tech. Later on, engineering programmes such as B.Tech and B.E in Computer Science & Engineering and in Information Technology were introduced in various engineering College/Institutions to cater to the growing demand for trained engineering manpower in IT industries.Parallelly, BCA, BSc and MSc programmes with specialisation in Computer Science were introduced to train manpower in this highly demanding area.

BCA and BCA (Hons) are aimed at undergraduate level training facilitating multiple career paths. Students so graduated, can take up postgraduate programmes in CS or MCA leading to research as well as R&D, can be employable at IT industries, or can

pursue a teaching profession or can adopt a business management career.BCA and BCA (Hons) aims at laying a strong foundation of computer application at an early stage of the career. There are several employment opportunities and aftersuccessful completion of BCA, graduating students can fetch employment directly in companies as programmer, Web Developer, Software Engineer, Network Administrator, Data Scientist, or AI/ML personnel.

The Program outcomes in BCA are aimed at allowing flexibility and innovation indesign and development of course content, in method of imparting training, in teaching learning process and in assessment procedures of the learning outcomes. The emphasis in BCA courses, in outcome-based curriculum framework, help students learn solving problems, accomplishing IT tasks, and expressing creativity, both individually and collaboratively. The proposed framework will help Students learn programming techniques and the syntax of one or more programming languages.

All students must, therefore, have access to a computer with a modern programming language installed. The computer science framework does not prescribe a specific language. The teacher and students will decide which modern programming languages students will learn. More importantly, students will learn to adapt to changes in programming languages and learn new languages as they are developed.

The present Curriculum Framework for BCA degrees is intended to facilitate the students to achieve the following.

- To develop an understanding and knowledge of the basic theory of Computer Science and Information Technology with good foundation on theory, systems and applications such as algorithms, data structures, data handling, data communication and computation
- To develop the ability to use this knowledge to analyse new situations in the application domain

- To acquire necessary and state-of-the-art skills to take up industry challenges. The objectives and outcomes are carefully designed to suit to the above-mentioned purpose.
- The ability to synthesize the acquired knowledge, understanding and experience for a better and improved comprehension of the real-life problems
- To learn skills and tools like mathematics, statistics and electronics to find the solution, interpret the results and make predictions for the future developments
- To formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate

PROGRAM OUTCOMES:

By the end of the program the following outcomes will be achieved by the students:

1. **Discipline knowledge:** Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. **Problem Solving:** Improved reasoning with strong mathematical ability to Identify, formulate and analyse problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. **Design and Development of Solutions:** Ability to design and development of algorithmic solutions to real world problems and acquiring a minimum knowledge on statistics and optimization problems. Establishing excellent skills in applying various design strategies for solving complex problems.
4. **Programming a Computer**: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day applications with thorough knowledge on programming languages of various levels.
5. **Application Systems Knowledge:** Possessing a sound knowledge on computer application software and ability to design and develop app for applicative problems.
6. **Modern Tool Usage:** Identify, select and use a modern scientific and IT tool or technique for modelling, prediction, data analysis and solving problems in the area of Computer Science and making them mobile based application software.
7. **Communication:** Must have a reasonably good communication knowledge both in oral and writing.
8. **Project Management:** Practicing of existing projects and becoming independent to launch own project by identifying a gap in solutions.
9. **Ethics on Profession, Environment and Society:** Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.

10. **Lifelong Learning:** Should become an independent learner. So, learn to learn ability.
11. **Motivation to take up Higher Studies:** Inspiration to continue educations towards advanced studies on Computer Science.

By the end of the program the students will be able to:

The Bachelor of Computer Application (BCA (Hons)) program enables students to attain following additional attributes besides the afore-mentioned attributes, by the time of graduation:

1. Apply standard Software Engineering practices and strategies in real -time software projectdevelopment
2. Design and develop computer programs/computer -based systems in the areas related to AI, algorithms, networking, web design, cloud computing, IoT and data analytics.
3. Acquaint with the contemporary trends in industrial/research settings and thereby innovate novel solutions to existingproblems
4. The ability to apply the knowledge and understanding noted above to the analysis of a given information handlingproblem.
5. The ability to work independently on a substantial software project and as an effective teammember.

PROGRAM STRUCTURE

Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of BCA with Discipline Scheme for the Four Years Computer Application BCA Undergraduate Honors Programmewith effect from 2021-22

SEMESTER-1										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L-1	21BCA1L1LK1	Kannada	40	60	100	4	0	0	3	2
	21BCA1L1LFK1	Functional Kannada								
L-2	21BCA1L2LEN2	English	40	60	100	4	0	0	3	2
	21BCA1L2LHI2	Hindi								
	21BCA1L2LSN2	Sanskrit								
	21BCA1L2LTE2	Telugu								
	21BCA1L2LUR2	Urdu								
DSC1	21BCA1C1L	Programming in C	40	60	100	3	0	0	3	2
	21BCA1C1P	C Programming Lab	25	25	50	0	0	3	2	3
DSC2	21BCA1C2L	Fundamentals of Computers	40	60	100	3	0	0	3	2
	21BCA1C2P	Information Technology Lab	25	25	50	0	0	3	2	3
DSC3	21BCA1C3LMF	Mathematical Foundation*	40	60	100	3	0	0	3	2
	21BCA1C3LAC	Accountancy*								
OEC1	21BCA1O1CPL	C Programming Concepts	40	60	100	3	0	0	3	2
SEC1	21BCA1S1FD	Digital Fluency	25	25	50	1	0	2	2	2
VBC1	21BCA1V1PE1	Physical Education - Yoga	25	-	25	-	-	2	1	-
VBC2	21BCA1V2HW	Health & Wellness	25	-	25	-	-	2	1	-
Total Marks					**800**	**Semester Credits**			**26**	

SEMESTER-2										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L-3	21BCA2L3LK2	Kannada	40	60	100	4	0	0	3	2
	21BCA2L3FKL2	Functional Kannada								
L-4	21BCA2L4EN2	English	40	60	100	4	0	0	3	2
	21BCA2L4HI2	Hindi								
	21BCA2L4SN2	Sanskrit								
	21BSC2L4TE2	Telugu								
	21BCA2L4UR2	Urdu								
DSC4	21BCA2C4L	Data Structures using C	40	60	100	3	0	0	3	2
	21BCA2C4P	Data Structures Lab	25	25	50	0	0	3	2	3
DSC5	21BCA2C5L	Object Oriented Concepts using Java	40	60	100	3	0	0	3	2
	21BCA2C5P	JAVA Lab	25	25	50	0	0	3	2	3
DSC6	21BCA2C6L	Discrete Mathematics	40	60	100	3	0	0	3	2
OEC2	21BCA2O2MPL	Web Designing	40	60	100	3	0	0	3	2
AECC1	21BCA2AE1L	Environmental Studies	20	30	50	1	0	2	2	2
VBC3	21BCA2V3PE2	Physical Education – Sports	25	-	25	-	-	2	1	-
VBC4	21BCA2V4NC1	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
Total Marks					**800**	**Sem Credits**			**26**	
Exit option with Certificate in Computer Applications (with the completion of courses equivalent to a minimum of 48 credits)					**1600**	**I year Credits**			**52**	

SEMESTER-3										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L-5	21BCA3L5LK3	Kannada	40	60	100	4	0	0	3	2
	21BCA3L5LFK3	Functional Kannada								
L-6	21BCA3L6EN3	English	40	60	100	4	0	0	3	2
	21BCA3L6HI3	Hindi								
	21BCA3L6SN3	Sanskrit								
	21BSC3L6TE3	Telugu								
	21BCA3L6UR3	Urdu								
DSC7	21BCA3C7L	Database Management System	40	60	100	3	0	0	3	2
	21BCA3C7P	DBMS Lab	25	25	50	0	0	3	2	3
DSC8	21BCA3C8L	C# and .Net Framework	40	60	100	3	0	0	3	2
	21BCA3C8P	C# and .Net Framework Lab	25	25	50	0	0	3	2	3
DSC9	21BCA3C9L	Computer Communication and Networks	40	60	100	3	0	0	3	2
OEC3	21BCA3O3RPL	E-Commerce	40	60	100	3	0	0	3	2
SEC2	21BCA3SE2AI	Artificial Intelligence	25	25	50	1	0	2	2	2
VBC5	21BCA3V5PE3	Physical Education – Sports	25	-	25	-	-	2	1	-
VBC6	21BCA3V6NC2	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
Total Marks					**800**	**Semester Credits**			**26**	

SEMESTER-4										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L-7	21BCA4L7LK4	Kannada	40	60	100	4	0	0	3	2
	21BCA4L7LFK4	Functional Kannada								
L-8	21BCA4L8EN4	English	40	60	100	4	0	0	3	2
	21BCA4L8HI4	Hindi								
	21BCA4L8SN4	Sanskrit								
	21BSC4L8TE4	Telugu								
	21BCA4L8UR4	Urdu								
DSC10	21BCA4C10L	Python Programming	40	60	100	3	0	0	3	2
	21BCA4C10P	Python Programming Lab	25	25	50	0	0	3	2	3
DSC11	21BCA4C11L	Multimedia & Animation	40	60	100	3	0	0	3	2
	21BCA4C11P	Multimedia & Animation Lab	25	25	50	0	0	3	2	3
DSC12	21BCA4C12L	Operating System Concepts	40	60	100	3	0	0	3	2
OEC4	21BCA4O4ECL	Multimedia & Animation	40	60	100	3	0	0	3	2
AECC2	21BCA4AE2CIL	Constitution of India	20	30	50	1	0	2	2	2
VBC7	21BCA4V7PE4	Physical Education – Sports	25	-	25	-	-	2	1	-
VBC8	21BCA4V8NC3	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
Total Marks					**800**	**Semester Credits**			**26**	
Exit option with Diploma in Computer Applications (with the completion of courses equivalent to a minimum of 96 credits)					**3200**	**II year Credits**			**104**	

SEMESTER-5										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC13	21BCA5C13L	Internet Technologies	40	60	100	3	0	0	3	2
	21BCA5C13P	Internet Technology Laboratory	25	25	50	0	0	3	2	3
DSC14	21BCA5C14L	Statistical Computing and R Programming	40	60	100	3	0	0	3	2
	21BCA5C14P	R Programming Lab	25	25	50	0	0	3	2	3
DSC15	21BCA5C15L	Software Engineering	40	60	100	3	0	0	3	2
DSE1	21BCA5DE1AL	Information Security & Cryptography	40	60	100	3	0	0	3	2
	21BCA5DE1BL	Cloud Computing								
	21BCA5DE1CL	Business Intelligence								
VC1	21BCA5VC1AL	Unix & Shell Programming	40	60	100	3	0	0	3	2
	21BCA5VC1BL	Web Content Management								
SEC3	21BCA5SE3L	Cyber Security	25	25	50	1	0	2	2	2
VBC9	21BCA5V7PE5	Physical Education – Sports	25	-	25	-	-	2	1	-
VBC10	21BCA5V8NC4	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
Total Marks					**700**	**Semester Credits**			**23**	

SEMESTER-6										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC16	21BCA6C16L	PHP and MySQL	40	60	100	3	0	0	3	2
	21BCA6C16P	PHP and MySQL LAB	25	25	50	0	0	3	2	3
DSC17	21BCA6C17L	Artificial Intelligence and Applications	40	60	100	3	0	0	3	2
DSC18	21BCA6C18P	Project Work	50	100	150	0	0	10	5	3
INT	21BCA6INT1	Internship	50	-	50			-	2	-
DSE2	21BCA6DE2AL	Fundamentals of Data Science	40	60	100	3	0	0	3	2
	21BCA6DE2BL	Mobile Application Development								
	21BCA6DE2CL	Embedded Systems								
VC2	21BCA6VC2AL	Health Care Technologies	40	60	100	3	0	0	3	2
	21BCA6VC2BL	Digital Marketing								
SEC4	21BCA6SE4L	Professional Communication	25	25	50	1	0	2	2	2
VBC11	21BCA6V7PE6	Physical Education – Sports	25	-	25	-	-	2	1	-
VBC12	21BCA6V8NC5	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
Total Marks					**750**	**Semester Credits**			**25**	
Exit Option with Bachelor of Computer Applications Degree, BCA Degree (with completion of courses equivalent to a minimum of 140 credits)					**4650**	**Total Credits for BCA Program**			**152**	

Concept Note, Abbreviation Explanation and Coding:

Concept Note:

1. CBCS is a mode of learning in higher education which facilitates a student to have some freedom in selecting his/her own choices, across various disciplines for completing a UG/PG program.
2. A credit is a unit of study of a fixed duration. For the purpose of computation of workload as per UGC norms the following is mechanism be adopted in the university:
   One credit (01) = One Theory Lecture (L) period of one (1) hour.
   One credit (01) = One Tutorial (T) period of one (1) hour.
   One credit (01) = One practical (P) period of two (2) hours.
3. Course: paper/subject associated with AECC, DSC, DSEC, SEC, VBC, OEC, VC, IC, MIL.
4. Wherever there is a practical there will be no tutorial and vice-versa
5. Vocational course is a course that enables individual to acquire skills set that are required for a particular job.
6. Internship is a designated activity that carries some credits involving more than 25 days of working in an organization (either in same organization or outside) under the guidance of an identified mentor. Internship shall be an integral part of the curriculum.
7. OEC: For non- Computer Science students. Computer Science students have to opt for OEC from departments other than their disciplines

Abbreviation Explanations:

1. AECC: Ability Enhancement Compulsory Course.
2. DSC: Discipline Specific Core Course.
3. DSEC: Discipline Specific Elective Course.

4. SEC: Skill Enhancement Course.
5. VBC: Value Based Course.
6. OEC: Open/Generic Elective Course
7. VC: Vocational Course.
8. IC: Internship Course
9. L1: Language One
10. L2: MIL
11. L= Lecture; T= Tutorial; P=Practical.
12. MIL= Modern Indian Language; English or Hindi or Telugu or Sanskrit or Urdu

Program Coding:

1. Code 21: Year of Implementation
2. Code BCA: BCA Program under the faculty of Applied Science of the University
3. Code 1: First Semester of the Program, (2 to 6 represent higher semesters)
4. Code A: AECC, (C for DSC, S for SEC, V for VBC and O for OEC)
5. Code 1: First "AECC" Course in semester, similarly in remaining semester for such other courses
6. Code LK: Language Kannada, FK for Functional Kannada, similarly Language English, Language Hindi, Language Sanskrit, &Language Urdu
7. Code 1: Course in that semester.

COURSE-WISE SYLLABUS

Semester I

Year	I	**Course Code: 21BCA1C2L**	**Credits**	03
Sem.	I	**Course Title:** Fundamentals of Computers	**Hours**	40
Course Pre-requisites, if any:		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA: 02 hrs.	
Course Outcomes		At the end of the course the student should be able to: 1. Create an awareness of computers its classification and anatomy 2. Understand Number systems , Computer Languages and the steps for problem solving 3. Understand the fundamentals of operating systems and basic commands 4. Understand basic concepts of DBMS and Internet		
Unit No.		**Course Content**	**Hours**	
Unit I		**Fundamentals of Computers:** Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and Generations of Computers, Basic Organisation of a Digital Computer; Functions & Components of a Computer, Central Processing Unit, Microprocessor, Storage units, Input and output Devices. How CPU and memory works.Classification of Digital Computer Systems: Microcomputers, Minicomputers, Mainframes, Super computers	10	
Unit II		**Number Systems** – different types, conversion from one number system to another; Computer Codes – BCD, Gray Code, ASCII; Boolean Algebra – Boolean Operators with Truth Tables; **Computer Languages** - Machine Level, Assembly Level & High Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program – Algorithm and Flowchart with Examples.	10	
Unit III		**Operating System Fundamentals:** Operating Systems: Introduction, Functions of an operating System, Classification of Operating Systems, System programs, Application programs, Utilities, The Unix	10	

	Operating System, Basic Commands (cal, date, bc, echo, who, ls, pwd, cd, mkdir, rmdir), Commands to work with file (cat, cp, rm, mv, file, wc, head, tail)	
Unit IV	**Introduction to Database Management Systems:** Database, DBMS, Why Database -File system vs DBMS, Database applications, Database users, Introduction to SQL, Classification of SQL-DDL, DML, DCL**Internet Basics:** Introduction, Features of Internet, Internet application, Services of Internet, Logical and physical addresses, Internet Service Providers, Domain Name System.**Web Basics:** Introduction to web, web browsers, http/https, URL.	10
Print Resources	1. Pradeep K. Sinha and PritiSinha: Computer Fundamentals (Sixth Edition), BPB Publication 2. David Riley and Kenny Hunt, Computational thinking for modern solver, Chapman &Hall/CRC, 3. J. Glenn Brook shear," Computer Science: An Overview", Addision-Wesley, Twelth Edition, 4. R.G. Dromey, "How to solve it by Computer", PHI,	

<table>
<tr><td>Year</td><td>I</td><td>Course Code: 21BCA1C2P</td><td>Credits</td><td>02</td></tr>
<tr><td>Sem.</td><td>I</td><td>Course Title: Information Technology Lab</td><td>Hours</td><td>40</td></tr>
<tr><td colspan="2">Course Pre-requisites, if any:</td><td colspan="3">NA</td></tr>
<tr><td colspan="2">Formative Assessment Marks: 25</td><td>Summative Assessment Marks: 25</td><td colspan="2">Duration of ESA: 02hrs.</td></tr>
<tr><td colspan="2"></td><td colspan="3">Part A: Hardware
1. Identification of the peripherals of a computer, components in a CPU and their functions.
2. Assembling and disassembling the system hardware components of personal computer.
3. Basic Computer Hardware Trouble shooting.
5. LAN and WiFi Basics.
6. Operating System Installation – Windows OS, UNIX/LINUX, Dual Booting.
7. Installation and Uninstallation of Software – Office Tools, Utility Software (like Anti-Virus, System Maintenance tools); Application Software - Like Photo/Image Editors, Audio Recorders/Editors, Video Editors …); Freeware, Shareware, Payware and Trialware; Internet Browsers, Programming IDEs,
8. System Configuration – BIOS Settings, Registry Editor, MS Config, Task Manager, System Maintenance, Third-party System Maintenance Tools (Similar to CCleaner and Jv16 PowerTools)</td></tr>
<tr><td colspan="2"></td><td colspan="3">Part B: Software
1. Activities using Word Processor Software
2. Activities using Spreadsheets Software
3. Activities using Presentation Software
4. Activities involving Multimedia Editing (Images, Video, Audio)
5. Tasks involving Internet Browsing
6. Flow charts: Installation and using of flowgarithms software for different arithmetic tasks like sum, average, product, difference, quotient and remainder of given numbers, calculate area of Shapes (Square, Rectangle, Circle and Triangle), arrays and recursion.</td></tr>
</table>

	Note: Use any open source software to execute the above assignments.

Reference:

1. Computational Thinking for the Modern Problem Solver, By Riley DD, Hunt K.A CRC press, 2014

2. Ferragina P, Luccio F. Computational Thinking: First Algorithms, Then Code. Springer

Web References:

http://www.flowgorithm.org/documentation/

Evaluation Scheme for Information Technology Lab Examination

Assessment Criteria		**Marks**
Activity – 1 from Part A	Write up on the activity/ task	3
	Demonstration of the activity/ task	07
Activity-2 from Part B	Write up on the activity/ task	3
	Demonstration of the activity/ task	07
Viva Voice based on Lab Activities		05
Total		**25**

Year	I	**Course Code:**21BCA1C1L	**Credits**	03
Sem.	I	**Course Title:** Programming in C	**Hours**	40
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA: 02 hrs.	
Course Outcomes		At the end of the course the student should be able to: 1. Read, understand and trace the execution of programs written in C language 2. Apply programming control structures for a given problem to create C code 3. Understand derived datatypes and develop C code using arrays/ strings 4. Understand user defined functions and datatypes to develop C code		

Unit No.	Course Content	Hours
Unit I	**Introduction to C Programming:** Overview of C; History and Features of C; Structure of a C Program with Examples; Creating and Executing a C Program; Compilation process in C.**C Programming Basic Concepts:** C Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration & initialization of variables; Symbolic constants.**Input and output with C:** Formatted I/O functions - printf and scanf, control stings and escape sequences, output specifications with printf functions; Unformatted I/O functions to read and display single character and a string - getchar, putchar, gets and puts functions.	10
Unit II	**C Operators & Expressions:** Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment & Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associatively; Evaluation of arithmetic expressions; Type conversion.**Control Structures:** Decision making Statements - Simple if, if_else, nested if_else, else_if ladder, Switch Case, goto, break & continue statements; Looping. Statements - Entry controlled and exit controlled statements, while, do-while, for loops, Nested loops.	10

Unit III	**Derived data types in C:** Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation.**Strings:** Declaring & Initializing string variables; String handling functions - strlen, strcmp, strcpy and strcat; Character handling functions - toascii, toupper, tolower, isalpha, isnumeric etc.	08
Unit IV	**User Defined Functions:** Need for user defined functions; Format of C user defined functions; Components of user defined functions - return type, name, parameter list, function body, return statement and function call; Categories of user defined functions - With and without parameters and return type.**User defined data types:** Structures - Structure Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, comparing structure variables, Array of Structures; Unions - Union definition; difference between Structures and Unions.	12
Recommended Learning Resources		
Print Resources	1. C: The Complete Reference, By Herbert Schildt. 2. C Programming Language, By Brain W. Kernighan 3. Kernighan & Ritchie: The C Programming Language (PHI) 4. P. K. Sinha&PritiSinha: Computer Fundamentals (BPB) 5. E. Balaguruswamy: Programming in ANSI C(TMH) 6. Kamthane: Programming with ANSI and TURBO C (Pearson Education) 7. V. Rajaraman: Programming in C (PHI –EEE) 8. S. Byron Gottfried: Programming with C(TMH) 9. YashwantKanitkar: Let us C 10. P.B. Kottur: Programming in C (Sapna Book House)	

<table>
<tr><td>Year</td><td>I</td><td>Course Code: 21BCA1C1P</td><td>Credits</td><td>02</td></tr>
<tr><td>Sem.</td><td>I</td><td>Course Title: Lab: C Programming</td><td>Hours</td><td>40</td></tr>
<tr><td colspan="2">Course Pre-requisites, if any:</td><td colspan="3">NA</td></tr>
<tr><td colspan="2">Formative Assessment Marks: 25</td><td>Summative Assessment Marks: 25</td><td colspan="2">Duration of ESA: 02 hrs.</td></tr>
<tr><td colspan="2"></td><td colspan="3"><u>Part A:</u>
1. Program to read radius of a circle and to find area and circumference
2. Program to read three numbers and find the biggest of three
3. Program to demonstrate library functions in math.h
4. Program to generate the factorial of a given number
5. Program to generate n fibonacii sequence
6. Program to read a number, find the sum of the digits, reverse the number and check it for palindrome
7. Program to read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers
8. Program to read percentage of marks and to display appropriate message (demonstration of switch Case statement)
9. Program to find the roots of quadratic equation (Demonstration of else-if ladder)
10. Program to read marks scored by a students and find the average of marks
11. Program to remove Duplicate Element in a single dimensional Array</td></tr>
<tr><td colspan="2"></td><td colspan="3"><u>Part B</u>:
1. Program to Swap Two Numbers
2. Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.
3. Program to Reverse a string without using built in function
4. Program to find the length of a string without using built in function
5. Program to demonstrate string functions.
6. Program to read, display and to find the trace of a square matrix</td></tr>
</table>

	7. Program to perform addition and subtraction of Matrices 8. Program to read, display and multiply two m x n matrices using functions 9. Program to check a number for prime by defining isprime( ) function 10. Program to demonstrate student structure to read & display records of n students. 11. Program to demonstrate the difference between structure & union.

Note: Student has to execute a minimum of 10 programs in each part to complete the Lab course

Evaluation Scheme for Lab Examination

Assessment Criteria		Marks
Program – 1 from Part A	Writing the Program	03
	Execution and Formatting	07
Program -2 from Part B	Writing the Program	03
	Execution and Formatting	07
Viva Voice		05
Total		**25**

Year	I	**Course Code:** 21BCA1C3LMF	**Credits**	03
Sem.	I	**Course Title:** Mathematical Foundation	**Hours**	40
Course Pre-requisites, if any	NA			
Formative Assessment Marks: 40	Summative Assessment Marks:: 60	Duration of ESA: 02 hrs.		
Course Outcomes	At the end of the course the student should be able to: 1. Study and solve problems related to connectives, predicates and quantifiers under different situations. 2. Develop basic knowledge of matrices and to solve equations using Cramer'srule. 3. Know the concept of Eigenvalues. 4. To develop the knowledge about derivatives and know various applications of differentiation. 5. Understand the basic concepts of Mathematical reasoning, set and functions			

Unit No.	**Course Content**	**Hours**
Unit I	**Basic concepts of set theory:** Mathematical logic introduction statementsConnectives-negation, Conjunction, disjunctionstatement formulas and truth tables- conditional and bi Conditional statements- tautology contradiction- equivalence of formulas-duality law-Predicates and Quantifiers, Arguments.	10
Unit II	**Operations on sets**: power set- Venn diagram Cartesian product-relations - functions- types of functions - composition of functions.	10
Unit III	**Matrix algebra:** Introduction-Types of matrices-matrix operations- transpose of a matrix - determinant of matrix - inverse of a matrix-Cramer's rule. **Matrix:** finding rank of a matrix - normal form-echelon form Cayley Hamilton theorem-Eigen values	12
Unit IV	**Differential calculus:** Functions and limits - Simple Differentiation of Algebraic Functions – Evaluation of First and Second Order Derivatives – Maxima and Minima	08

Recommended Learning Resources	
Print Resources	1. P. R. Vittal-Business Mathematics and Statistics, Margham Publications, Chennai B. S. Vatsa-Discrete Mathematics –New Age International Limited Publishers, New Delhi

Year	I	**Course Code:** 21BCA1C3LAC	**Credits**	03
Sem.	I	**Course Title:** Accountancy	**Hours**	40
Course Pre-requisites, if any	NA			
Formative Assessment Marks: 40	Summative Assessment Marks: 60		Duration of ESA: 02 hrs.	
Course Outcomes	At the end of the course the student should be able to: 1. Study and understand Accounting, systems of Book, Branches of accounting advantage and limitations 2. Know the concept of accounting, financial accounting process and Journalization 3. Maintenance different account book and reconciliations 4. Preparations of different bills, and trial balance.			

Unit No.	**Course Content**	**Hours**
Unit I	**Introduction:** History and Development of Accounting, Meaning, Objectives and functions of Accounting, Book keeping V/s Accounting, Users of accounting data, systems of book keeping and accounting, branches of accounting, advantages and limitations of accounting	08
Unit II	**Accounting Concepts and Convention:** Meaning, need and classification, accounting standards meaning, need and classification of Indian accounting standards. Accounting principles V/s accounting standard.Financial Accounting Process: Classification of accounting transactions and accounts, rules of debit and credit as per Double Entry System. Journalization and Ledger posting.	10
Unit III	**Preparation of Different Subsidiary Books:** Purchase Day book Sales Day Book, Purchase Returns Day Book, Sales Returns Day Book, Cash Book. Bank Reconciliation Statement: Meaning, Causes of Difference, Advantages, Preparation of Bank Reconciliation Statements.	10
Unit IV	**Account Procedure:** Honor of the Bill, Dishonor of the Dill, Endorsement, Discounting, Renewal, Bill for collection, Retirement of the Bill, Accommodation Bills, Bill Receivable Book and Payable Book. Preparation of Trial Balance: Rectification of errors and Journal Proper.**Preparation of Final Accounts:** Meaning, need and classification, Preparation of Manufacturing, Trading, Profit and loss account and Balance – Sheet of sale- traders and partnership firms.	12

Recommended Learning Resources	
Print Resources	**Reference Books:** 1. S. Ramesh, B.S. Chandrashekar, A Text Book of Accountancy. 2. V.A. Patil and J.S. Korlahalli, Book – keeping and accounting, (R. Chand and Co.Delhi). 3. R.S.Singhal, Principles of Accountancy,(NageenPrakashpvt.Lit.Meerut). 4. M.B.Kadkol, Book–Keeping and Accountancy, (RenukaPrakashan, Hubil) 5. Vithal, Sharma: Accounting for Management, Macmillan Publishers, Mumbai. 6. B B.S. Raman, Accountancy, (United Publishers, Mangalore). 7. Tulsian, Accounting and Financial Management – I:Financial Accounting – Person Education

OPEN-ELECTIVE SYLLABUS :

Year	I	**Course Code:** 21BCA1O1CPL **Course Title: C programming Concepts**	**Credits**	03
Sem.			**Hours**	40
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:...32hrs.	
Course Outcomes		At the end of the course the student should be able to: 1. Read, understand and trace the execution of programs written in C language 2. Apply programming control structures for a given problem to create C code 3. Understand derived datyes and develop C code using arrays/ strings 4. Understand user defined functions and datatypes to develop C code		
Unit No.		**Course Content**		**Hours**
Unit I		**Introduction to C Programming:** Overview of C; History and Features of C; Structure of a C Program with Examples; Creating and Executing a C Program; Compilation process in C. **C Programming Basic Concepts:** C Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration & initialization of variables; Symbolic constants. **Input and output with C:** Formatted I/O functions - *printf*and*scanf,* control stings and escape sequences, output specifications with *printf*functions; Unformatted I/O functions to read and display single character and a string - *getchar, putchar, gets* and *puts* functions **C**		10
Unit II		**Operators & Expressions:** Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment & Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associatively; Evaluation of arithmetic expressions; Type conversion. **Control Structures:** Decision making Statements - Simple if, if_else, nested if_else, else_if ladder, Switch Case, goto, break &continue statements;Looping Statements - Entry controlled and exit controlled		10

	statements, while, do-while, for loops, Nested loops.	
Unit III	**Derived data types in C:** Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation.**Strings:** Declaring & Initializing string variables; String handling functions - strlen, strcmp, strcpy and strcat; Character handling functions - toascii, toupper, tolower, isalpha, isnumericetc	10
Unit IV	**User Defined Functions:** Need for user defined functions; Format of C user defined functions; Components of user defined functions - return type, name, parameter list, function body, return statement and function call; Categories of user defined functions - With and without parameters and return type.	10
Recommended Leaning Resources		
Print Resources	**Reference Books:** 1. C: The Complete Reference, By HerbertSchildt. 2. C Programming Language, By Brain W.Kernighan 3. Kernighan & Ritchie: The C Programming Language(PHI) 4. E. Balaguruswamy: Programming in ANSI C(TMH) 5. Kamthane: Programming with ANSI and TURBO C (PearsonEducation) 6. V. Rajaraman: Programming in C (PHI –EEE) 7. S. Byron Gottfried: Programming with C(TMH) 8. YashwantKanitkar: Let usC 9. P.B. Kottur: Programming in C (SapnaBookHouse)	

Semester II

Year	I	**Course Code:** 21BCA2C4L	**Credits**	03
Sem.	II	**Course Title:**Data Structures using C	**Hours**	40
Course Pre-requisites, if any		Knowledge of Programming		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA: 02 hrs.	
Course Outcomes		At the end of the course the student should be able to: 1. Understand the classification of data structures and dynamic memory allocation 2. Understand the difference between iteration and recursion and apply recursive definition for problem solving 3. Understand and evaluate the applications of stacks and queues 4. Understand and evaluate the applications of linked lists and tree		

Unit No.	**Course Content**	**Hours**
Unit I	**Introduction to data structures:** Definition; Types of data structures - Primitive & Non-primitive, Linear and Non-linear; Operations on data structures. Dynamic memory allocation: Static & Dynamic memory allocation; Memory allocation and de-allocation functions - malloc, calloc, realloc and free.**Pointers in C:** Understanding pointers - Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers and Arrays; Pointer Arithmetic; Advantages and disadvantages of using pointers;	08
Unit II	**Recursion:** Definition; Types of recursions; Recursion Technique Examples - GCD, Binomial coefficient nCr, Towers of Hanoi; Comparison between iterative and recursive functions.**Sorting and Searching:** Arrays as abstract data types, Representation of linear arrays in memory, Traversing linear arrays; Inserting and deleting elements; Sorting – Selection sort, Bubble sort, Quick sort, Selection sort, Insertion sort; Searching - Sequential Search, Binary search; Iterative and Recursive searching	10

Unit III	**Stacks:** Basic Concepts – Definition and Representation of stacks; Operations on stacks – Push, Pop; Applications of stacks; Infix, postfix and prefix notations; Conversion from infix to postfix using stack; Evaluation of postfix expression using stack; Application of stack in function calls.**Queues:** Basic Concepts – Definition and Representation of queues; Types of queues, - Simple queues, Circular queues, Double ended queues, Priority queues; Operations on Simple queues;	10
Unit IV	**Linked list:** Basic Concepts – Definition and Representation of linked list, Types of linked lists - Singly linked list, Doubly linked list, Circular linked list Doubly Circular Linked list; Representation of Linked list in Memory;Operations on Singly linked lists – Traversing, Searching, Insertion, Deletion;**Trees:** Definition; Tree terminologies –node, root node, parent node, ancestors of a node, siblings, terminal & non-terminal nodes, degree of a node, level, edge, path, depth; **Binary tree:** Type of binary trees - strict binary tree, complete binary tree, binary search tree and heap tree; Array representation of binary tree. Traversal of binary tree; preorder, in order and post order traversal.	12
Recommended Learning Resources		
Print Resources	1. Ellis Horowitz and SartajSahni: Fundamentals of Data Structures 2. Tanenbaum: Data structures using C (Pearson Education) 3. Kamathane: Introduction to Data structures (Pearson Education) 4. Y. Kanitkar: Data Structures Using C(BPB) 5. Kottur: Data Structure Using C 6. Padma Reddy: Data Structure Using C	

<table>
<tr><td>Year</td><td>I</td><td>Course Code: 21BCA2C4P</td><td>Credits</td><td>02</td></tr>
<tr><td>Sem.</td><td>II</td><td>Course Title: Lab: Data Structures</td><td>Hours</td><td>40</td></tr>
<tr><td colspan="2">Course Pre-requisites, if any:</td><td colspan="3">Knowledge of Programming</td></tr>
<tr><td colspan="2">Formative Assessment Marks: 25</td><td>Summative Assessment Marks: 25</td><td colspan="2">Duration of ESA: 02 hrs.</td></tr>
<tr><td colspan="2"></td><td colspan="3"><u>Part A:</u>
1. Program to find GCD using recursive function
2. Program to generate binomial coefficient using recursive function.
3. Program to generate n Fibonacci numbers using recursive function.
4. Program to implement Towers of Hanoi using recursion.
5. Program to implement dynamic array, find smallest and largest element of the array.
6. Program to read the names of cities and arrange them alphabetically.
7. Program to sort the given list using selection sort technique.
8. Program to sort the given list using bubble sort technique.
9. Program to sort the given list using insertion sort technique.</td></tr>
<tr><td colspan="2"></td><td colspan="3"><u>Part B</u>:
1. Program to sort the given list using quick sort technique.
2. Program to sort the given list using merge sort technique.
3. Program to search an element using linear search technique.
4. Program to search an element using binary search technique.
5. Program to implement Stack.
6. Program to convert an infix expression to postfix.
7. Program to implement simple queue.
8. Program to implement linear linked list.
9. Program to display in-order traversal of a binary tree.</td></tr>
</table>

Year	I	**Course Code:** 21BCA2C5L	**Credits**	03
Sem.	II	**Course Title:** Object Oriented Programming with JAVA	**Hours**	40
Course Pre-requisites, if any		Knowledge of Programming		
Formative Assessment Marks: 30		Summative Assessment Marks: 70	Duration of ESA: 03 hrs.	
Course Outcomes		At the end of the course the student should be able to: 1. Understand the features of Java and the architecture of JVM 2. Write, compile, and execute Java programs that may include basic data types and control flow constructs and how type casting is done 3. Identify classes, objects, members of a class and relationships among them needed for a specific problem and demonstrate the concepts of polymorphism and inheritance 4. The students will be able to demonstrate programs based on interfaces and threads and explain the benefits of JAVA's Exceptional handling mechanism compared to other Programming Language 5. Write, compile, execute Java programs that include GUIs and event driven programming and also programs based on files		
Unit No.		**Course Content**		**Hours**
Unit I		**Introduction to Java:** OOPs concepts, Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Arrays in java. **Objects and Classes:** Basics of objects and classes in java, Methods and objects,Instance of operator, Visibility modifiers, Method Overloading, Constructors, Static Members, Inbuilt classes like String, Character, String Buffer, this reference.		12
Unit II		**Inheritance and Polymorphism:** Inheritance in java, Super and sub class, Types of inheritance, Overriding, Polymorphism, Dynamic binding, Abstract class, Interface in java, Packages in java - defining and importing user defined packages.		08
Unit III		**Event and GUI programming:** Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout,		10

	Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, TextFields, Text Areas, Combo Boxes, Lists, Windows, Menus.	
Unit IV	**Multithreading in java:** Thread life cycle and methods, Runnable interface, Thread priorities, Exception handling mechanism with try catch-finally, Introduction to JavaBeans.**I/O programming:** Java Input Output: Java IO package, File, Byte/Character Stream, File reader / writer	10
Recommended Learning Resources		
Print Resources	**Reference Books:** 1. Java, By E Balagurusamy – A Primer, Fourth Edition, Tata McGraw Hill Education Private Limited. 2. Core Java Volume I – Fundamentals, By Cay S. Horstmann, PrenticeHall 3. Object Oriented Programming with Java : Somashekara, M.T., Guru, D.S., Manjunatha,K.S 4. Java 2 - The Complete Reference – McGraw Hillpublication. 5. Java - The Complete Reference, 7th Edition, By Herbert Schildt– McGraw Hill publication.	

<table>
<tr><td>Year</td><td>I</td><td>Course Code: 21BCA2C5P</td><td>Credits</td><td>02</td></tr>
<tr><td>Sem.</td><td>II</td><td>Course Title: Lab: JAVA</td><td>Hours</td><td>40</td></tr>
<tr><td colspan="2">Course Pre-requisites, if any:</td><td colspan="3">Knowledge of Programming</td></tr>
<tr><td colspan="2">Formative Assessment Marks: 25</td><td>Summative Assessment Marks: 25</td><td colspan="2">Duration of ESA: 02 hrs.</td></tr>
<tr><td colspan="2"></td><td colspan="3"><u>Practice Labs</u>
1. Program to print the following triangle of numbers
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
2. Program to simple java application, to print the message, “Welcome to java”
3. Program to display the month of a year. Months of the year should be held in an array.
4. Program to find the area of rectangle.
5. program to demonstrate a division by zero exception
6. Program to create a user defined exception say Pay Out of Bounds.</td></tr>
<tr><td colspan="2"></td><td colspan="3"><u>Part A</u>: Programming Lab – Java Fundamentals – OOPS in JAVA
1. Program to assign two integer values to X and Y. Using the ‘if’ statement the output of the program should display a message whether X is greater than Y.
2. Program to list the factorial of the numbers 1 to 10. To calculate the factorial value, use while loop. (Hint: Fact of 4 = 4*3*2*1)
3. Program to find the area and circumference of the circle by accepting the radius from the user.
4. Program to add two integers and two float numbers. When no arguments are supplied, give a default value to calculate the sum. Use function overloading.
5. Program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from AddSub class</td></tr>
</table>

	to use the member data of the super class. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations. 6. Program with class variable that is available for all instances of a class. Use static variable declaration. Observe the changes that occur in the object's member variable values. 7. Program to create a student class with following attributes; Enrollment No: Name, Mark of sub1, Mark of sub2, mark of sub3, Total Marks. Total of the three marks must be calculated only when the student passes in all three subjects. The passing mark for each subject is 50. If a candidate fails in any one of the subjects his total mark must be declared as zero. Using this condition write a constructor for this class. Write separate functions for accepting and displaying student details. In the main method create an array of three student objects and display the details. 8. Write a program to demonstrate multiple inheritance and use of Implementing Interfaces 9. Illustrate creation of thread by a) Extending Thread class. b) Implementing Runnable Interfaces 10. Write a program to demonstrate multiple inheritance and use of iimplementing Interfaces. 11. Create a package 'BCA' in your current working directory. a. Create a class student in the above package with the following attributes: Name, age, gender. Include appropriate constructor and a method for displaying the details. b. Import above package and access the member variables and function contained in a package.
	PART B: Exception Handling & GUI Programming 1. Program to catch Negative Array Size Exception. This exception is caused when the array size is initialized to negative values. 2. Program to demonstrate exception handling with try, catch and finally. 3. Program which create and displays a message on the window 4. Program to draw several shapes in the created window 5. Programto create a 4×4 grid and fills it in with 15 buttons, each 1. labeled with its index.

	6. Program which creates a frame with two buttons father and mother. When we click the father button the name of the father, his age and designation must appear. When we click mother button similar details of mother also appear. 7. Create a frame which displays your personal details with respect to a button click 8. Program to create a window with TextFields and Buttons. The "ADD" button adds the two integers and display the result. The "CLEAR" button shall clear all the text fields. 9. Program to create a window, when we press M or m, the window displays "good morning", A or a, the window display's Good Afternoon" , E or e, the window displays "good morning", N or n, the window displays "good morning" 10. Demonstrate the various mouse handling events using suitable example. 11. Program to create menu bar and pull-down menus.

Note: Student has to execute a minimum of 10 programs in each part to complete the Lab course

Evaluation Scheme for Data Structures and Java Lab Examination

Assessment Criteria		Marks
Program – 1 from Part A	Writing the Program	03
	Execution and Formatting	07
Program -2 from Part B	Writing the Program	03
	Execution and Formatting	07
Viva Voice		05
Total		**25**

Year	I	**Course Code:** 21BCA2C6L	**Credits**	04
Sem.	II	**Course Title:** Discrete Mathematics	**Hours**	40
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA: 02 hrs.	
Course Outcomes		1. At the end of the course the student should be able to: 2. To understand the basic concepts of Mathematical reasoning, set and functions. 3. To understand various counting techniques and principle of inclusion and exclusions. 4. Understand the concepts of various types of relations, partial ordering and 5. Equivalence relations. 6. Apply the concepts of generating functions to solve the recurrence relations. 7. Familiarize the fundamental concepts of graph theory and shortest path algorithm		

Unit No.	Course Content	Hours
Unit I	**The Foundations:** Logic and proofs: Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.**Basic Structures:** Sets, Functions, Sequences, Sums, and Matrices: Sets, set operations, Functions, Sequences and Summations, matrices.	10
Unit II	**Counting:** Basics of counting, Pigeonhole principle, Permutation and combination, Binomial Coefficient and Combination, Generating Permutation and Combination. **Advanced Counting Techniques:** Applications of Recurrence Relations, Solving Linear Recurrence, Relations, Divide and Conquer Algorithms and Recurrence Relations, Generating functions, Inclusion-Exclusion, Applications of Inclusion-exclusion.	10
Unit III	**Induction and Recursion:** Mathematical Induction, Strong Induction and Well- Ordering, Recursive Definitions and Structural Induction, Recursive	12

	Algorithms, Program Corrections. **Relation:** Properties of relation, Composition of relation, Closer operation on relation, Equivalence relation and partition. Operation on relation, Representing relation.	
Unit IV	**Graphs**: Graphs and Graph models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring..	08
Recommended Learning Resources		
Print Resources	**Reference Books:** 1. Discrete Mathematics and Its Applications, Kenneth H. Rosen: Seventh Edition, 2012. 2. Discrete Mathematical Structure, Bernard Kolman, Robert C, Busby, Sharon Ross, 2003. 3. Graph Theory with Applications to Engg and Comp. Sci: Narsingh Deo-PHI1986. 4. Discrete and Combinatorial Mathematics Ralph P. Grimaldi, B. V. Ramatta, Pearson, Education, 5Edition. 5. Discrete Mathematical Structures, Trembley and Manobar.	

Year	I	**Course Code: 21BCA2O2MPL** **Course Title: Web Designing**	**Credits**	03
Sem.			**Hours**	40
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:..02 hrs.	
Course Outcomes		At the end of the course the student should be able to: 1. Understand the History of Internet and web Designing tools 2. Understand Markup Languages and stylesheet 3. Implement Scripting 4. Appreciate website creation		

Unit No.	**Course Content**	**Hours**
Unit I	Histroy of Internet, The World Wide Web, Web Browser, Web Server, URL, Working of Web, Web Page, Types of Web Pages, Web Content, Websites, Home Pages, Building Website, Website building tools; Web graphics design, basic tips for graphics design, to web programming: what is web programming? , web programming languages.	10
Unit II	Introduction to XHTML- Basic Syntax, Standard structure, Basic text markup, Images, Hypertext, Links, Lists, Tables, Forms-<form>,<input>,<label>,<select>,<textarea> tags and action buttons(submit and reset).CSS-Introduction, Levels of style sheets, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and tags.	10
Unit III	JavaScript: Object orientation and JavaScript; General syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input; Control statements; Object creation and modification; Arrays; Functions; Constructor; Pattern matching using regular expressions; Errorsin scripts; Examples.	10
Unit IV	Introduction to XML, Syntax of XML , XML document structure, Displaying raw XML documents, Displaying XML documents with CSS,XSLT Stylesheets and Displaying XML documents with XSLT.	10

	Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation	
Recommended Leaning Resources		
Print Resources	**Reference Books:** 1. Robert W. Sebestra, "Programming the World Wide Web", 7th Edition /4th edition Addison Wesley Publication,2013. 2. Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India 3. Web Technologies, Black Book, dreamtech Press 4. HTML 5, Black Book, dreamtech Press 5. Web Design, Joel Sklar, Cengage Learning 6. Developing Web Applications in PHP and AJAX, Harwani, McGrawHill 7. Internet and World Wide Web How to program, P.J. Deitel& H.M. Deitel, Pearson	

Question Paper Pattern:

RANI CHANNAMMA UNIVERSITY
Department of Computer Science

Bachelor of Computer Applications

Sub: Code: Maximum Marks: 60

a. Answer any Six Questions from Question 1 b. Answer any Three each Questions from Question 2,3,4 and 5

Q.No.1.	**Answer any Six Questions (Atlest Two question from Each Unit)** **a.** **b.** **c.** **d,** **e.** **f.** **g.** **h.**	**2X6=12**
Q.No.2.	**(Should cover Entire Unit-I)** **a.** **b.** **c.** **d.**	**4X3=12**
Q.No.3.	**(Should cover Entire Unit-II)** **a.** **b.** **c.** **d.**	**4X3=12**
Q.No.4.	**(Should cover Entire Unit-III)** **a.** **b.** **c.** **d.**	**4X3=12**
Q.No.5.	**(Should cover Entire Unit-IV)** **a.** **b.** **c.** **d.**	**4X3=12**

ASSESSMENT METHODS

Evaluation Scheme for Internal Assessment:

Theory:

Assessment Criteria	40 marks
1st Internal Assessment Test for30 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1 hr after 15 weeks . Average of two tests should be considered.	30
Assignment	10
Total	**40**

Assessment Criteria	25 marks
1st Internal Assessment Test for20 marks 1/2 hr after 8 weeks and 2nd Internal Assessment Test for 20 marks 1/2 hr after 15 weeks. Average of two tests should be considered.	20
Assignment	05
Total	**25**

Practical:

Assessment Criteria	25 marks
Semester End Internal Assessment Test for 20 marks 2 hrs	20
Journal (Practical Record)	05
Total	**25**

Rani Channamma University Belagavi

Vidyasangama, NH-04, Bhutaramanahatti, Belagavi – 591 156

Bachelor of Computer Applications (B.C.A.)

Syllabus for III and IV Semester

(as per National Education Policy – 2020)

2022-23 onwards

RANI CHANNAMMA UNIVERSITY

Vidyasangama, NH-04, Bhutaramanahatti, Belagavi – 591 156

SYLLABUS

Bachelor of Computer Applications (B.C.A.)

(as per National Education Policy – 2020)

Submitted by

Dr. Parashuram Bannigidad
Chairperson BoS (UG) – Rani Channamma University, Belagavi

Members of Board of Studies

1. Dr. Vijayalaxmi M Belagumpi — Member
   Assistant Professor,
   Dept. of Computer Science,
   GFGC Vijayapur
2. Dr. Bhagirathi Halalli — Member
   Assistant Professor,
   Dept. of Computer Science,
   GFGC Raibag

SEMESTER-3										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams(Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L-5	21BCA3L5LK3	Kannada	40	60	100	4	0	0	3	2
	21BCA3L5LFK3	Functional Kannada								
L-6	21BCA3L6EN3	English	40	60	100	4	0	0	3	2
	21BCA3L6HI3	Hindi								
	21BCA3L6SN3	Sanskrit								
	21BSC3L6TE3	Telugu								
	21BCA3L6UR3	Urdu								
DSC7	21BCA3C7L	Database Management System	40	60	100	3	0	0	3	2
	21BCA3C7P	DBMS Lab	25	25	50	0	0	3	2	3
DSC8	21BCA3C8L	C# and .Net Framework	40	60	100	3	0	0	3	2
	21BCA3C8P	C# and .Net Framework Lab	25	25	50	0	0	3	2	3
DSC9	21BCA3C9L	Computer Communication and Networks	40	60	100	3	0	0	3	2
OEC3	21BCA3O3PPCL	Python Programming Concepts	40	60	100	3	0	0	3	2
AECC2	21BCA3AE2CIL	Constitution of India	20	30	50	1	0	2	2	2
VBC5	21BCA3V5PE3	Physical Education – Sports	25	-	25	-	-	2	1	-
VBC6	21BCA3V6NC2	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
Total Marks					**800**	**Semester Credits**			**26**	

SEMESTER-4										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams(Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L-7	21BCA4L7LK4	Kannada	40	60	100	4	0	0	3	2
	21BCA4L7LFK4	Functional Kannada								
L-8	21BCA4L8EN4	English	40	60	100	4	0	0	3	2
	21BCA4L8HI4	Hindi								
	21BCA4L8SN4	Sanskrit								
	21BSC4L8TE4	Telugu								
	21BCA4L8UR4	Urdu								
DSC10	21BCA4C10L	Python Programming	40	60	100	3	0	0	3	2
	21BCA4C10P	Python Programming Lab	25	25	50	0	0	3	2	3
DSC11	21BCA4C11L	Multimedia & Animation	40	60	100	3	0	0	3	2
	21BCA4C11P	Multimedia & Animation Lab	25	25	50	0	0	3	2	3
DSC12	21BCA4C12L	Operating System Concepts	40	60	100	3	0	0	3	2
OEC4	21BCA4O4ECL	Financial Education and Investment Awareness	20	30	50	3	-	-	2	1hr30min
SEC2	21BCA4SE2OST	Open Source Tools	20	30	50	1	0	2	2	2
VBC7	21BCA4V7PE4	Physical Education – Sports	25	-	25	-	-	2	1	-
VBC8	21BCA4V8NC3	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
Total Marks					**750**	**Semester Credits**			**25**	
Exit option with Diploma in Computer Applications (with the completion of courses equivalentto a minimum of 96 credits)					**3150**	**II year Credits**			**103**	

Syllabus for BCA III and IV Semesters

III Semester Curriculum for BCA

Sem	Core Courses	Hour / Week	
		Theory	**Lab**
III	Database Management Systems	**3**	
	C# and DOT NET Framework	**3**	
	Computer Communication and Networks	**3**	
	LAB: DBMS		**4**
	LAB: C# and DOT NET Framework		**4**
	OEC: Python Programming Concepts	**3**	**-**
IV	Python Programming	**3**	
	Computer Multimedia and Animation	**3**	
	Operating Systems Concepts	**3**	
	LAB: Python programming		**4**
	LAB: Multimedia and Animation		**4**

Course Content for BCA III Semester

Course Title: **Database Management System**	Course code: **21BCA3C7L**
Total Contact Hours: 42	Course Credits: 03
Formative Assessment or IA Marks: 40	Duration of SEE/Exam: 02 Hours
Summative Assessment Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the various database concepts and the need for database systems.
- Identify and define database objects, enforce integrity constraints on a database using DBMS.
- Demonstrate a Data model and Schemas in RDBMS.
- Identify entities and relationships and draw ER diagram for a given real-world problem.
- Convert an ER diagram to a database schema and deduce it to the desired normal form.
- Formulate queries in Relational Algebra, Structured Query Language (SQL) for database manipulation.
- Explain the transaction processing and concurrency control techniques.

DSC7: Database Management System (DBMS)

Unit	Description	Hours
1	**Database Architecture:** Introduction to Database system applications. Characteristics and Purpose of database approach. People associated with Database system. Data models. Database schema. Database architecture. Data independence. Database languages, interfaces, and classification of DBMS.	08
2	**E-R Model:** Entity-Relationship modeling: E – R Model Concepts: Entity, Entity types, Entity sets, Attributes, Types of attributes, key attribute, and domain of an attribute. Relationships between the entities. Relationship types, roles and structural constraints, degree and cardinality ratio of a relationship. Weak entity types, E -R diagram.	08
3	**Relational Data Model:** Relational model concepts. Characteristics of relations. Relational model constraints: Domain constrains, key constraints, primary & foreign key constraints, integrity constraints and null values.	10

	Relational Algebra: Basic Relational Algebra operations. Set theoretical operations on relations. JOIN operations Aggregate Functions and Grouping. Nested Sub Queries-Views. Introduction to PL/SQL & programming of above operations in PL/SQL.	
4	**Data Normalization:** Anomalies in relational database design. Decomposition. Functional dependencies. Normalization. First normal form, Second normal form, Third normal form. Boyce-Codd normal form.	07
5	**Query Processing Transaction Management:** Introduction Transaction Processing. Single user & multiuser systems. Transactions: read & write operations. Need of concurrency control: The lost update problem, Dirty read problem. Types of failures. Transaction states. Desirable properties (ACID properties) of Transactions. Concurrency Control Techniques: Locks and Time stamp Ordering. Deadlock & Starvation.	09

References:

1. Fundamentals of Database Systems, Ramez Elamassri, Shankant B. Navathe, 7th Edition, Pearson, 2015
2. An Introduction to Database Systems, Bipin Desai, Galgotia Publications, 2010.
3. Introduction to Database System, C J Date, Pearson, 1999.
4. Database Systems Concepts, Abraham Silberschatz, Henry Korth, S.Sudarshan, 6th Edition, McGraw Hill, 2010.
5. Database Management Systems, Raghu Rama Krishnan and Johannes Gehrke, 3rd Edition, McGraw Hill, 2002

Year	II	**Course Code:** 21BCA3C7P	**Credits**	02
Sem.	III	**Course Title: DBMS LAB**	**Hours**	40
Course Pre-requisites, ifany:		Knowledge of Programming		
Formative Assessment Marks: 25		Summative Assessment Marks: 25	Duration of ESA: 03 hrs.	

Practicals:

CO: Student would be able to create tables, execute queries and PL/SQL programs.

1. Execute a single line query and group functions.
2. Execute DDL Commands.
3. Execute DML Commands
4. Execute DCL and TCL Commands.
5. Implement the Nested Queries.
6. Implement Join operations in SQL
7. Create views for a particular table
8. Implement Locks for a particular table
9. Write PL/SQL procedure for an application using exception handling.
10. Write PL/SQL procedure for an application using cursors.
11. Write a PL/SQL procedure for an application using functions
12. Write a PL/SQL procedure for an application using package

Evaluation Scheme for Lab Examination:

Assessment Criteria		**Marks**
Program – 1 from Part A	Writing the Program	03
	Execution and Formatting	07
Program -2 from Part B	Writing the Program	03
	Execution and Formatting	07
Viva Voice based on **DBMS**		05
Total		25

Course Title: **C# and Dot Net Framework**	Course code: **21BCA3C8L**
Total Contact Hours: 42	Course Credits: 03
Formative Assessment or IA Marks: 40	Duration of SEE/Exam: 02 Hours
Summative Assessment Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

- Describe Object Oriented Programming concepts like Inheritance and Polymorphism in C# programming language.
- Interpret and Develop Interfaces for real-time applications.
- Build custom collections and generics in C#.

DSC8: C# and Dot Net Framework

Unit	Description	Hours
1	Introduction The C# language, the .Net Architecture and .Net Framework, The Common Language Runtime (CLR), Microsoft Intermediate Language (MSIL) Code, Just In Time Compilers (JITers),The Framework Class Library (FCL), The Common Languages Specification (CLS), The Common Type System (CTS), The .Net Framework, Working with Visual Studio.Net, Similarities and Differences between C# and C++, Java, and Visual Basic, Understanding the HELLO WORLD Application Code, The System. Environment Class, The System. Console Class, Namespaces in C#, The using Keyword, The class Keyword, The Main() Method, Printing on the Console, Comments.	10
2	C# Basics: Data Types, Variables & Constants, Operators in C#, Arithmetic Operators, Prefix and Postfix notation, Assignment Operators, Relational Operators, Other Operators, Operators precedence, Flow Control and Conditional Statements. Object and Classes: Concept of a class, Objects, Fields, Methods, Access modifiers, Properties, Static members of the class, Constructors, Destructors, Method overloading.	08
3	Pillars of OOP, Encapsulation support, Class properties, C#"s Inheritance Support, C #'s Polymorphic Support, Interface: Deriving classes, calling base class constructor, Overriding Methods, Non-Inheritable Classes, Abstract Class, Interface Inheritance, Namespace and Access Modifiers, Boxing and Un-boxing. .NET Delegate type, defining a Delegate in C#, System. Delegate Base Classes, Delegate examples, C# Events, operator overloading.	08
4	Exception Handling: Handling Exceptions using try and catch, Raising Exceptions using throw, Pre- defined Exception classes, Custom Exception classes, Understanding Object Lifetime classes, Objects and References, the basics of Object Lifetime, System. GC type. Assemblies-The Role of .NET Assemblies, Understanding the format of .NET Assemblies, single file assembly, multifile assembly, Private and Shared Assemblies.	08

5	Working with Collections: List and Dictionary, Array List and Hash Table, Generic Classes, Comparable and Sorting, WinForms: Introduction, Controls, Menus and Context Menus, Menu Strip, Toolbar Strip, Graphics and GDI, SDI and MDI Applications, Dialog box (Modal and Modeless), Form Inheritance, Developing Custom, Composite and Extended Controls.	08

References:

1. E. Balagurusamy, Programming in C#, Tata McGraw Hill
2. Stephen Walthert, ASP.NET 3.5 unleased, SAMS
3. ShibiPanikkar and Kumar Sanjeev, C# with .NET Frame Work, Firewall Media
4. Jeffrey Richter, Applied Microsoft .Net Framework Programming, (Microsoft)

Additional Reading:

5. http://www.bestdotnettraining.com
6. http://www.bestsharepointtraining.com
7. https://stackoverflow.com/documentation
8. Troelsen, Andrew, Pro C# 5.0 and the .NET 4.5 Framework, 6th Edition, APress, India

Year	II	**Course Code: 21BCA3C8P**	**Credits**	02
Sem.	III	**Course Title: C# and Dot Net Framework LAB**	**Hours**	40
Course Pre-requisites, ifany:		Knowledge of Programming		
Formative Assessment Marks: 25		Summative Assessment Marks: 25	Duration of ESA: 03 hrs.	

Practicals:

1. Write a C# program to show the machine details like machine name, Operating System, Version, Physical Memory and calculate the time since the Last Boot Up. (Hint: Use System. Environment Class)
2. Write a program in C# Sharp to count a total number of alphabets, digits and special characters in a string
3. Write a program in C# Sharp to create a function to calculate the sum of the individual digits of a given number.
4. Draw a square with sides 100 pixels in length. Then inscribe a circle of radius 50 inside the square. Position the square and the inscribed circle in the middle of the screen.
5. Write a program to implement multilevel inheritance.
6. Write a program to demonstrate System exception.
7. Write an object oriented program to demonstrate bank transaction. Include methods for amount deposit, amount withdrawal and display.
8. Demonstrate operator overloading two complex numbers.
9. Demonstrate Dialog box (Modal and Modeless).
10. Write a program in C# Sharp to create Menu and menu items.

Evaluation Scheme for Lab Examination:

Assessment Criteria		**Marks**
Program – 1 from Part A	Writing the Program	03
	Execution and Formatting	07
Program -2 from Part B	Writing the Program	03
	Execution and Formatting	07
Viva Voice based on **C# and Dot Net Framework**		05
Total		25

Course Title: **Computer Communication and Networks**	Course code: **21BCA3C9L**
Total Contact Hours: 42	Course Credits: 03
Formative Assessment or IA Marks: 40	Duration of SEE/Exam: 02 Hours
Summative Assessment Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data.
- Apply the basics of data communication and various types of computer networks in real world applications.
- Compare the different layers of protocols.
- Compare the key networking protocols and their hierarchical relationship in the conceptual model like TCP/IP and OSI.

DSC9: Computer Communication and Networks

Unit	Description	Hours
1	**Introduction:** Computer Networks and its applications, Network structure, network architecture, Topologies, LAN, WAN, MAN, The OSI reference model, The TCP/IP reference model.	08
2	**The Physical Layer:** Transmission Media – Twisted pair, coaxial cable, optical fiber, radio transmission, microwaves and infrared transmission, Switching – message switching, Multiplexing.	07
3	**The Data Link Layer:** Data Link Layer design issues, Error detection – Single parity checking, Checksum, polynomial codes – CRC, Error correction- Hamming code, Elementary data link protocols, sliding window protocols.	08
4	**The Network Layer:** Network layer design issues, Routing algorithms – Flooding, Distance vector routing, Hierarchical routing, Link state routing, Congestion, control algorithms – Leaky bucket, token bucket algorithm, admission control, Hop by Hop choke packets.	09
5	**The Transport Layer and Application Layer:** Elements of Transport service, Elements of Transport, protocols, Internet transport protocols (TCP & UDP), DNS, Electronic Mailing, and World Wide Web.	10

References:

1. Computer Networks, Andrew S. Tanenbaum, 5th Edition, Pearson Education, 2010.
2. Data Communication & Networking, Behrouza A Forouzan, 3rd Edition, Tata McGraw

Hill,2001.
3. Data and Computer Communications, William Stallings, 10th Edition, Pearson Education, 2017.
4. Data Communication and Computer Networks, Brijendra Singh, 3rd Edition, PHI, 2012.
5. Data Communication & Network, Dr. Prasad, Wiley Dreamtech.
6. http://highered.mheducation.com/sites/0072967757/index.htmls

Open Elective for III Semester

OEC3: Python Programming Concepts

Course Code: **21BCA3O3PPCL** Course Title: **Python Programming Concepts**	Course Credits: 3 (3L+0T+0P)
Semester: III	Duration of SEE: 02 Hour
Total Contact Hours: 42	SEE: 60 Marks IA: 40 Marks

Course Outcomes (COs):

- Explain the fundamentals of Computers.
- Explain the basic concepts of Python Programming.
- Demonstrate proficiency in the handling of loops and the creation of functions.
- Identify the methods to create and store strings.

Unit I Fundamentals of Computers 10 Hrs

Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organization of a Digital Computer; Number Systems – different types, conversion from one number system to another; Computer Codes – BCD, Gray Code, ASCII and Unicode; Boolean Algebra – Boolean Operators with Truth Tables; Types of Software – System Software and Utility Software; Computer Languages - Machine Level, Assembly Level & High Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program - Algorithm, Flowchart and Pseudo code with Examples.

Unit II Python Basics 10 Hrs

Introduction to Features and Applications of Python; Python Versions; Installation of Python; Python Command Line mode and Python IDEs; Simple Python Program. Identifiers; Keywords; Statements and Expressions; Variables; Operators; Precedence and Association; Data Types; Indentation; Comments; Built-in Functions- Console Input and Console Output, Type Conversions; Python Libraries; Importing Libraries with Examples; Illustrative programs.

Unit III 08 Hrs

Python Control Flow: Types of Control Flow; Control Flow Statements- if, else, elif, while loop, break, continue statements, for loop Statement; range() and exit () functions; Illustrative programs.

Unit IV 08 Hrs

Python Functions: Types of Functions; Function Definition- Syntax, Function Calling, Passing Parameters/arguments, the return statement; Default Parameters; Command line Arguments; Key Word Arguments; Illustrative programs.

Unit V **6 Hrs**

Strings: Creating and Storing Strings; Accessing Sting Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String Methods; Illustrative programs.

References

1. Computer Fundamentals (BPB), P. K. Sinha & Priti Sinha
2. Think Python How to Think Like a Computer Scientist, Allen Downey et al., 2nd Edition, Green Tea Press. Freely available online 2015. @https://www.greenteapress.com/thinkpython/thinkCSpy.pdf
3. Introduction to Python Programming, Gowrishankar S et al., CRC Press, 2019.
4. http://www.ibiblio.org/g2swap/byteofpython/read/
5. http://scipy-lectures.org/intro/language/python_language.html
6. https://docs.python.org/3/tutorial/index.html

Course Content for BCA IV Semester

Course Title: **Python Programming**	Course code: **21BCA3C10L**
Total Contact Hours: 42	Course Credits: 03
Formative Assessment or IA Marks: 40	Duration of SEE/Exam: 02 Hours
Summative Assessment Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the basic concepts of Python Programming.
- Demonstrate proficiency in the handling of loops and creation of functions.
- Identify the methods to create and manipulate lists, tuples and dictionaries.
- Discover the commonly used operations involving file handling.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Develop the emerging applications of relevant fields using Python.

DSC10: Python Programming

Unit	Description	Hours
1	**Introduction** to Features and Applications of Python; Python Versions; Installation of Python; Python Command Line mode and Python IDEs; Simple Python Program. **Python Basics:** Identifiers; Keywords; Statements and Expressions; Variables; Operators; Precedence and Association; Data Types; Indentation; Comments; Built-in Functions- Console Input and Console Output, Type Conversions; Python Libraries; Importing Libraries with Examples. Python Control Flow: Types of Control Flow; Control Flow Statements- if, else, elif, while loop, break, continue statements, for loop Statement; range () and exit () functions.	08
2	**Exception Handling:** Types of Errors; Exceptions; Exception Handling using try, except and finally. **Python Functions:** Types of Functions; Function Definition- Syntax, Function Calling, Passing Parameters/arguments, the return statement; Default Parameters; Command line Arguments; Key Word Arguments; Recursive Functions; Scope and Lifetime of Variables in Functions. **Strings:** Creating and Storing Strings; Accessing Sting Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String Methods.	08
3	**Lists:** Creating Lists; Operations on Lists; Built-in Functions on Lists; Implementation of Stacks and Queues using Lists; Nested Lists. Dictionaries: Creating Dictionaries; Operations on Dictionaries; Built-in Functions on Dictionaries; Dictionary Methods; Populating and Traversing Dictionaries. **Tuples and Sets:** Creating Tuples; Operations on Tuples; Built-in Functions	08

	on Tuples; Tuple Methods; Creating Sets; Operations on Sets; Built-in Functions on Sets; Set Methods.	
4	**File Handling:** File Types; Operations on Files– Create, Open, Read, Write, Close Files; File Names and Paths; Format Operator. **Object Oriented Programming:** Classes and Objects; Creating Classes and Objects; Constructor Method; Classes with Multiple Objects; Objects as Arguments; Objects as Return Values; Inheritance- Single and Multiple Inheritance, Multilevel and Multipath Inheritance; Encapsulation- Definition, Private Instance Variables; Polymorphism- Definition, Operator Overloading.	08
5	**GU Interface:** The tkinter Module; Window and Widgets; Layout Management- pack, grid and place. **Python SQLite:** The SQLite3 module; SQLite Methods- connect, cursor, execute, close; Connect to Database; Create Table; Operations on Tables- Insert, Select, Update. Delete and Drop Records. **Data Analysis:** NumPy- Introduction to NumPy, Array Creation using NumPy, Operations on Arrays; Pandas- Introduction to Pandas, Series and DataFrames, Creating DataFrames from Excel Sheet and .csv file, Dictionary and Tuples. Operations on DataFrames. **Data Visualisation:** Introduction to Data Visualisation; Matplotlib Library; Different Types of Charts using Pyplot- Line chart, Bar chart and Histogram and Pie chart.	10

References:

1. Think Python How to Think Like a Computer Scientist, Allen Downey et al., 2nd Edition, Green Tea Press. Freely available online @ https://www.greenteapress.com/thinkpython/thinkCSpy.pdf, 2015.
2. Introduction to Python Programming, Gowrishankar S et al., CRC Press, 2019.
3. Python Data Analytics: Data Analysis and Science Using Pandas, matplotlib, and the Python Programming Language, Fabio Nelli, Apress®, 2015
4. Advance Core Python Programming, MeenuKohli, BPB Publications, 2021.
5. Core PYTHON Applications Programming, Wesley J. Chun, 3rd Edition, Prentice Hall, 2012.
6. Automate the Boring Stuff, Al Sweigart, No Starch Press, Inc, 2015.
7. Data Structures and Program Design Using Python, D Malhotra et al., Mercury Learning and Information LLC, 2021.
8. http://www.ibiblio.org/g2swap/byteofpython/read/
9. https://docs.python.org/3/tutorial/index.html

Year	II	**Course Code: 21BCA4C10P**	**Credits**	02
Sem.	III	**Course Title: Python Programming LAB**	**Hours**	40
Course Pre- requisites, ifany:		Knowledge of Programming		
Formative AssessmentMarks: 25		Summative Assessment Marks: 25	Duration of ESA: 03 hrs.	

Practicals:

Part-A

1. Check if a number belongs to the Fibonacci Sequence
2. Solve Quadratic Equations
3. Find the sum of n natural numbers
4. Display Multiplication Tables
5. Check if a given number is a Prime Number or not
6. Implement a sequential search
7. Create a calculator program
8. Explore string functions
9. Implement Selection Sort
10. Implement Stack
11. Read and write into a file

Part-B

1. Demonstrate usage of basic regular expression
2. Demonstrate use of advanced regular expressions for data validation.
3. Demonstrate use of List
4. Demonstrate use of Dictionaries
5. Create SQLite Database and Perform Operations on Tables
6. Create a GUI using Tkinter module
7. Demonstrate Exceptions in Python
8. Drawing Line chart and Bar chart using Matplotlib
9. Drawing Histogram and Pie chart using Matplotlib
10. Create Array using NumPy and Perform Operations on Array
11. Create DataFrame from Excel sheet using Pandas and Perform Operations on Data Frames

Note: A minimum of 10 Programs should be done in each Part.

Evaluation Scheme for Lab Examination:

Assessment Criteria		**Marks**
Program – 1 from Part A	Writing the Program	03
	Execution and Formatting	07
Program -2 from Part B	Writing the Program	03
	Execution and Formatting	07
Viva Voice based on Python Programming		05
Total		25

Course Title: Computer Multimedia & Animation	Course code: **21BCA3C11L**
Total Contact Hours: 42	Course Credits: 03
Formative Assessment or IA Marks: 40	Duration of SEE/Exam: 02 Hours
Summative Assessment Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

- Write a well-designed, interactive Web site with respect to current standards and practices.
- Demonstrate in-depth knowledge of an industry-standard multimedia development tool and its associated scripting language.
- Determine the appropriate use of interactive versus standalone Web applications.

DSC11: Computer Multimedia & Animation

Unit	Description	Hours
1	Web Design: Origins and evolution of HTML, Basic syntax, Basic text markup, Images, Lists, Tables, Forms, Frame, Overview and features of HTML5. CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The and tags; Overview and features of CSS3. JavaScript: Object orientation and JavaScript; General syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input.	10
2	Animation: What is an Animation? The Start and End States, Interpolation, Animations in HTML. All About CSS Animations, Creating a Simple Animation, Detailed Look at the CSS Animation Property, Keyframes, Declaring Multiple Animations, Wrap-up. All About CSS Transitions, Adding a Transition, Looking at Transitions in Detail, The Longhand Properties, Longhand Properties vs. Shorthand Properties, Working with Multiple Transitions.	09
3	HTML5 – SVG: Viewing SVG Files, Embedding SVG in HTML5, HTML5 − SVG Circle, HTML5 − SVG Rectangle, HTML5 − SVG Line, HTML5 − SVG Ellipse, HTML5 − SVG Polygon, HTML5 − SVG Polyline, HTML5 − SVG Gradients, HTML5 − SVG Star.	08
4	HTML5 – CANVAS: The Rendering Context, Browser Support, HTML5 Canvas Examples, Canvas - Drawing Rectangles, Canvas - Drawing Paths, Canvas - Drawing Lines, Canvas - Drawing Bezier Curves, Canvas - Drawing Quadratic Curves, Canvas - Using Images, Canvas - Create Gradients,	08
5	HTML5 - Styles and Colors, Canvas - Text and Fonts, Canvas - Pattern and Shadow, Canvas - Save and Restore States, Canvas - Translation, Canvas - Rotation, Canvas - Scaling, Canvas - Transforms, HTML5 Canvas - Composition, Canvas – Animations.	07

References:

1. The Complete Reference HTML and CSS, 5th Edition, Thomas A Powell, 2017.
2. Animation in HTML, CSS, and JavaScript, Kirupa Chinnathambi, 1st Edition, Createspace Independent Pub, 2013.
3. https://www.w3.org/Style/CSS/current-work#CSS3
4. http://bedford-computing.co.uk/learning/cascading-style-sheets-css/

Year	II	**Course Code:** 21BCA4C11P	**Credits**	02
Sem.	III	**Course Title: Computer Multimedia & Animation LAB**	**Hours**	40
Course Pre-requisites, ifany:		Knowledge of Programming		
Formative Assessment Marks: 25		Summative Assessment Marks: 25	Duration of ESA: 03 hrs.	
		Practicals: **Part A** 1. Program to Design LOG IN Form in Html. 2. Program for Creating animation of "Bouncing Cloud" using HTML and CSS 3. Program to demonstrate a keyframe animation. 4. Program to demonstrate a Font style, font weight, and font size properties using CSS. 5. Program to demonstrate multiple animations. 6. Program to use table tag to format web page. Also create the Time Table of your class using table tag. 7. Program to Demonstrate Longhand properties in CSS. 8. Program to Demonstrate shorthand properties in CSS. 9. Program to Demonstrate animation in reverse direction or alternate cycles. 10. Write JavaScript Program to show light ON/OFF Demo		
		Part B 1. Program to Demonstrate SVG (Scalable Vector Graphics) Circle. 2. Program to Demonstrate SVG (Scalable Vector Graphics) Eclipse. 3. Program to Demonstrate SVG (Scalable Vector Graphics) Star. 4. Program to demonstrate "**StrokeText()"** method using HTML Canvas. 5. Program to demonstrate **BezierCurveTo()** method using HTML canvas. 6. Program to demonstrate different **line patterns** with different colors using Canvas. 7. Program to demonstrate **Gradients** using HTML Canvas. 8. Program to demonstrate **Text shadows** using HTML Canvas. 9. Program to Demonstrate Source-Over, Source-in, and Source-Out properties for composition using HTML Canvas. 10. Program to create a rectangle and animate increase and decrease the size of rectangle.		

Evaluation Scheme for Lab Examination:

Assessment Criteria		**Marks**
Program – 1 from Part A	Writing the Program	03
	Execution and Formatting	07
Program -2 from Part B	Writing the Program	03
	Execution and Formatting	07
Viva Voice based on **Computer Multimedia & Animation**		05
Total		25

Course Title: **Operating System Concepts**	Course code: **21BCA3C12L**
Total Contact Hours: 42	Course Credits: 03
Formative Assessment or IA Marks: 40	Duration of SEE/Exam: 02 Hours
Summative Assessment Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the fundamentals of the operating system.
- Comprehend multithreaded programming, process management, process synchronization, memory management and storage management.
- Compare the performance of Scheduling Algorithms
- Identify the features of I/O and File handling methods.

DSC12: Operating System Concepts

Unit	Description	Hours
1	**Introduction to Operating System:** Definition, History and Examples of Operating System; Computer System organization; Types of Operating Systems; Functions of Operating System; Systems Calls; Operating System Structure. **Process Management:** Process Concept- Process Definition, Process State, Process Control Block, Threads; Process scheduling- Multiprogramming, Scheduling Queues, CPU Scheduling, Context Switch; Operations on Processes- Creation and Termination of Processes; Inter process communication (IPC)- Definition and Need for Inter process Communication; IPC Implementation Methods- Shared Memory and Message Passing;	08
2	**Multithreaded Programming**: Introduction to Threads; Types of Threads; Multithreading- Definition, Advantages; Multithreading Models; Thread Libraries; Threading Issues. **CPU Scheduling**: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling; Multiprocessor Scheduling; Real-Time CPU Scheduling.	10
3	**Process Synchronization:** Introduction; Race Condition; Critical Section Problem and Peterson's Solution; Synchronization Hardware, Semaphores; Classic Problems of Synchronization- Readers and Writers Problem, Dining Philosophers Problem; Monitors. **Deadlocks:** System Model; Deadlocks Characterization; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection; and Recovery from Deadlock.	10

4	**Memory Management:** Logical and Physical Address Space; Swapping; Contiguous Allocation; Paging; Segmentation; Segmentation with Paging. **Virtual Memory:** Introduction to Virtual Memory; Demand Paging; Page Replacement; Page Replacement Algorithms; Allocation of frames, Thrashing.	08
5	**File System:** File Concepts- Attributes, Operations and Types of Files; File System; File Access methods; Directory Structure; Protection; File System Implementation- File System Structure, Allocation Methods, Free Space Management	06

References:

1. Operating System Concepts, Silberschatz' et al., 10th Edition, Wiley, 2018.
2. Operating System Concepts - Engineering Handbook, Ghosh PK, 2019.
3. Understanding Operating Systems, McHoes A et al., 7th Edition, Cengage Learning, 2014.
4. Operating Systems - Internals and Design Principles, William Stallings, 9th Edition, Pearson.
5. Operating Systems – A Concept Based Approach, Dhamdhere, 3rd Edition, McGraw Hill Education India.
6. Modern Operating Systems, Andrew S Tanenbaum, 4th Edition, Pearson.

(Skill Enhancement Course: SEC for BCA Course)
Open Source Tools

Semester: IV

Course Code: 21BCA4SE2OST Course Title: **Open Source Tools**	Course Credits: 2 (1L+0T+2P)
Semester: IV	Duration of SEE: 01 Hour
Total Contact Hours: 13 hours of theory and 26-28 hours of practical's	SEE: 30 Marks IA: 20 Marks

Course Outcomes (COs):

- Recognize the benefits and features of Open Source Technology and to interpret,contrast and compare open source products among themselves
- Use appropriate open source tools based on the nature of the problem
- Write code and compile different open-source software.

Course Content (Open Source Tools)

Module	Details of topic	Duration
Module 1: Open Source Softwares	i. Introduction to Open sources, Need of Open Sources, Open Source –Principles, Standard Requirements, Advantages of Open Sources – ii. Free Software – FOSS iii. Licenses – GPL, LGPL, Copyrights, Patents, Contracts & Licenses and Related Issues iv. Application of Open Sources. Open Source Operating Systems : FEDORA, UBUNTU	05 hours
Module 2: Programming Tools and Techniques	i. Usage of design Tools like Argo UML or equivalent ii. Version Control Systems like Git or equivalent iii. Bug Tracking Systems (Trac, BugZilla) iv. BootStrap	04 hours
Module 3: Case Studies	**i.** Apache **ii.** Berkeley Software Distribution **iii.** Mozilla (Firefox) **iv.** Wikipedia **v.** Joomla **vi.** GNU Compiler Collection **vii.** Libre Office	04 hours

Text Book:

1. KailashVadera, Bhavyesh Gandhi, "Open Source Technology", Laxmi Publications Pvt.Ltd 2012, 1st Edition.

Reference Book:

2. Fadi P. Deek and James A. M. McHugh, "Open Source: Technology and Policy",Cambridge Universities Press 2007.

Note:

Semester End Exam Question Paper Pattern for Skill Enhancement Course (SEC) is of Multiple Choice Questions

Semester End Exam Question Paper Pattern

Duration of the examination: **2hour** **Max. Marks:60**

Section A

Answer any TEN from the following, each carries 2 marks: [10X2=20]

1. **----------**
2. **----------**
3. **----------**
4. **----------**
5. **----------**
6. **----------**
7. **----------**
8. **----------**
9. **----------**
10. **----------**
11. **----------**
12. **----------**

Section B

Answer any FOUR from the following questions each carries 5 marks.

[4X5=20]

13. **----------**
14. **----------**
15. **----------**
16. **----------**
17. **----------**

Section C

Answer Any two from the following questions each carries 10 marks.

(The Question may consist two sub-questions)

[2X10=20]

18. **----------**
19. **----------**
20. **----------**

Theory Paper IA 40 Marks distribution

	C1	C2	Total Marks
First IA	Test-1: 15marks	Assignment/Activity-1: 05Marks	**20**
Second IA	Test-2: 15marks	Assignment/Activity-2 : 05Marks	**20**
	30	**10**	**40**

Theory Paper IA 20 Marks distribution

	C1	C2	Total Marks
First IA	Test-1: 10 marks	--	**10**
Second IA	Test-2: 5marks	Assignment/Activity-2 : 05	**10**
	15	**5**	**20**

Rani Channamma University Belagavi

Vidyasangama, NH-04, Bhutaramanahatti, Belagavi – 591 156

Bachelor of Computer Application (BCA)

Syllabus for V and VI Semester

(as per National Education Policy – 2020)

2023-24 onwards

RANI CHANNAMMA UNIVERSITY

Vidyasangama, NH-04, Bhutaramanahatti, Belagavi – 591 156

SYLLABUS

Bachelor of Computer Application (BCA)

(as per National Education Policy – 2020)

Submitted by

Dr. Parashuram Bannigidad

Chairperson BoS (UG) – Rani Channamma University, Belagavi

Members of Board of Studies

1. Dr. Vijayalaxmi M. Belagumpi — Member
   Assistant Professor,
   Dept. of Computer Science,
   GFGC Vijayapur
2. Dr. Bhagirathi Halalli — Member
   Assistant Professor,
   Dept. of Computer Science,
   GFGC Raibag
3. Dr. Basavaraj K Galagali — Member
   Assistant Professor,
   Coordinator of BCA
   BLDEA'S Commerce, BHS Arts and TGP Science College, Jamakhandi

SEMESTER-5										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams(Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC13	21BCA5C13L	Design & Analysis of Algorithms	40	60	100	4	0	0	4	2
	21BCA5C13P	Design & Analysis of Algorithms Laboratory	25	25	50	0	0	3	2	3
DSC14	21BCA5C14L	Statistical Computing and R Programming	40	60	100	4	0	0	4	2
	21BCA5C14P	R Programming Lab	25	25	50	0	0	3	2	3
DSC15	21BCA5C15L	Software Engineering	40	60	100	4	0	0	4	2
DSE-E1	21BCA5DE1AL	Information Security & Cryptography	40	60	100	3	0	0	3	2
	21BCA5DE1BL	Cloud Computing								
	21BCA5DE1CL	Business Intelligence								
VC1	21BCA5VC1AL	Digital Marketing	40	60	100	3	0	0	3	2
SEC3	21BCA5SE3L	Cyber Security	20	30	50	2	0	2	3	2
Total Marks					**650**	**Semester Credits**			**25**	

SEMESTER-6										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams(Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC16	21BCA6C16L	PHP and MySQL	40	60	100	4	0	0	4	2
	21BCA6C16P	PHP and MySQL LAB	25	25	50	0	0	3	2	3
DSC17	21BCA6C17L	Artificial Intelligence and Applications	40	60	100	4	0	0	4	2
DSC18	21BCA6C18P	Project Work	50	100	150	0	0	10	6	3
DSE-E2	21BCA6DE2AL	Fundamentals of Data Science	40	60	100	3	0	0	3	2
	21BCA6DE2BL	Mobile Application Development								
	21BCA6DE2CL	Embedded Systems								
VC2	21BCA6VC2AL	Web Content Management System	40	60	100	3	0	0	3	2
INT	21BCA6INT1	Internship	50	-	50			-	2	-
Total Marks					**650**	**Semester Credits**			**24**	
Exit Option with Bachelor of Computer Applications Degree, BCA Degree (with completion of courses equivalent to a minimum of 136 credits)					**4100**	**Total Credits for BCA Program**			**152**	

Program Name	**BCA**	Semester	**V**
Course Title	**Design and Analysis of Algorithm (Theory)**		
Course Code:	**DSC13**	No. of Credits	04
Contact hours	**42 Hours**	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): Basic Knowledge of Data structure
After the successful completion of the course, the student will be able to: CO1. Understand the fundamental concepts of algorithms and their complexity, including time and space complexity, worst-case and average-case analysis, and Big-O notation. BL (L1, L2) CO2. Design algorithms for solving various types of problems, such as Sorting, Searching, Graph traversal, Decrease-and-Conquer, Divide-and-Conquer and Greedy Techniques. BL (L1, L2, L3) CO3. Analyze and compare the time and space complexity of algorithms with other algorithmic techniques. BL (L1, L2,L3,L4) CO4. Evaluate the performance of Sorting, Searching, Graph traversal, Decrease-and-Conquer, Divide-and-Conquer and Greedy Techniques using empirical testing and benchmarking, and identify their limitations and potential improvements. BL (L1, L2, L3, L4) CO5. Apply various algorithm design to real-world problems and evaluate their effectiveness and efficiency in solving them. BL (L1, L2, L3) Note: Blooms Level(BL): L1=Remember, L2=Understand, L3=Apply, L4=Analyze, L5= Evaluate, L6= Create

Description	**42 Hrs**
UNIT 1: Introduction: What is an Algorithm? Fundamentals of Algorithmic problem solving, Fundamentals of the Analysis of Algorithm Efficiency, Analysis Framework, Measuring the input size, Units for measuring Running time, Orders of Growth, Worst-case, Best-case and Average-case efficiencies.	8
UNIT 2: Asymptotic Notations and Basic Efficiency classes, Informal Introduction, O-notation, Ω-notation, θ-notation, mathematical analysis of non-recursive algorithms, mathematical analysis of recursive algorithms.	8
UNIT 3: Brute Force & Exhaustive Search: Introduction to Brute Force approach, Selection Sort and Bubble Sort, Sequential search, Exhaustive Search- Travelling Salesman Problem and Knapsack Problem, Depth First Search, Breadth First Search	9
UNIT 4: Decrease-and-Conquer: Introduction, Insertion Sort, Topological Sorting **Divide-and-Conquer:** Introduction, Merge Sort, Quick Sort, Binary Search, Binary Tree traversals and related properties.	9
UNIT 5: Greedy Technique: Introduction, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Lower-Bound Arguments, Decision Trees, P Problems, NP Problems, NP- Complete Problems, Challenges of Numerical Algorithms.	8

References
1. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009, Pearson
2. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, 4. Clifford Stein, 3rd Edition, PHI.
5. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)
6. Weblinks and Video Lectures (e-Resources): http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html https://nptel.ac.in/courses/106/101/106101060/ http://elearning.vtu.ac.in/econtent/courses/video/FEP/ADA.html http://cse01-iiith.vlabs.ac.in/ http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms

Course Title	**Design and Analysis of Algorithm Lab (Practical)**	Practical Credits	**02**
Course Code	**DSC5-Lab**	Contact Hours	**04** **Hours/week**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

Part-A

1. Write a program to sort a list of N elements using Selection Sort Technique.
2. Write a program to perform Travelling Salesman Problem
3. Write a program to perform Knapsack Problem using Greedy Solution
4. Write program to implement the DFS algorithm for a graph.
5. Write program to implement the BFS algorithm for a graph.
6. Write a program to find minimum and maximum value in an array using divide and conquer.
7. Write a test program to implement Divide and Conquer Strategy for Quick sort algorithm
8. Write a program to implement Merge sort algorithm for sorting a list of integers in ascending order.

Part-B

1. Write C program that accepts the vertices and edges for a graph and stores it as an adjacency matrix.
2. Implement function to print In-Degree, Out-Degree and to display that adjacency matrix.
3. Write program to implement backtracking algorithm for solving problems like N queens .
4. Write a program to implement the backtracking algorithm for the sum of subsets problem
5. Write program to implement Dynamic Programming algorithm for the 0/1 Knapsack problem.
6. Write program to implement Dynamic Programming algorithm for the Optimal Binary Search Tree Problem.
7. Write a program that implements Prim's algorithm to generate minimum cost spanning Tree.
8. Write a program that implements Kruskal's algorithm to generate minimum cost spanning tree.

ProgramName	**BCA**	Semester	**V**
Course Title	**Statistical Computing & R Programming (Theory)**		
Course Code:	**DSC14**	No. of Credits	**04**
Contact hours	**42 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Basic Knowledge About Programming and Web browsers	
Course Outcomes (COs): After the successful completion of the course, the student will be able to	
CO1	Explore fundamentals of statistical analysis in R environment.
CO2	Describe key terminologies, concepts and techniques employed in Statistical Analysis.
CO3	Define Calculate, Implement Probability and Probability Distributions to solve a wide variety of problems.
CO4	Conduct and interpret a variety of Hypothesis Tests to aid Decision Making.
CO5	Understand, Analyse, and Interpret Correlation Probability and Regression to analyse the underlying relationships between different variables.

Contents	**42 Hrs**
UNIT-I: **Introduction of the Language**, Numeric, Arithmetic, Assignment, And Vectors, Matrices andArrays, Non-numeric Values, Lists and Data Frames, Special Values, Classes, and Coercion, Basic Plotting.	08
UNIT-II: R Programming Structures, Control Statements, Loops, – Looping Over Non-vector Sets,- If-Else, Arithmetic, and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Example: ABinary Search Tree, Error Handling.	08
UNIT-III: Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability Cumulative Sums and Products-Minima and Maxima- Calculus, Functions for Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files.	10
UNIT-IV: Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests - ANOVA.	08
UNIT-V Simple Linear & Non-Linear Regression, multiple linear regressions, linear model selection and diagnostics. Advanced graphics: plot customization, plotting regions and margins, point and click coordinate interaction, customizing traditional R plots, specialized text and label notation. Defining colors and plotting in higher dimensions, representing and using color, 3D scatter plots.	08

Preferred Text Books	
1	Tilman M. Davies, "The book of R: A first course in programming and statistics", San Francisco, 2016.
2	Vishwas R. Pawgi, "Statistical computing using R software", Nirali prakashan publisher, e1-edition, 2022.
3	https://www.youtube.com/watch?v=KlsYCECWEWE https://www.geeksforgeeks.org/r-tutorial/ https://www.tutorialspoint.com/r/index.htm

References	
1	Introductory Statistics with R (Statistics and Computing) Dalgaard, Peter (Author) English (Publication Language) 267 Pages - 02/10/2004 (Publication Date) - Springer (Publisher) Read more at: https://examupdates.in/statistics-with-r-programming-notes/
2	Statistics: An Introduction using R Crawley, Michael J. (Author) English (Publication Language) 342 Pages - 03/11/2005 (Publication Date) - Wiley–Blackwell (Publisher) Read more at: https://examupdates.in/statistics-with-r-programming-notes/
3	A Handbook of Statistical Analyses using R RC Press Hothorn, Torsten (Author) English (Publication Language) 304 Pages - 06/25/2014 (Publication Date) - Chapman and Hall/CRC (Publisher) Read more at: https://examupdates.in/statistics-with-r-programming-notes/
4	A First Course in Statistical Programming with R Braun, W. John (Author) English (Publication Language) 230 Pages - 07/18/2016 (Publication Date) - Cambridge University Press (Publisher) Read more at: https://examupdates.in/statistics-with-r-programming-notes
5	Statistical Analysis with R For Dummies Schmuller, Joseph (Author) English (Publication Language) 464 Pages - 05/16/2017 (Publication Date) - For Dummies (Publisher) Read more at: https://examupdates.in/statistics-with-r-programming-notes

ProgramName	**B.C.A**	Semester	**V**
Course Title	**R Programming Lab**		
Course Code:	**DSC14-Lab**	No. of Credits	**02**
Contact hours	**03 Hours per week**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**25**	Summative Assessment Marks	**25**

1. Write an R program Illustrate with if-else statement and how does it operate on vectors of variable length.
2. Write an R program Illustrate with for loop and stop on condition, to print the error message.
3. Write an R Program To find Factorial of given number using recursion.
4. Write an R Program to implement T-Test for Anova.
5. Write an R Program Compute mean values for vector aggregates defined by factors tapply and sapply.
6. Write a R program for finding stationary distribution of markanov chains.
7. Write an R Program for implementing Quick Sort for Binary Search.
8. Write an R Program Illustrate Reading & Writing Files.
9. Write a R program for any visual representation of an object with creating graphs using graphic functions: Plot(),Hist(),Linechart(),Pie(),Boxplot(),Scatterplots().
10. Write a R program for with any dataset containing data frame objects, and employ manipulating and analyzing data.
11. Write a program to create an any application of Linear Regression in multivariate context for predictive purpose.
12. Write an R Program to Find Mean, Mode & Median.

Program Name	**B.C.A**	Semester	**V**
Course Title	**Software Engineering (Theory)**		
Course Code:	**DSC15**	No. of Credits	**04**
Contact hours	**42 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

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.

Description	42 Hrs
Introduction: Professional software development, Software engineering ethics Requirements engineering: Functional and non-functional requirements, The software requirements document - IEEE structure of a requirements document (SRS) , Requirement elicitation and analysis, Requirement validation, Requirement management	08
Software Processes: Software process models – Waterfall model, Incremental development, Reuse oriented software engineering, Process Activities, Boehm's spiral model of the software process Agile software development: Plan-driven and agile development, The extreme programming release cycle, The Scrum process (scrum sprint cycle).	08
Architectural Design: Architectural Views, Architectural Patterns – MVC, Layered, Repository, Client Server, Pipe and Filter System Modeling: Interaction Modeling: Use case diagrams, Sequence diagrams; Structural modeling: Class diagrams; Behavioral Modeling : State diagrams; Functional modeling : Data flow diagrams	10
User Interface Design: The golden rules, User Interface Analysis and Design models and process, Webapp and mobile interface design (interface design principles and guidelines) Implementation issues: Reuse, configuration management, Host target development Software quality: What is software quality, McCall's quality factors, ISO 9126 quality factors	08
Software Testing: Types of testing – white box, black box, stages of testing (development testing) – Unit, Component, System, Test-driven development (TDD) , Release testing, User Testing	08

Reference Books
Software Engineering, Ian Summerville, 9th Edition, Pearson Education (for Unit 1 , Unit 2, Unit3 , Unit 4 (Implementation issues) , Unit 5
Software Engineering A Practitioner's Approach, Roger S Pressman , McGraw Hill , 8th Edition - Indian Edition (for Unit 4)
Additional Reading: An Integrated Approach to Software Engineering, Pankaj Jalote, 3rd Edition, 2013, Narosa Publishing House

Program Name	**B.C.A**	Semester	**V**
Course Title	**Information Security & Cryptography (Theory)**		
Course Code:	**DSE1**	No. of Credits	**04**
Contact hours	**42 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

CO1	Understand Cybercrime and Information Security and its classification.
CO2	Understand how criminals plan cyber-attacks.
CO3	Understand various tool and methods used in cyber-attacks.
CO4	Understand legal perspectives and punishments for cybercrime in India.
CO5	Understand cyber forensic life cycle.
CO6	Understand various cryptographic methods.

Course Content	**42 Hrs**
Introduction to Cybercrime: Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA2000, A global Perspective on cybercrimes	6
Cyber offenses & Cybercrime: How criminal plan the attacks, Social Engg, Cyber stalking,Cybercafé and Cybercrimes, Botnets, Attack vector, Cloud computing, Credit Card Frauds	8
Tools and Methods Used in Cyberline: Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Steganography, DoS DDoS Attacks, SQL Injection, Buffer Over Flow, Phishing, Identity Theft (ID Theft). Cybercrimes and Cybersecurity: The Legal Perspectives Why do we need Cyberlaw: The Indian Context, The Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment.	10
Understanding Computer Forensics: Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Chain of Custody Concept, Setting of a Computer Forensics Laboratory: Understanding the Requirements, The Security/Privacy Threats, Forensics Auditing, Anti Forensics.	8
Cryptography: Mathematical Background for Cryptography - Modulo Arithmetic's, The Greatest Comma Divisor, Useful Algebraic Structures, Chinese Remainder Theorem, Basics of Cryptography - Preliminaries, Elementary Substitution Ciphers, Elementary Transport Ciphers, Other Cipher Properties, Secret Key Cryptography – Product Ciphers, DES Construction.	10

References

Nina Godbole, SunitBelapure, Cyber Security, Wiley India, New Delhi (UNIT I, II, III, IV)
Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition (UNIT V)

Additional Reading

Kennetch J. Knapp, Cyber Security & Global Information Assurance Information Science Publishing. William Stallings, Cryptography and Network Security, Pearson Publication

ProgramName	**B.C.A**	Semester	**V**
Course Title	**Cloud Computing (Theory)**		
Course Code:	**DSE-E1**	No. of Credits	**03**
Contact hours	**42 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

CO1	Explain the core concepts of the cloud computing paradigm such as how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
CO2	Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.
CO3	Identify resource management fundamentals like resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.
CO4	Analyze various cloud programming models and apply them to solve problems on the cloud.

Contents	**42 Hrs**
Introduction: Different Computing Paradigms- Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing etc., Comparison of various Computing Technologies; Cloud Computing Basics- What is Cloud Computing? History, Characteristic Features, Advantages and Disadvantages, and Applications of Cloud Computing; Trends in Cloud Computing; Leading Cloud Platform Service Providers.	**8**
Cloud Architecture: Cloud Service Models- Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS), Comparison of different Service Models; Cloud Deployment Models- Public Cloud; Private Cloud, Hybrid Cloud, Community Cloud; Cloud Computing Architecture- Layered Architecture of Cloud. Virtualization- Definition, Features of Virtualization; Types of Virtualizations- Hardware Virtualization, Server Virtualization, Application Virtualization, Storage Virtualization, Operating System Virtualization; Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples- Xen: Paravirtualization, VMware: Full Virtualization, Microsoft Hyper-V.	**10**
Cloud storage-overview, cloud storage providers, standards: - applications, client, infrastructure, service.	**8**
Cloud Computing At Work: Software as a service-overview, driving forces, company offerings, industries, software plus services- overview, mobile device integration, Providers, Microsoft Online.	**8**
Cloud Applications: Scientific Applications- Healthcare (ECG Analysis in the Cloud) Biology (Protein Structure Prediction and Gene Expression Data Analysis for Cancer Diagnosis), Geoscience (Satellite Image Processing); Business and Consumer Applications- CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.	**8**

Text Books:	
1	Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi: "Mastering Cloud Computing-Foundations and Applications Programming", Elsevier, 2013
2	Barrie Sosinsky: "Cloud Computing Bible", Wiley-India, 2010
3	Cloud Computing A practical Approach, Anthony T Velte, Toby J Velte,Ph.D. Robert Elsenpeter, McGraw Hill Education(India) Private Limited.
4	K Chandrashekaran: "Essentials of Cloud Computing", CRC Press, 2015
5	Derrick Rountree, Ileana Castrillo: "The Basics of Cloud Computing", Elsevier, 2014

Program Name	**BCA**	Semester	**V**
Course Title	**Business Intelligence (Theory)**		
Course Code:	**DSE-E1**	No. of Credits	**03**
Contact hours	**42 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s):	
Course Outcomes (COs): After the successful completion of the course, the student will be able to:	
CO1	Describe the Decision Support systems and Business Intelligence framework.
CO2	Explore knowledge management, explain its activities, approaches and its implementation.
CO3	Describe business intelligence, analytics, and decision support systems

Contents	**42 Hrs**
Business View of Information Technology Applications: Business Enterprise Organization, Its Functions and Core Business Process, Baldrige Business Excellence Framework, Key Purpose of Using IT in Business, The Connected World: Characteristics of Internet-ready IT Applications, Enterprise applications(ERP/CRM) and Bespoke IT applications, Information Users and Their Requirements. **Types of Digital data:** Getting to know Structured Data, Unstructured Data, Semi- structured Data and Difference between Semi-structured and Structured data.	8
Introduction to OLTP and OLAP: OLTP (Online Transaction Processing) OLAP (Online Analytical Processing), Different OLAP Architectures, OLTP and OLAP, Data models for OLTP and OLAP, Role of OLAP tools in the BI Architecture, OLAP operations on multidimensional data. **Business Intelligence:** Using Analytical Information of Decision Support, Information sources before dawn of BI, BI defined, Evolution of BI and Role of DSS, EIS, MIS and Digital Dashboards, Need for BI at virtually all levels, BI for past, present and future, The BI value chain, Introduction to Business Analytics.	8
BI Definitions and Concepts: BI Component Framework, BI Users, Business Intelligence Applications, BI Roles and Responsibilities. Basics of Data Integration: Need for Data Warehouse, Definition of Data Warehouse, Ralph Kimball's Approach vs Inmon's Approach, Goals of Data Warehouse, Constituents of Data Warehouse, Data Integration, Data Integration Technologies, Data Quality, Data Profiling.	8
Multidimensional Data Modeling: Data Modeling Basics, Types of Data Model, Data Modeling Techniques, Fact Table, Dimension Table, Typical Dimensional Models and Dimensional Modeling Life Cycle. Measures, Metrics, KPIs, and Performance Management: Understanding Measures and Performance Measurement System Terminology, Navigating a Business Enterprise: Attributes of a Good Metric, SMART test for ensuring metric relevance to business, KPI usage in Companies.	8
Basics of Enterprise Reporting: Reporting perspectives common to all levels of Enterprise, Report Standardization and Presentation Practices, Enterprise Reporting Characteristics in OLAP World, Balanced Scorecard and Dashboards. Introducing Power BI application: Installation of Power BI Desktop (Free trial), Importing the Data, Fixing the Column Names, Transforming the Data, Getting Started with Reports, Slicing the Data.	8

Text Book:
R.N. Prasad, Seema Acharya, Fundamentals of Business analytics, First Edition, 2011, Wiley-India

Reference Books:
1. GaliShmueli,. Nitin R Patel , peter C . Bruce, " Data mining for Business Intelligence" Wiley-India, 2011. 2. Ralph Kimball ,Margy Ross, "Practical tools for Data Warehosuing and Business Intelligence" , second Edition Wiley-India 2011

Program Name	**B.Sc./B.C.A**	Semester	**V**
Course Title	**Digital Marketing (Theory)**		
Course Code:	**VC-2**	No. of Credits	**03**
Contact hours	**42 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s):

- Basic Knowledge of internet and internet browsing.
- Experimental and Analytical mindset.
- No Hardcore technical knowledge required to pursue this course.

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

1. Understand the fundamental concepts and principles of digital marketing.
2. Develop practical skills to implement various digital marketing strategies and techniques.
3. Analyze and evaluate the effectiveness of digital marketing campaigns.
4. Apply critical thinking and problem-solving skills to real-world digital marketing scenarios.
5. Create comprehensive digital marketing plans and strategies.

Note: Blooms Level(BL): L1=Remember, L2=Understand, L3=Apply, L4=Analyse, L5=Evaluate, L6= Create

Units	**Contents**	42 Hours
UNIT I	**Introduction to Digital Marketing:** Overview of digital marketing, Evolution of digital marketing, Importance and benefits of digital marketing, Digitalmarketing channels and platforms **Digital Marketing Strategy and Planning:** Developing a digital marketing strategy, Setting goals and objectives, Budgeting and resource allocation.	**9**
UNITII	Campaign planning and execution, Monitoring and adjusting digital marketing campaigns **Social Media Marketing:** Overview of social media marketing, Social media platforms and their features, Creating and optimizing social media profiles, Social media content, strategy, Social media advertising and analytics	**8**
UNITIII	**Email Marketing:** Introduction to email marketing, Building an email list, Creating effective email campaigns, Email automation and segmentation, Email marketing metrics and analytics **Content Marketing:** Understanding content marketing, Content strategyand planning,	**8**
UNITIV	**Content creation and distribution**: Content promotion and amplification, Content marketing metrics and analytics. **Mobile Marketing:** Mobile marketing overview, Mobile advertising strategies, Mobile app marketing, Location-based marketing, Mobile marketing analytics	**8**
UNIT V	**Analytics and Reporting:** Importance of analytics in digital marketing, Setting up web analytics tools (e.g., Google Analytics), Tracking and measuring key performance indicators (KPIs), Conversion tracking and optimization, Reporting and data visualization	**9**

References	
1	"Digital Marketing Strategy: An Integrated Approach to Online Marketing" by Simon Kingsnorth.
2	"Email Marketing Rules: How to Wear a White Hat, Shoot Straight, and Win Hearts" by Chad S. White
3	"Content Inc.: How Entrepreneurs Use Content to Build Massive Audiences and Create Radically Successful Businesses" by Joe Pulizzi
4	"Mobile Marketing: How Mobile Technology is Revolutionizing Marketing, Communications and Advertising" by Daniel Rowles
5	"Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity" by Avinash Kaushik

Program Name	**BCA**	Semester	**VI**
Course Title	**PHP & MySQL (Theory)**		
Course Code:	**DSC17**	No. of Credits	**04**
Contact hours	**42 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s):	
Course Outcomes (COs): After the successful completion of the course, the student will be able to:	
CO1	Design dynamic and interactive web pages and websites.
CO2	Run PHP scripts on the server and retrieve results.
CO3	Handle databases like MySQL using PHP in Website

Contents	**42**
Introducing PHP: Basic development Concepts –Creating first PHP Scripts –Using Variable and Operators –Storing Data in variable –Understanding Data types –Setting and Checking variables–Data types –Using Constants –Manipulating Variables with Operators.	**10**
Controlling Program Flow: Writing Simple Conditional Statements -Writing More Complex Conditional Statements – Repeating Action with Loops –Working with String Functions.	**8**
Working with Arrays: Storing Data in Arrays –Processing Arrays with Loops and Iterations Working with Array Functions –Working with Dates and Times.	**8**
Functions and Classes: Creating User-Defined Functions -Creating Classes –Using Advanced OOP Concepts. Working with Database MySQL and PHP, MYSQL and PHP Database Create, Read, Update and Delete operations.	**8**
Introduction to Laravel framework: composer, Artisan, Features of Laravel, Laravel, Installation With composer, Laravel Application Structure/Directory Structure, LaravelRouting.	**8**

Text Books:
PHP A Beginner‟s Guide, VIKRAM VASWANI,Tata McGraw-Hill, 2008.
The PHP Complete Reference, Steven Holzner –Tata McGraw-HillEdition,2010
Spring into PHP5, Steven Holzer, Tata McCraw HillEdition,2005
https://www.tutorialspoint.com/laravel

Program Name	**B.C.A**	Semester	**VI**
Course Title	**PHP and MySQL Lab**		
Course Code:	**DSC17-Lab**	No. of Credits	**02**
Contact hours	**04 Hours per week**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**25**	Summative Assessment Marks	**25**

Sl. No	**Title of the Experiment**
1	Develop a PHP program to display prime numbers between the given range and display the total number of prime numbers.
2	Develop a PHP program and check message passing mechanism between pages.
3	Write a PHP program to implement simple calculator operations.
4	Develop a PHP program to demonstrate String functions. (any 6).
5	Write a PHP program to illustrate built in Array manipulation functions.(any 6)
6	Write a PHP program that displays a different message based on time of day. For example page should display "Good Morning" if it is accessed in the morning.
7	Write a PHP program that accepts two numbers using a web form and calculates greatest common divisor (GCD) and least common multiple (LCM) of entered numbers.(Use recursive function)
8	Develop a PHP program to demonstrate constructors and destructors.
9	Develop a PHP code to read the values entered into the form using the MySQL database.
10	Create Laravel Project using composer display Simple "Hello World" Message on Web page.

Program Name	**B.C.A**	Semester	**VI**
Course Title	Artificial Intelligence and Applications **(Theory)**		
Course Code:	**DSC16**	No. of Credits	**04**
Contact hours	**42 Hours**	Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s):	
Course Outcomes (COs): After the successful completion of the course, the student will be able to:	
CO1	Students will able to develop semantic-based and context-aware systems and use the knowledge embedded in multimedia content.
CO2	Students will achieve semantic interoperability between Web resources and services.
CO3	Students are understand the field of Robotics is a multi disciplinary.

Contents	**42 Hrs**
Introduction : What is Artificial Intelligence: The AI Problems, The Underlying assumption, What is an AI Technique?, Foundation of AI and History of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.	8
Searching and Reduction: Searching for solutions: uniformed search strategies – Breadth first search, depth first Search. Heuristic search techniques: Generate-and-test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis Game Playing-Adversial search, Games, mini-max algorithm, A* Search, AO* search Informed (Heuristic) Search Strategies, Heuristic Functions	10
Knowledge representation issues: Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, , predicate logic- logic programming, semantic nets- frames and inheritance .Representing knowledge using Rules : Procedural verses Declarative Knowledge, Logic Programming, Forward verses Backward Reasoning, Matching.	8
Learning: First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods ,Reinforcement Learning.	8
Application : Introduction, basic concepts, structure of expert systems, the human element in expert systems how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert systems, expert systems and the internet interacts web, knowledge engineering, scope of knowledge, difficulties, in knowledge acquisition methods of knowledge acquisition	8

Text Books:	
1	Elaine Rich,Kevin Knight, Shivashanka B Nair:Artificial Intelligence, Tata CGraw Hill 3rd edition. 2013
2	S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, SecondEdition, Pearson Education
3	David Poole, Alan Mackworth, Randy Goebel, ”Computational Intelligence : a logical approach”, Oxford University Press.
4	G. Luger, “Artificial Intelligence: Structures and Strategies for complex problemsolving”, Fourth Edition, Pearson Education.
5	J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier Publishers.

Program Name	**B.C.A**	Semester	**VI**
Course Title	**Fundamentals of Data Science (Theory)**		
Course Code:	**DSE-E2**	No. of Credits	**03**
Contact hours	**42 Hours**	Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s):	
Course Outcomes (COs): After the successful completion of the course, the student will be able to:	
CO1	Understand the concepts of data and pre-processing of data.
CO2	Know simple pattern recognition methods
CO3	Understand the basic concepts of Clustering and Classification
CO4	Know the recent trends in Data Science

Course Content	**42 Hours**
Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, A data Science Profile. Statistical Inference, Populations and samples, Populations and samples of Big Data, BigData can mean Big Assumptions, Modeling, Philosophy of Exploratory Data Analysis, The Data Science Process , A Data Scientist's Role in this Process.	10
Mathematical Preliminaries: Probability, Descriptive Statistics, Correlation Analysis. Data Munging: Languages for Data Science, Collecting Data, Cleaning Data, Crowdsourcing.	08
Scores and Rankings: The Body Mass Index(BMI), Developing Scoring Systems, Z-scores and Normalization. Statistical Analysis: Statistical Distributions, Sampling from Distributions, Statistical Significance, Permutation Tests and P-values	08
Visualizing Data: Exploratory Data Analysis, Developing a Visualization Aesthetic, Chart Types, Great Visualizations. Mathematical Models: Philosophies of Modeling, A Taxonomy of Models, Baseline Models, Evaluating Models, Evaluation Environment.	08
Linear and Logistic Regression: Linear Regression, Classification and Logistic Regression, Issues in Logistic Classification. Machine Learning: Naive Bayes, Decision Trees Classifiers.	08

References:	
1	Rachel Schutt & O'neil, "Doing Data Science", Straight Talk from The Frontline O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013. (Unit-1)
2	Steven S. Skiena, "The Data Science Design Manual", Springer 2017. (Unit-2,3,4,5)

Program Name	**B.C.A**	Semester	**VI**
Course Title	**Mobile Application Development (Theory)**		
Course Code:	**DSE-E2**	No. of Credits	**03**
Contact hours	**42 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s):	
Course Outcomes (COs): After the successful completion of the course, the student will be able to:	
CO1	Being able to build cross platform mobile application development
CO2	Learn the basics of the Dart programming language.
CO3	Learn the fundamentals of Flutter widgets.
CO4	Learn how to design and build user interfaces with Flutter.

Contents	**42 Hrs**
Introduction to Mobile Applications : Development, Flutter Introduction: Features of Flutter Advantages of Flutter and Disadvantages of Flutter, Flutter SDK, Android Studio and Creating Simple Hello world Application with flutter, Hot Reload Feature, Basic Flutter Application Structure, Creating Simple Flutter App using Online Sandboxes like FlutLab.io	**8**
Dart Programming Language Basics: Variable declaration and initialization, Constants and final values, Data Types: Numeric values, Strings, Boolean Types, Operators, Flow Control constructs: if and switch statements, looping statements. Lists and Maps. Object oriented Programming in Dart: Defining Classes, Instance Variables and Methods. Named parameters, Arrow functions Constructors, Subclasses,	**8**
Introduction to Widgets: Widgets, Gestures, Concept of State, Layers Widget Build Visualization, Platform Specific Widgets, Layout Widgets: Types of Layout Widgets, MaterialApp, Scaffold, Center, Row, Column, Expanded, Align, Container, Padding and Text Widgets, Button, Image and Icon Widgets.	**8**
Introduction to Gestures and State management: Tap, Double Tap, Long Press, VerticalDrag,Horizontal Drag and Pan. Dialogs, Flutter State Management: Ephemeral State Management, Application State, Navigation and Routing. Stateful Widgets: Input, Checkbox, Radio, Date and Time pickers and ListView	**8**
Introduction to Dart Packages and Accessing REST API and Database Concepts: Types of Packages and using Dart Package. Accessing REST API: Basic Concepts, Accessing ProductService API. Database Concepts: SQLite, SQLiteDbProvider object and its methods.	**10**

Text Books:
Practical Flutter: Improve your Mobile Development with Google's Latest Open-Source SDK By Author Frank Zammett
https://www.tutorialspoint.com/flutter/flutter_tutorial.pdf
https://flutlab.io/
https://zapp.run/

Program Name	**B.C.A**	Semester	**VI**
Course Title	**Embedded Systems (Theory)**		
Course Code:	**Voc-2**	No. of Credits	**03**
Contact hours	**42 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Contents	**40 Hrs**
Introduction to Embedded Systems : Introduction to embedded systems and their applications, Overview of hardware and software components in embedded systems, embedded system design process and development tools, embedded system architectures and microcontrollers, Basics of programming embedded systems	**8**
Embedded System Programming : Programming languages for embedded systems (C and Assembly),Data types, variables, and operators in embedded programming, Control structures and functions in embedded programming, Memory management in embedded systems, Debugging and testing embedded software	**10**
Real-Time Operating Systems (RTOS) : Introduction to real-time systems and their characteristics, Overview of real-time operating systems (RTOS), Task scheduling and synchronization in RTOS, Memory management and resource allocation in RTOS, Interfacing with peripherals and device drivers in RTOS	**8**
Embedded System Interfacing : Basics of digital and analog interfacing, Serial communication protocols (UART, SPI, I2C), Interfacing with sensors and actuators, A/D and D/A converters in embedded systems, Communication protocols for networking (Ethernet, Wi-Fi)	**8**
Embedded System Design and Testing : Design methodologies for embedded systems, System modeling and simulation techniques, Verification and validation of embedded systems, Power management and optimization in embedded systems, Case studies of real-world embedded systems	**8**

References	
1	Title: Embedded Systems: Architecture, Programming and Design Author: Raj Kamal Publisher: McGraw-Hill Education Year: 2014 (UNIT 1)
2	Title: Programming Embedded Systems: With C and GNU Development Tools Author: Michael Barr and Anthony Massa Publisher: O'Reilly Media Year: 2006 (UNIT 2)
3	Title: Real-Time Systems and Programming Languages: Ada, Real-Time Java, and C/Real-Time POSIX Author: Alan Burns and Andy Wellings Publisher: Addison-Wesley Professional Year: 2009 (UNIT 3)
4	Title: Interfacing PIC Microcontrollers: Embedded Design by Interactive Simulation Author: Martin P. Bates Publisher: Newnes Year: 2004 (UNIT 4)
5	Title: Embedded Systems Design: An Introduction to Processes, Tools, and Techniques Author: Arnold S. Berger Publisher: CMP Books Year: 2002 (UNIT 5)

Program Name	**B.C.A**	Semester	**VI**
Course Title	**Web Content Management System (Theory)**		
Course Code:	**Voc-1**	No. of Credits	**03**
Contact hours	**42 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s):	
Course Outcomes (COs): After the successful completion of the course, the student will be able to:	
CO1	Understand content development basics;
CO2	Gain Knowledge of tools for multimedia content development for audio/ video, graphics, animations, presentations, screen casting
CO3	Host websites and develop content for social media platforms such as wiki and blog
CO4	Understand e-publications and virtual reality
CO5	Use of e-learning platform Moodle and CMS applications Drupal and Joomla

Contents	**42 Hrs**
Web Content Development and Management, Content Types and Formats, Norms and Guidelines of Content Development, Creating Digital Graphics, Audio Production and Editing	**8**
Web Hosting and Managing Multimedia Content, Creating and Maintaining a Wiki Site. Presentation Software Part I, Presentation Software Part II, Screen casting Tools and Techniques, Multilingual Content Development.	**10**
Planning and Developing Dynamic Web Content Sites, Website Design Using CSSCreating and Maintaining a WIKI Site, Creating and Managing a Blog Site,	**8**
E- Publication Concept, E- Pub Tools, Simulation and Virtual Reality Applications, Creating 2D and 3 D Animations. Introduction to Moodle, Creating a New Course and Uploading,	**8**
Create and Add Assessment, Add and Enroll User and Discussion Forum, ContentManagement System: Joomla, Content Management System: Drupal	**8**

Text Books:	
1	Web Content Management: Systems, Features, and Best Practices 1st Edition by Deane Barker.
2	Content Management Bible (2nd Edition) 2nd Edition by Bob Boiko.
3	Moodle for Learning Management System (LMS): A Practical and Visual Guidebook of Administrator and Instructor for Distance Education Paperback – October 12, 2020 by James Koo
4	Using Joomla!: Efficiently Build and Manage Custom Websites 2nd Edition by Ron Severdia
Additional Reading:	
https://onlinecourses.swayam2.ac.in/cec20_lb09/preview	

Program Name	**BCA**	Semester	**VI**
Course Title	**Internship**		
Course Code:	**Inter1**	No. of Credits	**02**
Contact hours	**02 Hour per week**	Duration of SEA/Exam	**3 hours**

Internship Guidelines for BCA Graduate Programme

1. Internship shall be Discipline specific of 90 hours (2 credits) with a duration 4-6 weeks.
2. Internship may be full-time/part-time (full-time during semester holidays and part-time in the academic session)
3. Internship mentor/supervisor shall avail work allotment during 6^{th} semester is 1hour per week and Maximum 20 hours in a semester.
4. The student should submit the final internship report to the mentor for completion of the internship.

Program Name	**BCA**	Semester	**VI**
Course Title	**Project Work**		
Course Code:	**Proj 1**	No. of Credits	**06**
Contact hours	**10 Practical Hour per week**	Duration of SEA/Exam	**3 hours**

Guidelines for Project Work

1. Students are expected to work out a real life project in some industry/research and development laboratories/educational institutions/software companies, it is suggested that the project is to be chosen which should have some direct relevance in day-to-day activities of the candidates in his/her institution. However, it is not mandatory for a student to work on a real life project. The student can formulate a project problem with the help of Guide.
2. Project mentor/supervisor shall avail work allotment during 6th semester is 2 hour per week and Maximum 20 hours in a semester.
3. The student should submit the final project report to the college through the mentor for completion of the project work.

	Formative Assessment for Theory	
Components	**Assessment Occasion/ type**	**Marks**
C1	Test	10
	Seminar/Activity	10
C2	Test	10
	Assignment/Projects/Quiz	10
	Total	**40 Marks**

Summative Assessment for Theory

Semester End Exam Question Paper Pattern

Duration of the examination: **2hour** **Max. Marks:60**

Section A

Answer any TEN from the following, each carries 2 marks: **[10X2=20]**

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------
6. ----------
7. ----------
8. ----------
9. ----------
10. ----------
11. ----------
12. ----------

Section B

Answer any FOUR from the following questions each carries 5 marks.

[4X5=20]

13. ----------
14. ----------
15. ----------
16. ----------
17. ----------

Section C

Answer any two from the following questions each carries 10 marks.

(The Question may consist two sub-questions)

[2X10=20]

18. ----------
19. ----------
20. ----------